IEB
Institut
d'Economia
de Barcelona

IEB Working Paper 2020/06

MODELING THE U.S. FIREARMS MARKET: THE EFFECTS OF CIVILIAN STOCKS, CRIME, LEGISLATION, AND ARMED CONFLICT

Topher L. McDougal, Daniel Montolio, Jurgen Brauer

Version June 2020

Public Policies

IEB Working Paper 2020/06

MODELING THE U.S. FIREARMS MARKET: THE EFFECTS OF CIVILIAN STOCKS, CRIME, LEGISLATION, AND ARMED CONFLICT

Topher L. McDougal, Daniel Montolio, Jurgen Brauer

Postal Address:
Institut d'Economia de Barcelona
Facultat d'Economia i Empresa
Universitat de Barcelona
C/ John M. Keynes, 1-11
(08034) Barcelona, Spain
Tel.: + 34 93 403 46 46
ieb@ub.edu
http://www.ieb.ub.edu

IEB Working Paper 2020/06

MODELING THE U.S. FIREARMS MARKET: THE EFFECTS OF CIVILIAN STOCKS, CRIME, LEGISLATION, AND ARMED CONFLICT [*]

Topher L. McDougal, Daniel Montolio, Jurgen Brauer

ABSTRACT: This study represents an attempt to understand the U.S. firearms market – the largest in the world – in economic terms. A model of the underlying interplay of legal firearms supply and demand is a prerequisite for reliably evaluating the effectiveness of pertinent existing state and federal firearms policies, and to amend them as necessary. The stakes are high: compared to other nation-states, per capita firearms-related harm in the United States (including suicides and homicides) is exceptionally high and, within constitutional strictures, state and federal firearms policymakers increasingly view it as a major and pressing society-wide problem. Virtually all firearms in the U.S. are initially manufactured and sold legally. Solving a simultaneous equation model using the instrumental variable of natural disasters and employing a unique dataset of U.S. firearms prices and quantities, this paper models – we believe for the first time in the literature – the U.S. market supply of, and demand for, firearms. Encouragingly, we find that this market operates as any other would be expected to, with the notable exception that lagged nonmilitary firearms stocks generate new market demand in a positive feedback loop. We test as predictors of market performance federal firearms legislation as instances of policy, as well as of extraterritorial armed conflict, firearms industry concentration, crime, and technology gaps between U.S. and imported firearms. Except for the time-limited Federal Assault Weapons Ban (1994-2004), we find (restrictive) firearms legislation not to influence sales. We also find that acute external violent conflict and certain levels of violent crime, including homicides and mass shootings, drive up unit sales, and that higher industry concentrations in certain submarkets boost quantity supplied, suggesting economies of scale. Taken together, this study's findings may provide some empirical support for firearms stock reduction programs to reduce the total volumes of civilian arms.

JEL Codes: C36, D40, L11, L64
Keywords: United States, Civilian Firearms, Demand, Supply, National Model, 3SLS

Topher L. McDougal
Associate Professor of Economic Development
Joan B. Kroc School of Peace Studies,
University of San Diego, U.S.A.

Daniel Montolio
Professor of Economics
University of Barcelona and Barcelona Institute of Economics (IEB), Spain.

Jurgen Brauer
Visiting Professor of Economics, EBA Program, Faculty of Economics
Chulalongkorn University, Bangkok, Thailand,
and Emeritus Professor of Economics, Hull College of Business, Augusta University,
Augusta, GA, U.S.A.

[*] We acknowledge the research support of Taylor Yeates, as well as comments and suggestions of attendees of the 23rd International Conference on Economics and Security, Instituto Universario General Gutiérrez Mellado, Madrid, Spain, 25 June 2019, and attendees of the Economists for Peace & Security Panel at the American Economic Association Annual Meeting, San Diego, CA, 4 January 2020.

1. Introduction

Karp (2018) estimates that the United States, at 1.2 firearms per capita, has a higher rate of firearms ownership than anywhere in the world – more than double the rate of war-torn Yemen (0.53) and thrice that of postwar Serbia and Montenegro (both at 0.39). Firearms ownership *per se* need not be a problem, but the United States also suffers from the highest rates of firearms-related harm in the high-income world. For example, in 2017, the U.S. rate of firearms homicide of 4.5 per 100,000 people was over 13 times that of its equally well-off northern neighbor, Canada (National Center for Health Statistics, 2018). Informed by the Second Amendment to the U.S. Constitution, which guarantees its citizens the right to keep and bear arms, the United States also has some of the laxest firearms laws globally, resulting in the world's largest civilian firearms market. In 2017, nearly 57,000 federally licensed firearms outlets in the United States retailed a total of about 12.8 million firearms, about one-third of which were supplied by imports (DOJ/ATF, 2019).

Goods designed to multiply the potential for violence can theoretically be expected to provoke overall welfare declines. This study is therefore justified by an adverse externality that, in turn, begs an understanding of the underlying market in the first place. And while much public discussion in the U.S. can give the impression that some wish to eliminate the firearms market altogether, economists will give pause, understanding better than most the often deleterious effects of supply-side suppression (e.g., Beletsky and Davis (2017); Moore (2010)). Moreover, firearms proponents and opponents agree that with the privilege of firearms ownership comes the responsibility of legitimate and safe use, and they share the goal of reducing firearms-related harm. In theory, then, the design and evaluation of effective firearms legislation should parameterize the firearms market.

Econometric analysis of the legal firearms market is, however, a prerequisite to making informed policy decisions. This is true for at least three reasons. First, while most gun crimes are committed with illegally-acquired weapons, virtually all firearms in the U.S. are initially manufactured and sold legally (Fabio, Duell, Creppage, O'Donnell, & Laporte, 2016). Second, firearms are often viewed as both cause and effect of eroding public security, stimulating demand for private security (Fleitas, Espinoza, & Perret, 2015). By raising perceived or actual levels of insecurity, the supply of firearms may generate its own demand, requiring instrumental variable (IV) models to account for potential endogeneity. Indeed, the availability of firearms on the nonmilitary (i.e., the civilian and law enforcement) market is a function of complex supply chains (Brauer & Muggah, 2006) involving domestic manufacture; imports; exports; flows between civilian, law enforcement, and military stocks (Masera, 2016); and a dynamic interplay between licit and illicit markets and retail outlets. Third, moral hazard, balloon effects, relative elasticities of supply and demand, and other economic phenomena may affect the efficacy of certain types of policy interventions seeking to reduce firearms-related harm.

As an initial step toward characterizing the U.S. firearms market, we simultaneously estimate supply and demand curves for the industry. To perform credible market studies, economists require reliable data on prices and quantities. Ongoing data scarcity and lack of data openness, transparency, and access in the firearms industry and among U.S. government regulatory bodies have historically hindered studies of its

firearms market. In this paper, we use a combination of publicly available and uniquely derived datasets, including both firearms quantities domestically produced and imported, and prices, that collectively allow us to fully characterize the market by simultaneously predicting supply and demand volumes as a function of price. Thereafter, we separately investigate three phenomena not included in the primary analysis due to fewer study years being available to test each:

(i) industry concentration and potential cartel behavior;

(ii) the effect of a technology gap between domestically produced and imported weapons; and

(iii) violent crimes against persons (mass shootings and other violent crimes).

With one notable exception, we find that the firearms market functions like any other. The exception is that while greater recent civilian firearms stocks decrease the annual demand flow for new firearms, 5-year lagged stocks actually *increase* demand flows. Further lending credence to the idea that firearms generate their own demand, homicides and mass shootings are also associated with greater purchases. Further, we find that (demand-restrictive) firearms legislation does not affect realized demand, except for the time-limited Federal Assault Weapons Ban which was in effect from 1994—2004. We also find that U.S. participation in acute extraterritorial violent conflicts and higher industry concentration in certain submarkets (particularly pistols) boosts quantity supplied, suggesting economies of scale. Finally, we find evidence that a technology gap between imports and exports intuitively decreases quantities purchased.

The paper is organized as follows. Section 2 reviews the relevant literature on the economics of firearms, as part of the somewhat larger small arms market. Section 3 discusses our research method adopted for this study, a simultaneous equation model with an exogenous instrumental variable. Section 0 presents our results, including the effects of certain model controls such as civilian firearms stocks, the role of military veterans in firearms demand, and federal firearms legislation. Section 5 explores three additional influences on the firearms market: industry concentration, crime (mass shootings, other homicides, and other violent crime), and a technology gap between U.S. and foreign firearms producers. Section 6 sums up and concludes with a discussion, highlighting possible policy lessons.

2. Literature Review

Despite its large size and prominent role in early American industrialization (Brauer, Montolio, & Trujillo-Baute, 2017, footnote 2), the U.S. civilian firearms market remains largely uncharacterized from the point of view of economic analysis. One key limitation is data (Muggah & McDougal, 2014). Gabelnick, Haug, and Lumpe (2006) note a number of post-9/11 policy developments restricting data accessibility via the Department of Justice's Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), the Department of Defense, the Census Bureau, and the Customs and Border Protection Service (CBP), and also demonstrate significant data discrepancies across various U.S. agencies responsible for tracking firearms production, sales, imports, and exports. Brauer (2013b) has noted that, on a national level, we have quantity data but not price data, both of which are indispensable pieces in market characterization. Brauer (2013a),

however, proposed a method for estimating yearly price indices for firearms, which was implemented and used here to generate the data employed in this study.

The legal U.S. market for firearms comprises four distinct segments: pistols, revolvers, rifles, and shotguns. The pistol market has seen numerous producers enter and exit the market over the 1980-2010 period (and since then) while the revolver and shotgun markets were both stable duopolies (Ruger and Smith & Wesson in the former, Mossberg/Maverick and Remington in the second). The rifle market was diverse, though its top holding company enjoyed over 30% market share spread over several brands (Brauer, 2013b). Taken as a whole, the industry has exhibited severe production vacillations over the period 1980-2010 (Brauer, 2013b), with generally greatly heightened production in the 2010s and since then (see Figure 1 in Section 3.2 below). Prior to 2010, mass shootings tended to significantly reduce the stock prices of firearms manufacturers, possibly indicating a risk to producers of tighter legislation. This stock price reduction effect disappears after 2010, however, possibly indicating that worries of such legal crackdowns in the most recent decade have done more to boost demand than to threaten producers (Gopal & Greenwood, 2017; Jones & Stone, 2015). End-user "friendly" state legislation positively influences manufacturers' location decisions, but only as one among other factors which also include relative tax burden, wage profiles, and agglomeration effects (Brauer et al., 2017).

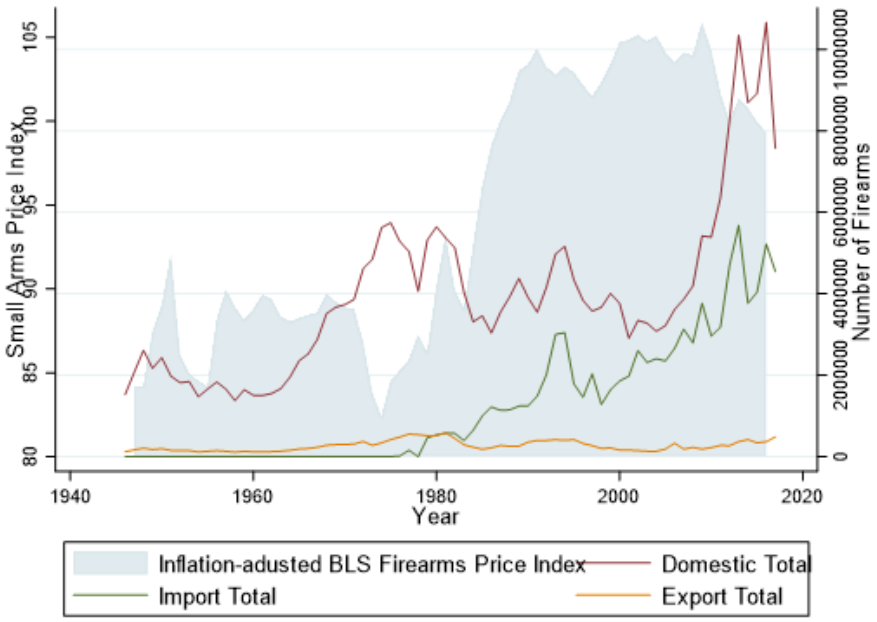

Figure 1. Annual domestic firearms production, export, and imports (lines, secondary y-axis) and BLS price index (area, primary y-axis) by year. Source: DOJ/ATF (2019) & BLS (2019).

The firearms market in the U.S. has for some years been described as "mature", "saturated," and even "stagnant" (Diaz, 2004), which until 2005 was demonstrably true but not since then, when unit sales vastly increased (see Figure 1 below). The market came under heavy foreign competition, especially in the pistol segment, starting in the mid-1980s, and yielded considerable market share to foreign brands in the

decades since, following trends in many other U.S. manufacturing industries (Brauer, 2013b). Beginning in the 1990s and 2000s, the market has relied on a combination of product design innovations (often making their products more deadly; see (Diaz, 2004; Smith et al., 2015), market demographic expansion (Blair & Hyatt, 1995; NSSF, 2014, 2015), and demand-stoking via vested interests, especially leveraging fear of crises and tightened legislation (see, e.g., Gopal & Greenwood, 2017; Langley, 1999). For instance, the impending passage of the federal Violent Crime Control and Law Enforcement Act of 1994 spurred the demand for, and production of, AR15-(assault-)style weapons that would soon be banned, creating a pre-passage price depression and a post-passage price surge (Koper & Roth, 2002).

There is a small but growing body of evidence on illicit firearms markets. They may operate with considerable transaction costs, resulting in much higher prices than on the legal market (Cook, Ludwig, Venkatesh, & Braga, 2007). They also rely on a varied set of pathways from the legal market (Chestnut et al., 2017), most often using near-to-retail diversions to obtain the firearms (Braga, Wintemute, Pierce, Cook, & Ridgeway, 2012). There is substantial interstate trafficking in firearms (Knight, 2013) due to the patchwork of legislation at subnational levels (Vernick, Webster, Bulzacchelli, & Mair, 2006), and a large quantity of small arms are trafficked annually from the U.S. into Mexico (McDougal, Shirk, Muggah, & Patterson, 2015).

As suggested in the introduction, endogeneity between quantity and price of firearms seems plausible. One the one hand, greater quantities of firearms supplied may, all other things equal, generate heightened levels of homicide and other victimization (including suicide) (Anglemyer, Horvath, & Rutherford, 2014). Variations in U.S. state laws regulating access to firearms have even had knock-on effects on homicide rates across the southern border in Mexico (Chicoine, 2011; Dube, Dube, & García-Ponce, 2013). On the other hand, lower levels of perceived or actual public security may also generate heightened demand for firearms as a source of personal protection (McDowall & Loftin, 1983), thereby driving up prices and spurring production quantities. Accounting for the possible existence of such circular causation suggests the use of instrumental variable regression. We now outline our statistical research strategy (Section 3) and then present the results (Section 4).

3. Methods

3.1. Empirical Strategy

We exclusively employ OLS models with natural logs of prices and quantities as primary outcomes and regressors – a choice both simple and appropriate to the task. In order to account for possible endogeneity in the estimation of firearms quantities produced as a function of prices, we employ a simultaneous 3-stage least squares instrumental variable model in which demand-side price is instrumented using measures of the severity of natural disasters. The supply and demand functions can be represented separately as simultaneous equations (see, e.g., Yobero (2016)):

Supply: $$\mathrm{Ln}Q_t^m = \alpha + \beta \mathrm{Ln}(P_t) + G \sum \mathrm{Ln}X_{t-1} + \epsilon_t^1 \qquad (1)$$

Demand: $$\mathrm{Ln}Q_t^m = \delta + \kappa \mathrm{Ln}(P_t) + M \sum \mathrm{Ln}Y_{t-1} + \epsilon_t^2 \qquad (2)$$

Instrument: $\mathrm{Ln}(P_t) = \gamma + \rho \mathrm{Ln}(D_{t-1}) + \epsilon_t^3$ (3)

where Q_t^m is the equilibrium quantity of firearms produced and sold for market m in year t, P_t is inflation-adjusted firearms prices on the U.S. legal market, X_{t-1} is a vector of other potential variables (economic, political) that could determine the sales of firearms in the U.S., while Y_{t-1} is a vector of other potential variables (economic, political) that could determine the demand of firearms in the U.S. D_{t-1} in Eq. (3) is a measure of the effects of natural disasters. By "market" (m), we mean one of three production categories: (1) domestic production for the domestic market (or nonexport production in the U.S.), (2) domestic production for foreign markets (exports), and (3) foreign production for the domestic market (imports). D serves as our instrumental variable and refers to certain measures of natural disasters. There is some anecdotal evidence that firearms are in greater demand following natural disasters, when strained law enforcement institutions may struggle to guarantee property rights and enforce contracts (see, e.g., NPR, 2006). Such observations would be in line with findings more broadly linking collective security to demand for firearms in Detroit for example (McDowell and Loftin, 1983). Conversely, however, the effect of the 2010 earthquake in Haiti was to dampen prices for firearms ammunition in that country; see McDougal et al. (2018.)

Per standard econometric estimations of supply and demand, we use logged outcome and primary predictor variables (see, e.g., Yobero, 2016; Zarembka, 1968), implying that resulting coefficients may be interpreted as elasticities. We also use lag predictor variables pertaining to the supply-side to allow for large firms to adjust and adapt to changes, as well as to meet the temporality criterion for demonstrating Granger causality (Gujarati and Porter, 2009). We do not attempt to model year fixed-effects, as they would be collinear with many of our other predictor variables.

3.2. Data

Data for our mediating and outcome variables – inflation-adjusted firearms prices on the U.S. legal market (1947-2017) and quantity of firearms for market m, respectively – come from the Department of Commerce's Bureau of Labor Statistics (BLS, 2019) and the U.S. Department of Justice's ATF (DOJ/ATF, 2019) and other data. The BLS price index, when inflation-adjusted, is similar, but not identical, to firearms prices as a percentage of personal income (see Figure 2).

Secondary, separate price indices for domestic handguns (1980-2017), domestic long guns (1980-2017), and imported handguns (1989-2017) were reverse-computed from the U.S. Treasury's Tax and Trade Bureau (TTB, 2019) and the U.S. Department of Justice's ATF data (DOJ/ATF, 2019). These are used to test findings in the handgun and long-gun sub-markets separately. The TTB gives tax obligations (slightly different from taxes collected) on firearms sales by manufacturer and importer supplying the wholesale or retail chain. Since the tax rate is known (e.g., 10% on handguns), one can take, say, $100 million in handgun tax obligations divided by 0.1 to compute $1 billion in handgun sales. We divide the figures on total sales volume by the ATF handgun production and Census/ITC import data to get a nominal average handgun price, and then deflate and index (2012 = 100) the result.

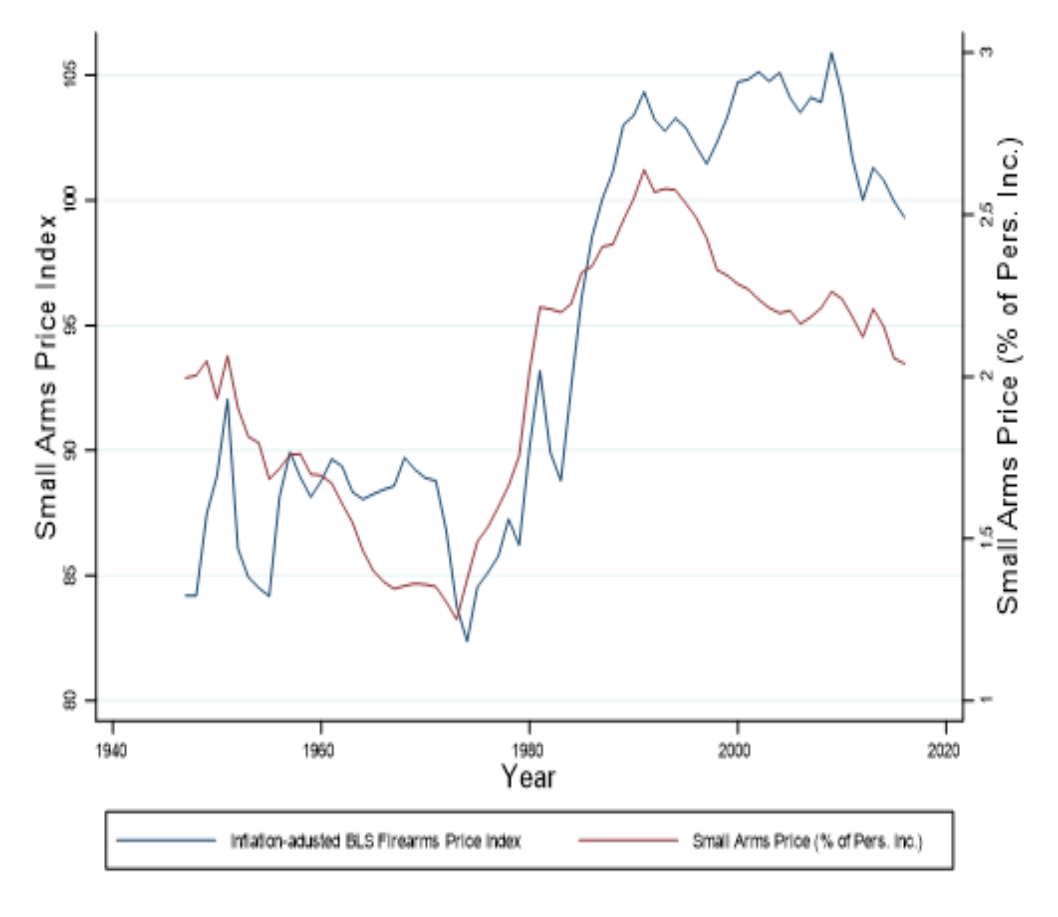

Figure 2. Inflation-adjusted small arms price index (primary y-axis, 2012 = 100) and small arms price as a percentage of mean personal income (secondary y-axis) by year. Sources: BLS (2019), the authors.

Quantity outcomes include domestic production for U.S. markets, exports, and imports. Domestic production for the U.S. market is calculated by subtracting reported exports from total domestic production. Total production already excludes manufactured weapons that go into producer inventories (though wholesalers and retailers may have inventories of their own for which we have no data). Imports, exports, and total U.S.-made firearms sold on U.S. markets are depicted above in Figure 1 against the backdrop of the BLS inflation-adjusted small arms price index. Visually and as one might expect, production spikes tend to correlate to price depressions and vice versa.

Our instrumental variable candidates having to do with the disasters were obtained from EM-DAT, the International Disasters Database maintained by the Centre for Research on the Epidemiology of Disasters (CRED) at the School of Public Health, Université Catholique de Louvain. Using the World Bank's country-year data on population and GDP, we created population rates of three variables (number of people affected by disaster, number of people rendered homeless by disaster, and the number of people killed in disasters) and normalized a fourth by GDP (to create a proxy for economic damages as a percentage of GDP). We then created log-normal versions of each of these variables for use in our models. We eliminated two candidates as IVs that were irrelevant to the mediator (i.e., log damages per GDP and log

disaster deaths per 100,000 people). For our empirical tests of the remaining two candidates, see Section 4.1 below.

Table 1. Summary statistics for the major outcome, mediating, and instrumental variables.

Variable	N	Mean	S.D.	Min	Median	Max	Skewness
Log U.S. Firearms Production for U.S.	72	15.06	0.50	14.14	15.12	16.18	-0.01
Log Imported Firearms to U.S. Market	72	8.23	7.08	0.00	13.23	15.55	-0.28
Log U.S. Firearms Exports	72	12.40	0.47	11.62	12.36	13.28	0.11
Log BLS Firearms Price Index	71	4.55	0.08	4.41	4.51	4.66	0.06
Log Brauer Handgun Price Index	38	4.50	0.13	4.06	4.50	4.68	-0.98
Log Brauer Long Gun Price Index	38	4.46	0.14	4.15	4.48	4.77	-0.11
Log Brauer Imported Handgun Price Index	29	4.67	0.10	4.45	4.66	4.90	0.14
Log People Rendered Homeless by Disasters	73	0.56	0.98	0	0	4.59	2.04
Log Disaster-Affected People Per 100k	73	2.31	2.49	0	1.63	10.18	0.88

We use most of our control variables to control for demand-side phenomena; only three variables – unemployment rate, conflict intensity, and cumulative conflict intensity – do we deem to affect supply most directly. Unemployment rate presumably affects producers by changing the costs of finding and retaining labor. War intensity and cumulative intensity may raise firearms production and capacity more generally, as many U.S.-based firearms manufacturers serve both the military and the nonmilitary markets[5]. Population, real income per capita, and unemployment rate all come from the Federal Reserve Economic Data (FRED II database). Numbers of U.S. veterans were obtained from annual Bureau of Veterans Affairs reports. Presidential party and Republican shares of the U.S. House of Representatives and Senate were obtained from public government records.

Firearms stocks were calculated with a cumulative subtraction algorithm from a recent starting point estimate. We began with a 2017 estimate by (Karp, 2018) of 393,347,000. We assumed an annual stock depreciation rate of 0%. This unrealistically low number is adopted because the total official domestic sales in the United States between 2011 (the year of the previous Small Arms Survey estimate of 270 million (Small Arms Survey, 2011)) and 2017 cannot collectively account for the difference between those two point estimates: the Small Arms Survey point estimates suggest a stock growth of 123.3 million firearms, but the official domestic sales in the intervening period totaled just 92 million.

Koper and Roth (2002) describe how the anticipated passage of the 1994 Federal Assault Weapons Ban drove up production by foresighted suppliers. Later, as prices rose following the ban's passage, supply dwindled due to the legal restrictions. Existing weapons were "grandfathered" in (meaning allowed under the laws in effect at the time of their purchase) and available for sale and resale during the ban-years. To model anticipated legislative changes, we generate an integer variable that is set by default to 0, but adds 1 for each year preceding the passage of a major piece of restrictive U.S. gun control legislation and

[5] The U.S. military does not tend to issue spot-orders to fill any immediate demand needs. That said, it is true that current and cumulative external conflict increases wear and tear and leads to replacement needs, even if stretched out over time (Stiglitz & Bilmes, 2012). These conflict events and periods may also be associated with higher security sensitivity and fear transmission in the general U.S. population (e.g., after the events of 9/11), and therefore with a hypothetical uptick in the civilian market. All-in-all it seems at least plausible that this variable may play a role in supply decisions.

subtracts one for each year preceding the passage of a major of U.S. legislation relaxation of firearms controls. We also generate a running cumulative variable to proxy for the strength of firearms control laws in any given year. Pertinent laws are listed in Table 3.

Table 2. Summary statistics for control variables.

Variable	N	Mean	S.D.	Min	Median	Max	Skewness
Log Population	72	12.33	0.24	11.86	12.35	12.69	-0.26
Log Military Veterans	73	17.01	0.14	16.65	17.03	17.21	-0.55
Log Civilian Firearms Stocks	72	18.66	0.71	17.34	18.77	19.79	-0.18
Real Income Per Capita	70	-3.90	0.45	-4.70	-3.88	-3.25	-0.22
Unemployment Rate	70	5.79	1.61	2.90	5.60	9.70	0.59
Log Real GDP (U.S.$2010)	58	9.02	0.51	8.06	9.08	9.76	-0.22
Presidential Party (Dem = 1)	72	0.49	0.50	0.00	0.00	1.00	0.06
Share Republican: House	72	0.45	0.07	0.32	0.44	0.57	0.13
Share Republican: Senate	72	0.46	0.07	0.32	0.45	0.55	-0.35
Anticipated Firearms Legislation Passage	73	0.04	0.39	-1.00	0.00	2.00	1.82
Log Gun Laws	73	0.93	0.66	0.00	1.10	1.79	-0.44
Federal Assault Weapons Ban	73	0.14	0.35	0.00	0.00	1.00	2.11
UCDP Summed Conflict Intensity	73	2.62	3.10	0.00	2.00	13.00	1.28
UCDP Summed Cumulative Conflict Intensity	73	1.48	1.80	0.00	1.00	7.00	1.24
Herfindahl-Hirschman Index	32	840.22	89.37	689.88	860.79	1030.1	-0.07053
Technology Gap	29	0.1492	0.1954	-0.106	0.075	0.5912	0.70039
Log Fatal Shootings	35	2.5593	1.0848	0	2.7081	4.2767	-0.72679
Log Violent Crimes	53	13.857	0.581	12.381	14.098	14.474	-1.39734
Log Murders	53	9.7232	0.2994	8.9737	9.7857	10.115	-1.17389

Table 3. Major pieces of federal gun legislation and their effects on the generated firearms control variable.

Year	Legislation	Variable Effect
1968	Gun Control Act	1
1968	Omnibus Crime Control and Safe Streets Act	1
1986	Firearm Owners Protection Act	-1
1988	Undetectable Firearms Act	1
1990	Gun-Free School Zones Act	1
1993	Brady Handgun Violence Prevention Act	1
1994	Federal Assault Weapons Ban	1
2004	Federal Assault Weapons Ban (expiry)	-1
2005	Protection of Lawful Commerce in Arms	-1

The experience of U.S. extraterritorial armed conflict is captured by two variables derived from the Uppsala Conflict Database Program's (UCDP) Armed Conflict Dataset (version 19.1) (Gleditsch, Wallensteen, Eriksson, Sollenberg, & Strand, 2002; Pettersson, Högbladh, & Öberg, 2019). The two original variables describe (a) intensity of each armed conflict in a given year (0-2), and (b) a binary (0,1) variable for cumulative intensity, denoting whether a conflict has equaled or exceeded 1,000 battle-related deaths since its inception. We first expanded this dataset to have the unit of analysis of country-conflict-year rather than conflict-year. We then collapsed the result by country-year, summing the conflict intensity

and cumulative intensity scores and yielding the variables we used for this study. Hence, the variable merged into our dataset represents the combined intensities of all conflicts in which the United States took part in a given year.

Several control variables were not included in the main models due to their limited observations, including the Herfindahl-Hirschman Index (HHI), technology gap, fatal shootings, total violent crimes, and murders. Nevertheless, we deemed these variables important enough to merit inclusion in tailored spin-off analyses. HHIs were calculated in the usual way using ATF-reported quantities of arms sold per producing Federal Firearms License (FFL). However, they will be floor estimates, as multiple FFLs manufacture arms are subsidiaries of a single holding corporation. Without in-depth knowledge of shifting corporate ownership structures, it is not possible to produce more accurate HHIs. The technology gap refers to the fact that imported weapons were considered more sophisticated than the U.S.-made competition during the 1980s and 1990s. We model this technology gap simply by normalizing the difference in price indices between imported and domestic handguns by the price index of domestic handguns. Crime figures come from the U.S. Department of Justice's Federal Bureau of Investigation (FBI, 2019).

3.3. Instrumental Variables

We identify four possible instrumental variables for our models: variables that might affect the price in the short-run, but not the quantity of firearms bought or sold. We introduced possible IV variables measuring the effects of natural disasters. While not necessarily exogenous to economic performance (Botzen, Deschenes, & Sanders, 2019), the effects of natural disasters may nevertheless be more exogenous than other economic disruptions of national scale and has been used as an IV in previous papers (McDougal, Kolbe, Muggah, & Marsh, 2018; Ramsay, 2011). However, their effects on prices and quantities of firearms are theoretically ambiguous: if they raise demand in the context of inelastic supply (or decrease supply in the context of inelastic demand), prices might rise without significant increases in quantity. Conversely, if they raise demand in the context of perfectly elastic supply (or decrease supply in the context of perfectly elastic demand), quantity might change without a corresponding change in price. We therefore test empirically log population killed by natural disasters (in a given year per 100,000 population), log population "affected" by natural disasters (in any way, including being killed, rendered homeless, displaced, etc.), log population rendered homeless, and log economic damages in constant U.S. dollars, for both relevance (to firearms prices) and exogeneity (vis-à-vis quantity of firearms sold) in uncontrolled and controlled OLS regressions. Controlled models include all covariates we later use in our full 3SLS regressions. We choose price as the IV mediator because we deem the total quantity of firearms sold on U.S. markets to be of greater direct policy import than prices. Table 4 summarizes Appendix Table 1 and Appendix Table 2, demonstrating that in controlled models, only log deaths due to disasters is both relevant (to price) and exogenous (to quantity). The other three candidates would meet the IV criteria only for a model that used a mediator of quantity to predict price.

Table 4. Prospective instrumental variables assessed for relevance and exogeneity.

	Relevance (to price)		Exogenous (to quantity)	
Prospective Instrumental Variable	Uncontrolled	Controlled	Uncontrolled	Controlled
Log Deaths Due to Disasters	No (+)	**Yes (-)**	**Yes (+)**	**Yes (+)**
Log People Rendered Homeless by Disasters	**Yes (+)**	No (+)	No (+)	**Yes (+)**
Log Total Affected by Disasters	**Yes (-)**	No (+)	No (+)	**Yes (+)**
Log Total Damages Due to Disasters (US$1,000)	**Yes (+)**	No (+)	No (+)	**Yes (-)**

Employing uncontrolled and controlled Durbin-Wu-Hausman tests, the residual terms from the first-stage equations are not significant ($p = 0.4542$ and $p = 0.939$ respectively) in predicting the outcome of domestic production for the U.S. market, indicating that controlling for possible endogeneity between price and quantity is not necessary (Davidson & MacKinnon, 1993). Given the responsiveness of price to log disaster deaths, we use the latter below in predicting price in our SEMs.

4. Basic Results

We present uncontrolled and controlled coefficients for the lagged price mediator in SEMs for three logged outcomes:

1. domestic production of domestically-sold firearms;
2. exports of domestically-produced firearms; and
3. imported production of domestically-sold firearms.

For each logged quantity outcome, we run ten models containing the log price predictor: supply and demand, each for five control scenarios. Results are presented in Table 5 (regressions that inform this summary coefficient table are presented in: Appendix Table 3, Appendix Table 4, and Appendix Table 5).

The results indicate that our primary outcome follows standard microeconomic theory. The price elasticity of supply is positive and significant across all model specifications that include any controls, indicating that domestic producers are willing to make more firearms as prices rise. Conversely, the price elasticity of demand is negative and significant in all models that include economic controls, indicating that buyers are less willing to purchase firearms as prices rise. The same signs (though different statistical significances) are seen in the case of exports, possibly suggesting that U.S. domestic prices are correlated, if imperfectly, with prices on foreign firearms markets. Finally, while foreign supplies appear to respond positively (and dramatically) to higher prices, the elasticity of demand for imports also appears positive (except in the case of economic controls only, where it is negative and significant). This might be explained by noting that the BLS small arms price index is a producer-price index and entirely dictated by U.S.-made firearms; therefore, rising domestic firearms prices might be expected to drive customers to imports in a substitution effect, and vice versa. This interpretation is contextualized by the fact that imports were initially more technologically sophisticated than U.S.-made firearms and therefore commanded higher

prices. In competition with improving U.S. weapons, the price gap eventually closed over the course of the 1980s and 1990s (see Figure 3 and section 5).

Table 5. Summary coefficients for firearms price in SEM regressions on various outcomes (IV = log people affected by natural disasters per 100,000).

Outcome	Supply/ Demand	1 Uncontrolled	2 Demographic Controls[1]	3 Economic Controls[2]	4 Political Controls[3]	5 Legal Controls[4]	6 All Controls
Domestic Production	Supply	5.259	**4.538*** **	**6.911*** **	**3.327** **	**7.471*** **	**3.422*** **
	Demand	6.106	-2.544	**-7.984*** **	**7.041*** **	4.580	**-3.288** **
Exports	Supply	5.492	**1.294***	**3.414*** **	0.120	**5.331*** **	**1.502** **
	Demand	6.376	**-9.883***	**-13.12*** **	1.055	-3.912	-1.088
Imports	Supply	**98.32** **	**88.94*** **	**91.23*** **	**99.38*** **	**108.5*** **	**90.02*** **
	Demand	**114.2** **	51.27	**-109.7** **	**124.0*** **	**50.72***	**27.38***

[1] X (supply): None. Y (demand): Population, military veterans, estimated firearms stocks, homicide rates, suicide rates.

[2] X: Unemployment rate. Y: Per capita real disposable income.

[3] X: UCDP conflict intensity, cumulative UCDP conflict intensity. Y: Party of the President, Republican share of Senate, Republican share of House.

[4] X: None. Y: Anticipated firearms legislation passage, cumulative firearms legal onus, federal Assault Weapons Ban.

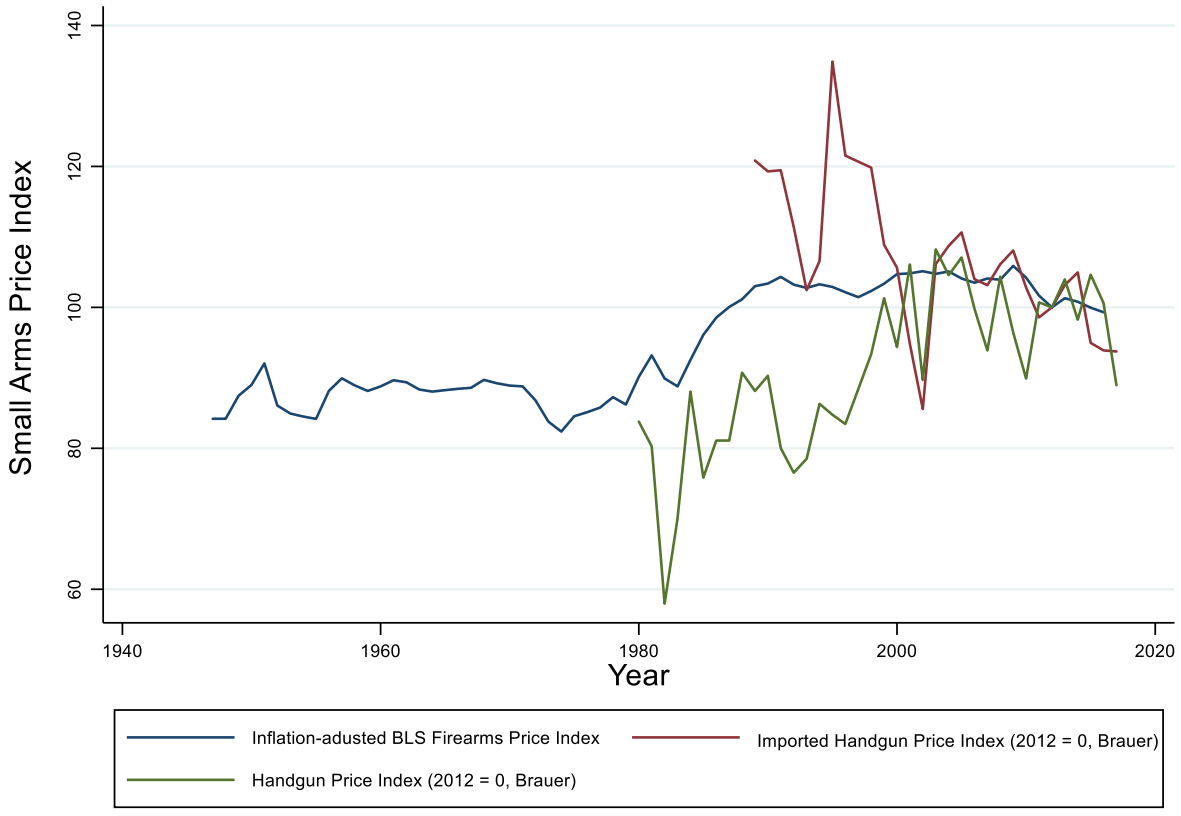

Figure 3. Imported (red) and domestic (green) handgun prices indices by year, plotted along with the overall inflation-adjusted BLS small arms price index (blue). 2012 = 100.

A few other results of our SEM also merit mention. In terms of U.S. production for domestic sale, Appendix Table 3 indicates that, as we had supposed, the unemployment rate is indeed a positive and highly significant predictor of quantity supplied. This suggests that higher unemployment rates unsurprisingly make it cheaper to pay worker salaries, and thus fits the general pattern of manufacture moving to lower-cost states (Brauer et al., 2017). Conversely, higher income is associated with more purchases on the demand side. The intensity of U.S. conflicts abroad is associated with greater production for civilian markets, possibly because of production economies of scale. Homicides are significantly associated with heightened future demand in both models in which they figure; suicides are not. The military veteran population is positively and significantly associated with demand when controlling for recent and 5-year lagged stocks (see below). Democratic-party U.S. presidents are generally associated with a boost the quantity demanded by around 10%, presumably due to fears of potential future federal firearms legislation. The share of Republican legislators in the House of Representatives is also positively associated with demand rises. However, the effects of legislation itself are mixed. The number of federal firearms laws (i.e., the running total of federal sales restrictions as described above) is not correlated to firearms unit sales, bucking popular presumption. The exception to this is the Federal Assault Weapons Ban, in effect from 1994-2004, which is credited by the SEM with a 0.25% decline in domestic firearms sales for U.S. markets. Overall, the models with sociodemographic and economic controls were most highly predictive of demand, explaining 86% and 64% of its variation, respectively. The model with political controls (including U.S. war involvement) was most highly predictive of supply, explaining 18% of its variation.

Intrigued by the non-association between estimated firearms stocks in civilian hands and current demand, we hypothesized that opposite trends may be simultaneously operating. Current stocks may satiate demand, while legacy stocks may boost it by increasing the likelihood that firearms fall into the wrong hands or are used for violent ends. We therefore introduced a 5-year lag of estimated civilian firearms stocks. Indeed, we found a significant ($p = 0.004$) and *positive* association for current stocks, and an even more significant ($p = 0.000$) and *negative* association for lagged stocks.

5. Other Influences

Certain factors we could not include in the overall models due to study period limitations on associated data. We therefore chose to deal with three important issues separately. The first two regard industry composition, namely: (1) industry concentration and cartel behavior, and (2) the technology gap between U.S. and foreign firms. The third issue involves the effects, if any, of high-profile mass shootings and other violent crimes, on the firearms market.

Given the characterization of certain firearms submarkets as being strong duopolies or oligopolies (Section 2 and (Brauer, 2013b)) and observing considerable variation in HHI for the U.S. firearms market as a whole as well as its submarkets (see Figure 4), we chose to investigate whether such industry supply concentrations are significant enough to influence production quantities. Since we have HHI information only for a subset of our study years (1986-2017), including the variable in the original SEM above would have reduced our number of observations from 71 to 31 (a drop of 56%). Accordingly, we re-ran controlled

and uncontrolled SEMs both with and without the inclusion of Herfindahl-Hirschman Indices (HHIs), restricting the observations utilized in both cases to those in which HHIs exist, for both the overall market as well as for the pistol and rifle submarkets.

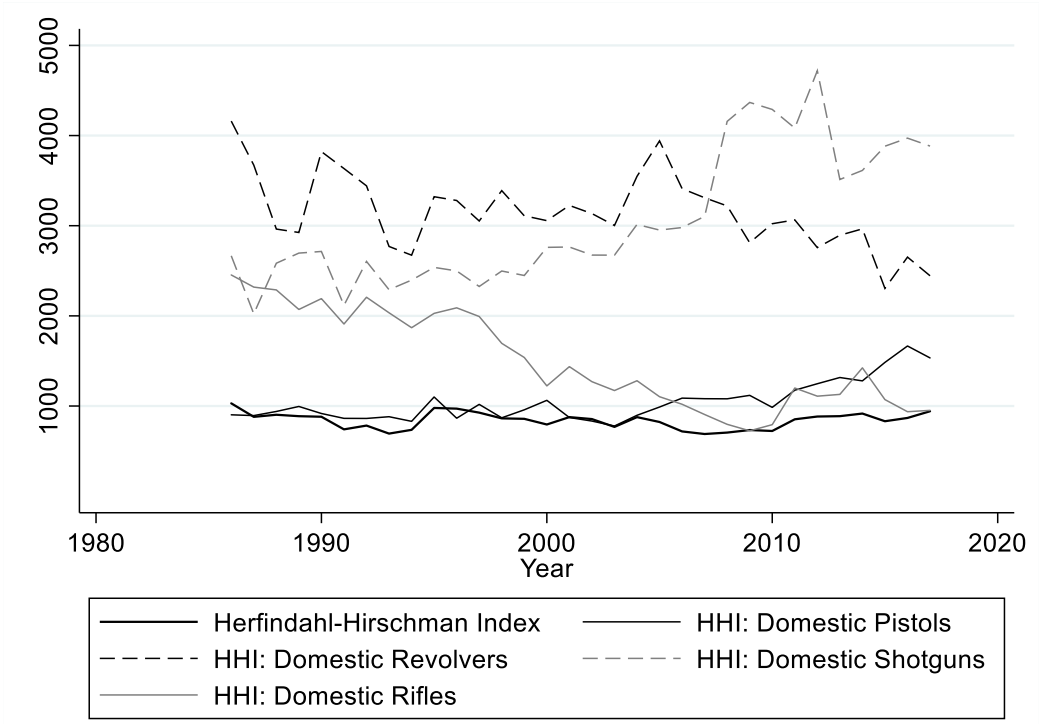

Figure 4. HHIs for the overall U.S. firearms market and submarkets, 1986-2017. Source: the authors.

The technology gap that existed between U.S. and foreign manufacturers in the 1980s and 1990s is commonly cited as a major factor in driving the steep rise in imported firearms to the U.S. over that period (Brauer (2013b); see Figure 3). We hypothesize, therefore, that the larger this gap, the fewer U.S.-made firearms would be sold. Since we have price indices for both domestically-produced and imported handguns sold in the U.S. for the period 1986-2017 and assuming that price is reflective of quality and technological sophistication in a given year, we are able to construct a proxy for the technology gap proxy as:

$$TechnologyGap_t = (P_{i,t} - P_{d,t})/P_{d,t} \quad (4)$$

where $P_{i,t}$ and $P_{d,t}$ the price of imported and domestically-produced handguns in time t, respectively. We use the same paired-sample methodology described above in our SEM estimations.

Just as with HHIs and the technology gap, we had limited data on violence and crime. Three indicators of interest to us were (1) mass shootings (from a dataset collected and maintained by *Mother Jones*, 1982-2016 (Follman, Aronson, & Pan, 2016)), (2) violent crimes in general (Department of Justice, 1960-2012). We ran side-by-side IV SEMs for each of these variables under uncontrolled and controlled scenarios,

restricting uncontrolled model observations by the same criteria that would apply in the controlled scenario.

Table 6. Coefficients for selected predictors (HHI, technology gap, crimes) in various SEM models estimating quantity of firearms. Derived from ¡Error! No se encuentra el origen de la referencia.-¡Error! No se encuentra el origen de la referencia. **in Appendix A.**

		1	2
Predictor	**Category**	**Uncontrolled**	**Controlled**
HHI	All	-0.00242	-0.000862
		(0.00155)	(0.000520)
	Hand guns: Pistols	0.0370	**0.00167*****
		(0.0250)	(0.000321)
	Hand guns: Revolvers	-0.00152	-0.000113
		(0.00198)	(0.000103)
	Long guns: Rifles	-1.66e-05	**0.000320***
		(8.85e-05)	(0.000127)
	Long guns: Shotguns	**0.000181***	**0.000324****
		(7.54e-05)	(0.000105)
Technology gap	All	**-1.171*****	**-0.620***
		(0.224)	(0.279)
	Handguns	-3.555	**-0.997*****
		(4.125)	(0.266)
	Long guns	-0.214	**-0.490*****
		(0.266)	(0.141)
Crime	Mass Shootings	**0.00899****	**0.00300*****
		(0.00335)	(0.000812)
	Violent Crimes	-0.171	-0.293
		(3.061)	(1.179)

Note: Standard errors in parentheses: *** p<0.001, ** p<0.01, * p<0.05.

Table 6 lists the values of coefficients for HHIs (only available for U.S. producers), the technology gap, and log-counts of selected crimes associated with firearms, within SEMs modeling quantity of firearms. HHI enters the SEM in the supply-side due to its presumed effects on competition pricing, while the technology gap and crimes enter on the demand-side due to their presumed effects on consumer willingness-to-pay. Coefficient estimates are derived in various sub-market categories as shown. Results from the industry concentration analysis show no cartel behavior overall. Strangely, there is evidence that industry concentration increases supply in the pistols submarket and, to a lesser extent, in the rifle and shotgun submarkets. These results would indicate that larger corporations are reaping economies of scale in those submarkets – though conspicuously this is not the case for revolvers[6]. There is evidence that the technology gap, as proxied, drives quantity demanded in the overall market, as well as in the handgun and long gun submarkets. In other words, larger gaps are associated with lower prices. As for crime, our basic model already provided evidence that homicides were positively associated with demand. Here, too,

[6] It is worth noting that import shares of revolvers (31%) are much lower than those for pistols (41%).

we find that mass shootings do indeed predict greater sales of firearms, but the effect size is only about 1/10 the size. In the case of violent crimes more generally, no effect is observed.

6. Conclusions

We have presented a national-level model of the U.S. firearms market, 1946-2017, using an instrumental variable simultaneous equation model approach. We believe that this study contributes to the understanding, and potentially more information pertinent to, regulation of a complex market. The basic contours of this market conform to microeconomic theory: the price elasticity of supply is positive, that of demand is negative. However, some interesting tidbits emerge from the initial model and subsequent analyses, as follows:

Firearms stocks and crime. Levels of existing stocks are not found to be associated with demand. However, when we include both stocks and 5-year stock lags in the models presented in Appendix Table 3, a clear pattern emerges: current stocks are associated with depressed realized demand, while lagged stocks are associated with boosts. This finding may accord with the hypothesis that misuse and abuse of firearms generally erodes property security (and perhaps feelings of personal safety as well), implying that firearms create their own demand. Indeed, we do find that violent crimes generally, and mass shootings specifically, drive demand for firearms up. Such a finding is in agreement with theoretical models of conflict in the absence of property security (Caruso, 2010), as well as empirical studies of the effects of collective insecurity on firearms demand (McDowall & Loftin, 1983). The finding specific to mass shootings also accords with recent work suggesting that these events drive up prices, and have traditionally driven *down* firearms manufacturers' stock prices – until a post-2010 "new normal" emerged (Gopal & Greenwood, 2017; Jones & Stone, 2015). These findings may suggest an economic justification for legal restrictions on the sales of firearms paralleling those on sales of harmful and addictive drugs, and for firearms buyback programs and small arms destruction programs in situations of over-supply. Further research is justified in assessing the elasticity of substitution of illegally-acquired weapons for legally-acquired ones.

Legislation. The (log) "burden" of firearms laws is not correlated to firearms sales. If firearms legislation does have a demand-dampening effect, it may also make legal purchase and ownership clearer and easier, or simply not do much besides stoke fears of impending firearms shortages. The major exception to this rule is the U.S. Federal Assault Weapons Ban (FAWB), signed into law in 1994 by then-President Clinton and allowed to expire 10 years later by then-President Bush, which we credit econometrically with a 0.25% drop in domestic firearms production for U.S. markets. These empirical findings may corroborate both seemingly-antithetical claims that firearms legislation largely has no significant effect on firearms sales (Polsby, 1994) and observations that the FAWB did in fact reduce the total availability of weapons on the market (Chicoine, 2011; Dube et al., 2013; Koper & Roth, 2002). This result may imply that firearms legislation only curbs volumes on the market when it involves an outright ban on some category of weapon.

War. We find that U.S. military campaigns abroad have a positive effect on quantity supplied both on the domestic and export markets, suggesting possible evidence of a military-industrial complex effect and economies of scale.

References

Anglemyer, A., Horvath, T., & Rutherford, G. (2014). The Accessibility of Firearms and Risk for Suicide and Homicide Victimization Among Household Members: A Systematic Review and Meta-analysis. *Annals of Internal Medicine, 160*(2), 101-110.

Beletsky, L., & Davis, C. S. (2017). Today's fentanyl crisis: Prohibition's Iron Law, revisited. *International Journal of Drug Policy, 46*(156-159). doi:https://doi.org/10.1016/j.drugpo.2017.05.050

Blair, M., & Hyatt, E. (1995). The Marketing of Guns to Women: Factors Influencing Gun-Related Attitudes and Gun Ownership by Women. *Journal of Public Policy & Marketing, 14*(1), 117-127.

BLS. (2019). *Small Arms Price Series (wpu151301)*.

Botzen, W. J. W., Deschenes, O., & Sanders, M. (2019). The Economic Impacts of Natural Disasters: A Review of Models and Empirical Studies. *Review of Environmental Economics and Policy, 13*(2), 167–188. doi:https://doi.org/10.1093/reep/rez004

Braga, A. A., Wintemute, G. J., Pierce, G. L., Cook, P. J., & Ridgeway, G. (2012). Interpreting the Empirical Evidence on Illegal Gun Market Dynamics. *Journal of Urban Health, 89*(5), 779–793.

Brauer, J. (2013a). Demand and Supply of Commercial Firearms in the United States. *The Economics of Peace and Security Journal, 8*(1), 23-28.

Brauer, J. (2013b). *The U.S. Firearms Industry: Production and Supply, Working Paper No. 14*. Retrieved from Geneva:

Brauer, J., Montolio, D., & Trujillo-Baute, E. (2017). How do US state firearms laws affect firearms manufacturing location? An empirical investigation, 1986–2010. *Economic Geography, 17*(4), 753-790. doi:https://doi.org/10.1093/jeg/lbw016

Brauer, J., & Muggah, R. (2006). Completing the Circle: Building a Theory of Small Arms Demand. *Contemporary Security Policy, 27*(1), 138-154.

Caruso, R. (2010). Butter, Guns & Ice-Cream: Theory and evidence from Sub-Saharan Africa. *Defence and Peace Economics, 21*(3), 269-283.

Chestnut, K., Barragan, M., Gravel, J., Pifer, N., Reiter, K., Sherman, N., & Tita, G. (2017). Not an 'Iron Pipeline', but Many Capillaries: Regulating Passive Transactions in Los Angeles' Secondary, Illegal Gun Market. *Injury Prevention, 23*(4).

Chicoine, L. (2011). *Exporting the Second Amendment: U.S. Assault Weapons and the Homicide Rate in Mexico*. Department of Economics. University of Notre Dame. South Bend, IN.

Cook, P., Ludwig, J., Venkatesh, S., & Braga, A. (2007). Underground Gun Markets. *The Economic Journal, 117*(524), F588-F618.

Davidson, R., & MacKinnon, J. G. (1993). *Estimation and Inference in Econometrics*. New York: Oxford University Press.

Diaz, T. (2004). Firearms: Another Peculiar American Institution. In N. Passas & N. Goodwin (Eds.), *It's Legal but It Ain't Right: Harmful Social Consequences of Legal Industries* (Vol. 74-100). Ann Arbor: University of Michigan Press.

DOJ/ATF. (2019). *Firearms Commerce in the United States: Annual Statistical Update 2019*.

Dube, A., Dube, O., & García-Ponce, O. (2013). Cross-Border Spillover: U.S. Gun Laws and Violence in Mexico. *American Political Science Review, 107*(03), 397-417. doi:http://dx.doi.org/10.1017/S0003055413000178

Fabio, A., Duell, J., Creppage, K., O'Donnell, K., & Laporte, R. (2016). Gaps continue in firearm surveillance: Evidence from a large U.S. City Bureau of Police. *Social Medicine, 10*(1).

FBI. (2019). Uniform Crime Reporting (UCR) Program. Retrieved from https://www.fbi.gov/services/cjis/ucr/

Fleitas, D. M., Espinoza, A. Y., & Perret, A. (2015). *Private Security and Firearms in Latin America and the Caribbean*. Retrieved from Buenos Aires: https://drive.google.com/file/d/1h2we2rb6uaJGB4nNxDkEIQTjbOcGX5Jq/view

Follman, M., Aronson, G., & Pan, D. (2016). US Mass Shootings, 1982-2016. *Mother Jones*.

Gabelnick, T., Haug, M., & Lumpe, L. (2006). *A Guide to the U.S. Small Arms Market, Industry and Exports, 1998–2004* (Vol. 19). Geneva: Small Arms Survey.

Gleditsch, N. P., Wallensteen, P., Eriksson, M., Sollenberg, M., & Strand, H. (2002). Armed Conflict 1946-2001: A New Dataset. *Journal of Peace Research, 39*(5).

Gopal, A., & Greenwood, B. N. (2017). Traders, guns, and money: The effects of mass shootings on stock prices of firearm manufacturers in the U.S. *PLoS One, 12*(5). doi:https://doi.org/10.1371/journal.pone.0177720

Jones, M. A., & Stone, G. W. (2015). The U.S Gun Control Paradox : Gun Buyer Response to Congressional Gun Control Initiatives. *Journal of Business & Economics Research, 13*(4).

Karp, A. (2018). *Estimating Global Civilian-Held Firearms Numbers*. Retrieved from Geneva:

Knight, B. (2013). State Gun Policy and Cross-State Externalities: Evidence from Crime Gun Tracing. *American Economic Journal: Economic Policy, 5*(4), 200-229.

Koper, C. S., & Roth, J. A. (2002). The Impact of the 1994 Federal Assault Weapons Ban on Gun Markets: An Assessment of Short-Term Primary and Secondary Market Effects. *Journal of Quantitatiûe Criminology, 18*(3), 239-266.

Langley, M. (1999). *Cashing in on the New Millennium: How the Firearms Industry Exploits Y2k Fears to Sell More Guns*. Retrieved from Washington, D.C.:

Masera, F. (2016). *Bringing War Home: Violent Crime, Police Killings and the Overmilitarization of the US Police*. Job Market Papers. RePEc. Retrieved from https://ideas.repec.org/p/jmp/jm2016/pma1994.html

McDougal, T. L., Kolbe, A., Muggah, R., & Marsh, N. (2018). Ammunition Leakage from Military to Civilian Markets: Market Price Evidence from Haiti, 2004-2012. *Defence and Peace Economics*. doi:https://doi.org/10.1080/10242694.2018.1492226

McDougal, T. L., Shirk, D. A., Muggah, R., & Patterson, J. H. (2015). The Way of the Gun: Estimating Firearms Traffic across the U.S.-Mexico Border. *Economic Geography, 15*(2), 297-327. doi:10.1093/jeg/lbu021

McDowall, D., & Loftin, C. (1983). Collective Security and the Demand for Legal Handguns. *American Journal Of Sociology, 88*(6), 1146–1161.

Moore, M. (2010). Arming the Embargoed: A Supply-Side Understanding of Arms Embargo Violations. *Journal of Conflict Resolution, 54*(4), 593-615. doi:https://doi.org/10.1177/0022002710369085

Muggah, R., & McDougal, T. L. (2014). We Need Better Data for a Serious Gun Control Debate. *Huffington Post*.

National Center for Health Statistics. (2018). *Multiple Causes of Death 1999-2017*. Retrieved from Washington, D.C.: http://wonder.cdc.gov/mcd-icd10.html

NSSF. (2014). *Women Gun Owners: Purchasing, Perceptions and Participation*. Retrieved from Newtown, CT: https://www.nssf.org/research-1/women-gun-owners/

NSSF. (2015). *Hispanic Market Study: Firearms and the Shooting Sports*. Retrieved from Newtown, CT:

Pettersson, T., Högbladh, S., & Öberg, M. (2019). Organized violence, 1989-2018 and peace agreements. *Journal of Peace Research, 56*(4).

Polsby, D. (1994). The False Promise of Gun Control Laws. *The Atlantic, March*.

Ramsay, K. W. (2011). Revisiting the Resource Curse: Natural Disasters, the Price of Oil, and Democracy. *International Organization, 65*, 507–529. doi:doi:10+10170S002081831100018X

Small Arms Survey. (2011). *Estimating Civilian Owned Firearms*. Retrieved from Geneva: http://www.smallarmssurvey.org/fileadmin/docs/H-Research_Notes/SAS-Research-Note-9.pdf

Smith , V., Siegel, M., Xuan, Z., Ross, C., Galea, S., Kalesan, B., . . . Goss, K. (2015). Broadening the Perspective on Gun Violence: An Examination of the Firearms Industry, 1990–2015. *American Journal of Preventive Medicine, 53*(5).

Stiglitz, J., & Bilmes, L. J. (2012). Estimating the Costs of War: Methodological Issues, with Applications to Iraq and Afghanistan. In M. R. Garfinkel & S. Skaperdas (Eds.), *Estimating the Costs of War: Methodological Issues, with Applications to Iraq and Afghanistan*. New York: Oxford University Press.

TTB. (2019). *Tax Collection Activities by Fiscal Year*. Retrieved from: https://www.ttb.gov/tax-audit/tax-collections

Vernick, J. S., Webster, D. W., Bulzacchelli, M. T., & Mair, J. S. (2006). Regulation of Firearm Dealers in the United States: An Analysis of State Law and Opportunities for Improvement. *The Journal of Law, Medicine, and Ethics, 34*(4), 765-775.

Yobero, C. (2016). *Simultaneous Equation Models: Estimating Supply and Demand Functions*. Retrieved from http://rstudio-pubs-static.s3.amazonaws.com/195495_d47be7c818424a3c9bfa5452dd17c6c6.html

Appendix: Regression Tables

Appendix Table 1. Relevance test of prospective disaster-related IVs predicting firearms price.

VARIABLES	(1) Log Inflation-adjusted BLS Firearms Price Index	(2) Log Inflation-adjusted BLS Firearms Price Index	(3) Log Inflation-adjusted BLS Firearms Price Index	(4) Log Inflation-adjusted BLS Firearms Price Index	(5) Log Inflation-adjusted BLS Firearms Price Index	(6) Log Inflation-adjusted BLS Firearms Price Index	(7) Log Inflation-adjusted BLS Firearms Price Index	(8) Log Inflation-adjusted BLS Firearms Price Index
Log Death Due to Disasters	0.0155	**-0.0114***						
	(0.0134)	(0.00605)						
Log People Rendered Homeless by Disasters			**0.0137*****	0.000156				
			(0.00158)	(0.00158)				
Log Total Affected by Disasters					**0.0105*****	-0.00114		
					(0.000984)	(0.00179)		
Log Total Damages Due to Disasters (US$1,000)							**0.0103*****	-0.00035
							(0.00312)	(0.00130)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Observations	70	68	70	68	70	68	70	68
R-squared	0.016	0.872	0.507	0.865	0.508	0.866	0.259	0.865

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

Appendix Table 2. Relevance test of prospective disaster-related IVs predicting firearms price.

VARIABLES	(1) Log Domestic Total	(2) Log Domestic Total	(3) Log Domestic Total	(4) Log Domestic Total	(5) Log Domestic Total	(6) Log Domestic Total	(7) Log Domestic Total	(8) Log Domestic Total
Log Death Due to Disasters	0.0899	0.0124						
	(0.0762)	(0.0350)						
Log People Rendered Homeless by Disasters			**0.0612*** **	0.00953				
			(0.0116)	(0.00786)				
Log Total Affected by Disasters					**0.0614*** **	0.00970		
					(0.00824)	(0.00709)		
Log Total Damages Due to Disasters (US$1,000)							**0.0588*** **	-0.00198
							(0.0150)	(0.00947)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Observations	72	69	72	69	72	69	72	69
R-squared	0.014	0.925	0.278	0.927	0.453	0.928	0.225	0.925

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

Appendix Table 3. Log-log SEM estimations of domestic production of firearms for the U.S. market on disaster-affected population under five control specifications (IV = log disaster deaths).

	(1) No Controls		(2) Sociodemographic		(3) Economics		(4) Politics		(5) Legislation		(6) All Controls		(7) All Controls[1]	
VARIABLES	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand
Log Inflation-adjusted BLS Firearms Price Index = L,	5.259		**4.538*** **		**6.911*** **		**3.327** **		**7.471*** **		**3.422*** **		**3.598*** **	
	(4.054)		(0.716)		(0.725)		(1.389)		(0.879)		(0.670)		(0.696)	
Log Inflation-adjusted BLS Firearms Price Index		6.106		-2.544		**-7.98*** **		**7.041*** **		4.580		**-3.288** **		-1.625
		(5.052)		(3.382)		(2.481)		(1.921)		(2.794)		(1.301)		(1.157)
Log US population in ('000s)				2.909								-0.873		1.399
				(1.897)								(1.954)		(1.703)
Log Number of Military Veterans				**-1.242*** **								**-0.740** **		**0.771***
				(0.480)								(0.376)		(0.462)
Log Estimated Total Firearms Stocks				-0.286								-0.172		**-2.124*** **
				(1.027)								(0.688)		(0.732)
Estimated Total Firearms Stocks = L,														**1.2e-08*** **
														(3.22e-09)
Homicide rate per 100k = L,				**0.0899*** **								**0.0527** **		**0.121*** **
				(0.0264)								(0.0254)		(0.0302)
Suicide rate per 100k = L,				0.136								0.102		**0.175*** **
				(0.109)								(0.0635)		(0.0591)
Unemployment Rate = L,					**0.101*** **						**0.135*** **		**0.127*** **	
					(0.0311)						(0.0291)		(0.0300)	
Log p.c. Real Disposable Personal Income, US$2009						**1.996*** **						**1.770*** **		0.752
						(0.394)						(0.585)		(0.540)
Sum UCDP War Intensity = L,							-0.0400				**0.161***		**0.158***	
							(0.105)				(0.0907)		(0.0940)	
Sum UCDP Cumulative War Intensity = L,							0.0957				-0.183		-0.176	
							(0.199)				(0.159)		(0.165)	
Party of the President (Dem= 1 / Rep = 0)								-0.0338				**0.101** **		**0.123*** **
								(0.0688)				(0.0421)		(0.0394)
Republican Share of House of Rep's								0.721				**1.037***		0.751
								(0.727)				(0.549)		(0.527)
Republican Share of Senate								-1.282				-0.684		-0.134
								(1.248)				(0.658)		(0.615)
Anticipated Firearms Legislation Passage										0.0323		0.0589		0.00890
										(0.0965)		(0.0487)		(0.0438)
Log Firearms Laws = L,										0.340		0.162		0.113
										(0.225)		(0.104)		(0.100)
Federal Assault Weapons Ban in Effect = L,										**-0.43*** **		**-0.25*** **		-0.104
										(0.137)		(0.0788)		(0.0864)
Constant	-8.831	-12.70	**-5.553***	15.01	**-16.9*** **	**45.33*** **	-0.0845	**-16.67** **	**-18.8*** **	-6.008	-1.408	**49.39*** **	-2.165	24.51
	(18.42)	(22.97)	(3.256)	(24.43)	(3.266)	(10.11)	(6.295)	(8.249)	(3.993)	(12.48)	(3.042)	(18.13)	(3.166)	(15.03)
Observations	69	69	69	69	68	68	69	69	69	69	68	68	66	66
R-squared	-	-	0.041	0.861	-	0.644	0.175	-	-	0.265	0.386	0.914	0.362	0.927

Note: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0. 1 Includes a 5-year lag for log estimated civilian firearms stocks.

Appendix Table 4. Log-log SEM estimations of U.S. exports on disaster-affected population under five control specifications: (1) no controls, (2) demographic controls, (3) economic controls, (4) political controls, (5) all previous controls. (IV = log disaster deaths)

	(1) No Controls		(2) Sociodemographic		(3) Economics		(4) Politics		(5) Legislation		(6) All Controls	
VARIABLES	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand
Log Inflation-adjusted BLS Firearms Price Index = L,	5.492		**1.294***		**3.414*** **		0.120		**5.331*** **		**1.502** **	
	(4.987)		(0.729)		(0.746)		(1.435)		(0.891)		(0.738)	
Log Inflation-adjusted BLS Firearms Price Index		6.376		**-9.883***		**-13.12*** **		1.055		-3.912		-1.088

		(6.224)		(5.793)		(4.107)		(1.702)		(3.269)		(1.534)
Log US population in ('000s)				-0.674								0.436
				(3.213)								(2.277)
Log Number of Military Veterans				**-1.483***								0.0628
				(0.801)								(0.439)
Log Estimated Total Firearms Stocks				1.399								-0.0526
				(1.754)								(0.806)
Homicide rate per 100k = L,				**0.173*****								**0.107*****
				(0.0436)								(0.0294)
Suicide rate per 100k = L,				-0.0757								0.0997
				(0.187)								(0.0740)
Unemployment Rate = L,					**0.103*****						**0.141*****	
					(0.0318)						(0.0314)	
Log p. c. Real Disposable Personal Income, US$2009						**2.175*****						0.00145
						(0.654)						(0.685)
Sum UCDP War Intensity = L,							0.0295				**0.249*****	
							(0.103)				(0.0963)	
Sum UCDP Cumulative War Intensity = L,							-0.0612				**-0.435****	
							(0.195)				(0.170)	
Party of the President (Dem= 1 / Rep = 0)								0.0302				**0.150*****
								(0.0512)				(0.0488)
Republican Share of House of Rep's								-0.390				0.840
								(0.528)				(0.639)
Republican Share of Senate								0.531				-0.376
								(1.055)				(0.766)
Anticipated Firearms Legislation Passage										**0.276****		0.0671
										(0.111)		(0.0565)
Log Firearms Laws = L,										**0.774*****		0.183
										(0.264)		(0.121)
Federal Assault Weapons Ban in Effect = L,										**-0.415*****		**-0.306*****
										(0.159)		(0.0914)
Constant	-12.56	-16.59	**6.519****	64.42	-3.721	**65.47*****	**11.87***	7.519	**-11.82*****	**29.52****	4.741	9.581
	(22.66)	(28.30)	(3.315)	(41.70)	(3.362)	(16.74)	(6.506)	(7.346)	(4.051)	(14.60)	(3.349)	(21.17)
Observations	69	69	69	69	68	68	69	69	69	69	68	68
R-squared	-	-	-	-	-	-	0.001	0.009	-	0.649	0.183	0.842

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

Appendix Table 5. Log-log SEM estimations of foreign imports on disaster-affected population under five control specifications (IV = log disaster deaths)

	(1) No Controls		(2) Sociodemographic		(3) Economics		(4) Politics		(5) Legislation		(6) All Controls	
VARIABLES	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand
Log Inflation-adjusted BLS Firearms Price Index = L,	**98.32****		**88.94*****		**91.23*****		**99.38*****		**108.5*****		**90.02*****	
	(39.64)		(6.900)		(6.538)		(14.25)		(8.555)		(6.362)	
Log Inflation-adjusted BLS Firearms Price Index		**114.2****		51.27		**-109.7****		**124.0*****		**50.72***		**27.38***
		(49.68)		(34.38)		(43.77)		(16.81)		(28.76)		(14.43)
Log US population in ('000s)				**-35.33***								**-35.62***
				(19.25)								(21.32)
Log Number of Military Veterans				0.681								-0.470

				(4.876)								(4.119)
Log Estimated Total Firearms Stocks				15.87								**30.79*** **
				(10.44)								(7.562)
Homicide rate per 100k = L,				0.300								**0.589** **
				(0.268)								(0.275)
Suicide rate per 100k = L,				0.191								-0.639
				(1.110)								(0.694)
Unemployment Rate = L,					**1.345*** **						**1.189*** **	
					(0.282)						(0.268)	
Log p. c. Real Disposable Personal Income, US$2009						**27.17*** **						**-15.65** **
						(6.971)						(6.422)
Sum UCDP War Intensity = L,							-0.147				1.035	
							(1.118)				(0.817)	
Sum UCDP Cumulative War Intensity = L,							-0.380				**-2.543***	
							(2.087)				(1.443)	
Party of the President (Dem= 1 / Rep = 0)								0.0253				0.211
								(0.709)				(0.456)
Republican Share of House of Rep's								-7.747				**-13.68** **
								(7.573)				(5.986)
Republican Share of Senate								5.812				5.212
								(11.27)				(7.173)
Anticipated Firearms Legislation Passage										0.673		-0.266
										(0.977)		(0.528)
Log Firearms Laws = L,										**4.489***		-1.797
										(2.307)		(1.134)
Federal Assault Weapons Ban in Effect = L,										-0.844		0.795
										(1.394)		(0.854)
Constant	**-438.5** **	**-510.7** **	**-395.8*** **	-101.0	**-414.1*** **	**425.0** **	**-442.5*** **	**-554.7*** **	**-484.6*** **	**-226.3***	**-406.8*** **	-188.0
	(180.2)	(225.9)	(31.36)	(248.2)	(29.45)	(178.4)	(64.57)	(72.02)	(38.88)	(128.5)	(28.85)	(198.4)
Observations	69	69	69	69	68	68	69	69	69	69	68	68
R-squared	0.504	0.422	0.571	0.869	0.629	0.028	0.534	0.325	0.404	0.796	0.685	0.933

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

Appendix Table 6. Comparisons of IV SEMs for the total U.S. firearms market with and without the introduction of an overall HHI, 1986-2017.

	(1) No HHI		(2) HHI		(3) No HHI		(4) HHI	
VARIABLES	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand
Log Inflation-adjusted BLS Firearms Price Index = L,	-11.39		-18.99		-3.855		**-12.18*** **	
	(12.05)		(12.70)		(2.047)		(2.802)	
Log Inflation-adjusted BLS Firearms Price Index		-21.26		0.221		**-10.10***		-9.814
		(22.54)		(8.604)		(4.814)		(7.304)
Herfindahl-Hirschman Index = L,			-0.00242				-0.000862	
			(0.00155)				(0.000520)	
Log US population in ('000s)						**-14.59****		**-16.92***
						(4.487)		(7.271)
Log Number of Military Veterans						-0.123		0.00455
						(0.639)		(0.920)
Log Estimated Total Firearms Stocks						**5.046****		**5.835***
						(1.717)		(2.623)
Homicide rate per 100k						0.0934		0.0924
						(0.0696)		(0.0996)
Suicide rate per 100k						-0.133		-0.150
						(0.150)		(0.215)
Log p. c. Real Disposable Personal Income, US$2009						3.201		3.424
						(1.670)		(2.458)
Party of the President (Dem= 1 / Rep = 0)						**0.254*****		**0.267***
						(0.0763)		(0.112)
Republican Share of House of Rep's						0.146		0.272
						(0.930)		(1.640)
Republican Share of Senate						**-3.839****		**-4.224***
						(1.190)		(1.862)
Anticipated Firearms Legislation Passage						0.0197		0.0227
						(0.0531)		(0.0818)
Log Firearms Laws						-0.148		-0.122
						(0.276)		(0.395)
Federal Assault Weapons Ban in Effect						-0.0136		-0.0257
						(0.130)		(0.188)
Unemployment Rate = L,					**0.0889****		**0.0851****	
					(0.0316)		(0.0284)	
Sum UCDP War Intensity = L,					0.123		0.0871	
					(0.0732)		(0.0672)	
Sum UCDP Cumulative War Intensity = L,					-0.0778		-0.0366	
					(0.123)		(0.111)	
Constant	68.08	113.8	105.4	14.32	**32.43*****	**141.7****	**71.78*****	**151.7***
	(55.81)	(104.4)	(60.04)	(39.86)	(9.536)	(43.79)	(13.34)	(63.44)
Observations	31	31	30	30	31	31	30	30
R-squared	-	-	0.377	-0.013	0.659	0.945	0.802	0.946

Note: Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05.

Appendix Table 7. Comparisons of IV SEMs for the U.S. handguns submarket with and without the introduction of pistol and revolver HHIs, 1986-2017.

	(1)		(2)		(3)		(4)	
	No HHI		HHI		No HHI		HHI	
VARIABLES	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand
Log Handgun Price Index (2012 = 0, Brauer) = L,	-327.0		-174.0		-1.405		**-1.641***	
	(14,720)		(123.2)		(1.192)		(0.774)	
Log Handgun Price Index (2012 = 0, Brauer)		-11.52		**18.55*****		0.0193		0.254
		(18.93)		(3.080)		(0.476)		(0.415)
HHI: Domestic Pistols = L,			0.0370				**0.00167*****	
			(0.0250)				(0.000321)	
HHI: Domestic Revolvers = L,			-0.00152				-0.000113	
			(0.00198)				(0.000103)	
Log US population in ('000s)						-7.879		**-10.41***
						(4.223)		(4.179)
Log Number of Military Veterans						-0.0424		-0.101
						(0.591)		(0.554)
Log Estimated Total Firearms Stocks						2.083		**3.069***
						(1.432)		(1.409)
Homicide rate per 100k = L,						0.0108		0.0858
						(0.0346)		(0.0488)
Suicide rate per 100k = L,						**0.298*****		**0.225****
						(0.0812)		(0.0810)
Log p.c. Real Disposable Personal Income, US$2009						2.441		3.166
						(2.003)		(1.932)
Party of the President (Dem= 1 / Rep = 0)						**0.256*****		**0.294*****
						(0.0611)		(0.0620)
Republican Share of House of Rep's						0.489		1.117
						(0.716)		(0.733)
Republican Share of Senate						**-2.466****		**-3.45*****
						(0.761)		(0.873)
Anticipated Firearms Legislation Passage						**0.103***		**0.125***
						(0.0516)		(0.0489)
Log Firearms Laws = L,						0.221		-0.0140
						(0.198)		(0.207)
Federal Assault Weapons Ban in Effect = L,						**-0.26*****		-0.155
						(0.0768)		(0.0859)
Unemployment Rate = L,					**0.157***		**0.140*****	
					(0.0635)		(0.0412)	
Sum UCDP War Intensity = L,					**0.273****		0.0949	
					(0.104)		(0.0723)	
Sum UCDP Cumulative War Intensity = L,					-0.259		-0.0731	
					(0.202)		(0.133)	
Constant	1,495	66.74	770.4	**-69.6*****	**19.58*****	62.37	**19.62*****	**73.37***
	(66,673)	(85.85)	(538.8)	(13.98)	(5.595)	(35.44)	(3.767)	(33.63)
Observations	32	32	31	31	31	31	30	30
R-squared	-	-	-	-	0.655	0.973	0.848	0.976

Note: Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05.

Appendix Table 8. Comparisons of IV SEMs for the U.S. long gun submarket with and without the introduction of an overall HHI, 1986-2017.

	(1)		(2)		(3)		(4)	
	No HHI		HHI		No HHI		HHI	
VARIABLES	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand
Log Longgun Price Index (2012 = 0, Brauer) = L,	0.758		0.744		-0.0567		-0.724	
	(1.472)		(0.875)		(0.601)		(0.522)	
Log Longgun Price Index (2012 = 0, Brauer)		1.571		**3.081*** **		**0.966***		0.491
		(2.861)		(0.492)		(0.427)		(0.328)
HHI: Domestic Rifles = L,			-1.66e-05				**0.000320***	
			(8.85e-05)				(0.000127)	
HHI: Domestic Shotguns = L,			**0.000181***				**0.000324****	
			(7.54e-05)				(0.000105)	
Log US population in ('000s)						**-13.2*** **		**-12.1*** **
						(3.496)		(3.638)
Log Number of Military Veterans						0.421		0.696
						(0.592)		(0.512)
Log Estimated Total Firearms Stocks						**2.844***		2.284
						(1.295)		(1.263)
Homicide rate per 100k = L,						0.0227		0.0105
						(0.0427)		(0.0522)
Suicide rate per 100k = L,						0.0793		0.127
						(0.0837)		(0.0815)
Log p. c. Real Disposable Personal Income, US$2009						**4.141***		**4.497****
						(1.609)		(1.607)
Party of the President (Dem= 1 / Rep = 0)						**0.258*** **		**0.244*** **
						(0.0571)		(0.0575)
Republican Share of House of Rep's						**1.584****		**1.690****
						(0.588)		(0.617)
Republican Share of Senate						**-2.21*** **		**-2.310****
						(0.640)		(0.771)
Anticipated Firearms Legislation Passage						0.0785		**0.0797***
						(0.0405)		(0.0370)
Log Firearms Laws = L,						0.213		0.229
						(0.181)		(0.189)
Federal Assault Weapons Ban in Effect = L,						-0.0708		-0.0519
						(0.0688)		(0.0781)
Unemployment Rate = L,					0.0422		-0.0419	
					(0.0298)		(0.0371)	
Sum UCDP War Intensity = L,					0.0805		-0.0388	
					(0.0680)		(0.0634)	
Sum UCDP Cumulative War Intensity = L,					-0.0321		0.186	
					(0.118)		(0.115)	
Constant	11.37	7.719	**10.92****	0.973	**14.58*** **	**98.97*** **	**16.57*** **	**91.52****
	(6.568)	(12.81)	(3.839)	(2.204)	(2.688)	(29.07)	(2.258)	(28.59)
Observations	32	32	31	31	31	31	30	30
R-squared	0.188	0.286	0.451	-0.191	0.515	0.934	0.640	0.938

Note: Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05.

Appendix Table 9. Comparisons of IV SEMs for the U.S. firearms market with and without the introduction of a technology gap proxy, 1989-2017

	(1)		(2)		(3)		(4)	
	No HHI		HHI		No HHI		HHI	
VARIABLES	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand
Log Inflation-adjusted BLS Firearms Price Index = L,	-45.30		-34.22		**-15.5*** **		**-15.3*** **	
	(46.15)		(33.85)		(1.399)		(1.383)	
Log Inflation-adjusted BLS Firearms Price Index		**3.313*** **		**3.351*** **		-8.451		-9.220
		(0.0995)		(0.105)		(7.082)		(6.676)
U.S.-Foreign Technology Gap Proxy				**-1.17*** **				**-0.620***
				(0.224)				(0.279)
Log US population in ('000s)						-8.146		-4.665
						(4.674)		(4.673)
Log Number of Military Veterans						0.529		0.872
						(0.635)		(0.612)
Log Estimated Total Firearms Stocks						1.393		1.536
						(1.735)		(1.632)
Homicide rate per 100k = L,						0.00604		0.0910
						(0.0386)		(0.0527)
Suicide rate per 100k = L,						0.168		0.104
						(0.172)		(0.166)
Log p. c. Real Disposable Personal Income, US$2009						3.939		2.040
						(2.172)		(2.237)
Party of the President (Dem= 1 / Rep = 0)						**0.210** **		**0.286*** **
						(0.0672)		(0.0711)
Republican Share of House of Rep's						0.0672		-0.0218
						(1.680)		(1.580)
Republican Share of Senate						**-2.60** **		**-2.387** **
						(0.875)		(0.829)
Anticipated Firearms Legislation Passage						0.0530		-0.00284
						(0.0882)		(0.0878)
Log Firearms Laws						0.166		-0.490
						(0.338)		(0.442)
Federal Assault Weapons Ban in Effect						0.00722		0.189
						(0.104)		(0.130)
Unemployment Rate = L,					**0.115*** **		**0.115*** **	
					(0.0153)		(0.0153)	
Sum UCDP War Intensity = L,					**0.0793***		**0.0786***	
					(0.0360)		(0.0359)	
Sum UCDP Cumulative War Intensity = L,					-0.0415		-0.0407	
					(0.0596)		(0.0595)	
Constant	225.3		174.0		**86.46*** **	**106.2***	**85.67*** **	65.04
	(213.9)		(156.9)		(6.500)	(41.92)	(6.423)	(42.77)
Observations	28	28	28	28	28	28	28	28
R-squared	-	-	-	-	0.919	0.955	0.920	0.959

Note: Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05.

Appendix Table 10. Comparisons of IV SEMs for the U.S. handguns market with and without the introduction of a technology gap proxy, 1989-2017

	(1)		(2)		(3)		(4)	
	No HHI		HHI		No HHI		HHI	
VARIABLES	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand
Log Handgun Price Index (2012 = 0, Brauer) = L,	9.286		**3.330***		-2.002		-1.949	
	(9.405)		(1.483)		(1.214)		(1.213)	
Log Handgun Price Index (2012 = 0, Brauer)		-24.51		-10.49		0.231		**-1.388***
		(59.48)		(9.687)		(0.468)		(0.626)
U.S.-Foreign Technology Gap Proxy				-3.555				**-0.997*****
				(4.125)				(0.266)
Log US population in ('000s)						-7.480		0.0391
						(4.334)		(4.075)
Log Number of Military Veterans						-0.129		1.030
						(0.541)		(0.575)
Log Estimated Total Firearms Stocks						2.548		0.0464
						(1.387)		(1.337)
Homicide rate per 100k = L,						0.0641		0.0133
						(0.0498)		(0.0456)
Suicide rate per 100k = L,						**0.237****		**0.369*****
						(0.0809)		(0.0781)
Log p. c. Real Disposable Personal Income, US$2009						1.978		0.564
						(2.029)		(1.738)
Party of the President (Dem= 1 / Rep = 0)						**0.269*****		**0.265*****
						(0.0634)		(0.0536)
Republican Share of House of Rep's						1.031		**1.566***
						(0.718)		(0.632)
Republican Share of Senate						**-3.00*****		**-1.838***
						(0.879)		(0.803)
Anticipated Firearms Legislation Passage						**0.129***		-0.00158
						(0.0562)		(0.0617)
Log Firearms Laws = L,						-0.136		-0.100
						(0.259)		(0.220)
Federal Assault Weapons Ban in Effect = L,						-0.142		**-0.226****
						(0.0882)		(0.0783)
Unemployment Rate = L,					**0.154***		**0.157***	
					(0.0626)		(0.0625)	
Sum UCDP War Intensity = L,					**0.267***		**0.270****	
					(0.104)		(0.104)	
Sum UCDP Cumulative War Intensity = L,					-0.235		-0.243	
					(0.200)		(0.200)	
Constant	-27.68	125.9	-0.611	62.71	**22.30*****	51.29	**22.05*****	-4.144
	(42.75)	(270.3)	(6.741)	(44.63)	(5.685)	(34.85)	(5.679)	(32.18)
Observations	29	29	29	29	28	28	28	28
R-squared	-	-	-	-	0.682	0.980	0.683	0.984

Note: Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05.

Appendix Table 11. Comparisons of IV SEMs for the U.S. long guns market with and without the introduction of a technology gap proxy, 1989-2017

	(1)		(2)		(3)		(4)	
	No HHI		HHI		No HHI		HHI	
VARIABLES	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand
Log Longgun Price Index (2012 = 0, Brauer) = L,	1.583		1.305		-0.0205		-0.0767	
	(1.148)		(0.703)		(0.547)		(0.585)	
Log Longgun Price Index (2012 = 0, Brauer)		2.629		**2.249*** **		**1.287***		**0.583****
		(2.093)		(0.570)		(0.525)		(0.220)
U.S.-Foreign Technology Gap Proxy			-0.214					**-0.490*****
			(0.266)					(0.141)
Log US population in ('000s)						**-13.97****		**-9.749****
						(4.593)		(3.560)
Log Number of Military Veterans						0.215		**1.106***
						(0.656)		(0.451)
Log Estimated Total Firearms Stocks						**3.139***		1.873
						(1.518)		(1.130)
Homicide rate per 100k = L,						0.0757		0.0247
						(0.0717)		(0.0422)
Suicide rate per 100k = L,						0.0334		**0.150***
						(0.106)		(0.0687)
Log p. c. Real Disposable Personal Income, US$2009						**4.478***		**3.412***
						(2.082)		(1.593)
Party of the President (Dem= 1 / Rep = 0)						**0.276*****		**0.263*****
						(0.0724)		(0.0509)
Republican Share of House of Rep's						**1.948****		**1.974*****
						(0.734)		(0.548)
Republican Share of Senate						**-2.807****		**-2.148****
						(0.952)		(0.704)
Anticipated Firearms Legislation Passage						**0.123***		**0.0884***
						(0.0530)		(0.0385)
Log Firearms Laws = L,						0.137		0.313
						(0.291)		(0.206)
Federal Assault Weapons Ban in Effect = L,						-0.00835		-0.106
						(0.103)		(0.0718)
Unemployment Rate = L,					**0.0683***		**0.0732***	
					(0.0303)		(0.0309)	
Sum UCDP War Intensity = L,					0.104		0.118	
					(0.0657)		(0.0668)	
Sum UCDP Cumulative War Intensity = L,					-0.0986		-0.113	
					(0.116)		(0.118)	
Constant	7.715	3.011	**8.990****	4.717	**14.33*****	**103.7****	**14.54*****	**65.44***
	(5.129)	(9.373)	(3.159)	(2.553)	(2.447)	(36.48)	(2.618)	(28.61)
Observations	29	29	29	29	28	28	28	28
R-squared	0.199	0.035	0.243	0.182	0.499	0.922	0.504	0.960

Note: Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05.

Appendix Table 12. Comparisons of IV SEMs for the U.S.firearms with and without the introduction of Mother Jones mass shootings, 1986-2017

	(1)		(2)		(3)		(4)	
	No HHI		HHI		No HHI		HHI	
VARIABLES	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand
Log Inflation-adjusted BLS Firearms Price Index = L,	-37.96		**41.14*** **		2.257		2.503	
	(60.63)		(10.11)		(1.442)		(1.519)	
Log Inflation-adjusted BLS Firearms Price Index		**3.314*** **		13.17		-3.710		**-3.776***
		(0.141)		(12.25)		(2.752)		(1.663)
Mother Jones Mass Shootings: Fatalities = L,				**0.00899****				**0.00300*****
				(0.00335)				(0.000812)
Log US population in ('000s)						-2.368		-5.723
						(7.377)		(4.555)
Log Number of Military Veterans						-0.199		-0.104
						(0.659)		(0.440)
Log Estimated Total Firearms Stocks						1.105		0.947
						(1.937)		(1.322)
Homicide rate per 100k = L,						0.0147		0.00419
						(0.0576)		(0.0378)
Suicide rate per 100k = L,						0.124		**0.182***
						(0.109)		(0.0776)
Log p. c. Real Disposable Personal Income, US$2009						0.751		2.719
						(3.119)		(1.828)
Party of the President (Dem= 1 / Rep = 0)						0.128		**0.174****
						(0.0964)		(0.0598)
Republican Share of House of Rep's						0.729		0.543
						(0.648)		(0.500)
Republican Share of Senate						-2.008		**-1.899***
						(1.384)		(0.891)
Anticipated Firearms Legislation Passage						0.0400		0.0537
						(0.0505)		(0.0348)
Log Firearms Laws						0.201		**0.315***
						(0.200)		(0.141)
Federal Assault Weapons Ban in Effect						-0.134		-0.0910
						(0.108)		(0.0697)
Unemployment Rate = L,					**0.0942***		**0.0899***	
					(0.0367)		(0.0374)	
Sum UCDP War Intensity = L,					0.112		0.156	
					(0.0825)		(0.0856)	
Sum UCDP Cumulative War Intensity = L,					-0.0734		-0.138	
					(0.139)		(0.144)	
Constant	190.6		**-174.8*****	-45.73	4.119	40.43	2.984	76.67
	(280.0)		(46.70)	(56.58)	(6.804)	(65.71)	(7.166)	(40.28)
Observations	35	35	34	34	35	35	34	34
R-squared	-	-	-	-	0.472	0.929	0.507	0.970

Note: Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05.

Appendix Table 13. Comparisons of IV SEMs for the U.S.firearms market with and without the introduction of log violent crimes, 1960-2012

	(1)		(2)		(3)		(4)	
	No HHI		HHI		No HHI		HHI	
VARIABLES	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand
Log Inflation-adjusted BLS Firearms Price Index = L,	5.986		**4.349*** **		**1.694***		1.361	
	(7.175)		(1.285)		(0.738)		(0.715)	
Log Inflation-adjusted BLS Firearms Price Index		7.202		6.057		-1.761		-1.362
		(9.911)		(33.07)		(1.647)		(2.419)
Log (sum) violent_crimes = L,				-0.171				-0.293
				(3.061)				(1.179)
Log US population in ('000s)						8.145		**10.49***
						(5.065)		(4.681)
Log Number of Military Veterans						0.272		0.848
						(0.605)		(0.983)
Log Estimated Total Firearms Stocks						-2.032		-2.233
						(1.465)		(1.385)
Homicide rate per 100k = L,						**0.0778***		0.0983
						(0.0329)		(0.149)
Suicide rate per 100k = L,						0.185		0.267
						(0.114)		(0.155)
Log p. c. Real Disposable Personal Income, US$2009						-0.227		-0.768
						(1.113)		(1.692)
Party of the President (Dem= 1 / Rep = 0)						0.0721		0.0645
						(0.0579)		(0.0783)
Republican Share of House of Rep's						0.406		0.597
						(0.836)		(1.357)
Republican Share of Senate						-0.215		-0.178
						(1.100)		(1.890)
Anticipated Firearms Legislation Passage						0.0479		0.0596
						(0.0585)		(0.0744)
Log Firearms Laws						**0.267***		0.303
						(0.127)		(0.202)
Federal Assault Weapons Ban in Effect						-0.154		-0.109
						(0.0990)		(0.181)
Unemployment Rate = L,					**0.111****		**0.114****	
					(0.0349)		(0.0340)	
Sum UCDP War Intensity = L,					0.219		0.183	
					(0.128)		(0.127)	
Sum UCDP Cumulative War Intensity = L,					-0.333		-0.268	
					(0.220)		(0.217)	
Constant	-12.14	-17.70	-4.656	-10.09	6.680	-46.60	**8.202***	-79.12
	(32.70)	(45.19)	(5.858)	(108.5)	(3.429)	(48.15)	(3.325)	(47.49)
Observations	53	53	53	53	53	53	53	53
R-squared	-	-	-	-	0.171	0.902	0.204	0.881

Note: Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05.

2015

2015/1, Foremny, D.; Freier, R.; Moessinger, M-D.; Yeter, M.: "Overlapping political budget cycles in the legislative and the executive"
2015/2, Colombo, L.; Galmarini, U.: "Optimality and distortionary lobbying: regulating tobacco consumption"
2015/3, Pellegrino, G.: "Barriers to innovation: Can firm age help lower them?"
2015/4, Hémet, C.: "Diversity and employment prospects: neighbors matter!"
2015/5, Cubel, M.; Sanchez-Pages, S.: "An axiomatization of difference-form contest success functions"
2015/6, Choi, A.; Jerrim, J.: "The use (and misuse) of Pisa in guiding policy reform: the case of Spain"
2015/7, Durán-Cabré, J.M.; Esteller-Moré, A.; Salvadori, L.: "Empirical evidence on tax cooperation between sub-central administrations"
2015/8, Batalla-Bejerano, J.; Trujillo-Baute, E.: "Analysing the sensitivity of electricity system operational costs to deviations in supply and demand"
2015/9, Salvadori, L.: "Does tax enforcement counteract the negative effects of terrorism? A case study of the Basque Country"
2015/10, Montolio, D.; Planells-Struse, S.: "How time shapes crime: the temporal impacts of football matches on crime"
2015/11, Piolatto, A.: "Online booking and information: competition and welfare consequences of review aggregators"
2015/12, Boffa, F.; Pingali, V.; Sala, F.: "Strategic investment in merchant transmission: the impact of capacity utilization rules"
2015/13, Slemrod, J.: "Tax administration and tax systems"
2015/14, Arqué-Castells, P.; Cartaxo, R.M.; García-Quevedo, J.; Mira Godinho, M.: "How inventor royalty shares affect patenting and income in Portugal and Spain"
2015/15, Montolio, D.; Planells-Struse, S.: "Measuring the negative externalities of a private leisure activity: hooligans and pickpockets around the stadium"
2015/16, Batalla-Bejerano, J.; Costa-Campi, M.T.; Trujillo-Baute, E.: "Unexpected consequences of liberalisation: metering, losses, load profiles and cost settlement in Spain's electricity system"
2015/17, Batalla-Bejerano, J.; Trujillo-Baute, E.: "Impacts of intermittent renewable generation on electricity system costs"
2015/18, Costa-Campi, M.T.; Paniagua, J.; Trujillo-Baute, E.: "Are energy market integrations a green light for FDI?"
2015/19, Jofre-Monseny, J.; Sánchez-Vidal, M.; Viladecans-Marsal, E.: "Big plant closures and agglomeration economies"
2015/20, Garcia-López, M.A.; Hémet, C.; Viladecans-Marsal, E.: "How does transportation shape intrametropolitan growth? An answer from the regional express rail"
2015/21, Esteller-Moré, A.; Galmarini, U.; Rizzo, L.: "Fiscal equalization under political pressures"
2015/22, Escardíbul, J.O.; Afcha, S.: "Determinants of doctorate holders' job satisfaction. An analysis by employment sector and type of satisfaction in Spain"
2015/23, Aidt, T.; Asatryan, Z.; Badalyan, L.; Heinemann, F.: "Vote buying or (political) business (cycles) as usual?"
2015/24, Albæk, K.: "A test of the 'lose it or use it' hypothesis in labour markets around the world"
2015/25, Angelucci, C.; Russo, A.: "Petty corruption and citizen feedback"
2015/26, Moriconi, S.; Picard, P.M.; Zanaj, S.: "Commodity taxation and regulatory competition"
2015/27, Brekke, K.R.; Garcia Pires, A.J.; Schindler, D.; Schjelderup, G.: "Capital taxation and imperfect competition: ACE vs. CBIT"
2015/28, Redonda, A.: "Market structure, the functional form of demand and the sensitivity of the vertical reaction function"
2015/29, Ramos, R.; Sanromá, E.; Simón, H.: "An analysis of wage differentials between full-and part-time workers in Spain"
2015/30, Garcia-López, M.A.; Pasidis, I.; Viladecans-Marsal, E.: "Express delivery to the suburbs the effects of transportation in Europe's heterogeneous cities"
2015/31, Torregrosa, S.: "Bypassing progressive taxation: fraud and base erosion in the Spanish income tax (1970-2001)"
2015/32, Choi, H.; Choi, A.: "When one door closes: the impact of the hagwon curfew on the consumption of private tutoring in the republic of Korea"
2015/33, Escardíbul, J.O.; Helmy, N.: "Decentralisation and school autonomy impact on the quality of education: the case of two MENA countries"
2015/34, González-Val, R.; Marcén, M.: "Divorce and the business cycle: a cross-country analysis"
2015/35, Calero, J.; Choi, A.: "The distribution of skills among the European adult population and unemployment: a comparative approach"

2015/36, Mediavilla, M.; Zancajo, A.: "Is there real freedom of school choice? An analysis from Chile"
2015/37, Daniele, G.: "Strike one to educate one hundred: organized crime, political selection and politicians' ability"
2015/38, González-Val, R.; Marcén, M.: "Regional unemployment, marriage, and divorce"
2015/39, Foremny, D.; Jofre-Monseny, J.; Solé-Ollé, A.: "'Hold that ghost': using notches to identify manipulation of population-based grants"
2015/40, Mancebón, M.J.; Ximénez-de-Embún, D.P.; Mediavilla, M.; Gómez-Sancho, J.M.: "Does educational management model matter? New evidence for Spain by a quasiexperimental approach"
2015/41, Daniele, G.; Geys, B.: "Exposing politicians' ties to criminal organizations: the effects of local government dissolutions on electoral outcomes in Southern Italian municipalities"
2015/42, Ooghe, E.: "Wage policies, employment, and redistributive efficiency"

2016

2016/1, Galletta, S.: "Law enforcement, municipal budgets and spillover effects: evidence from a quasi-experiment in Italy"
2016/2, Flatley, L.; Giulietti, M.; Grossi, L.; Trujillo-Baute, E.; Waterson, M.: "Analysing the potential economic value of energy storage"
2016/3, Calero, J.; Murillo Huertas, I.P.; Raymond Bara, J.L.: "Education, age and skills: an analysis using the PIAAC survey"
2016/4, Costa-Campi, M.T.; Daví-Arderius, D.; Trujillo-Baute, E.: "The economic impact of electricity losses"
2016/5, Falck, O.; Heimisch, A.; Wiederhold, S.: "Returns to ICT skills"
2016/6, Halmenschlager, C.; Mantovani, A.: "On the private and social desirability of mixed bundling in complementary markets with cost savings"
2016/7, Choi, A.; Gil, M.; Mediavilla, M.; Valbuena, J.: "Double toil and trouble: grade retention and academic performance"
2016/8, González-Val, R.: "Historical urban growth in Europe (1300–1800)"
2016/9, Guio, J.; Choi, A.; Escardíbul, J.O.: "Labor markets, academic performance and the risk of school dropout: evidence for Spain"
2016/10, Bianchini, S.; Pellegrino, G.; Tamagni, F.: "Innovation strategies and firm growth"
2016/11, Jofre-Monseny, J.; Silva, J.I.; Vázquez-Grenno, J.: "Local labor market effects of public employment"
2016/12, Sanchez-Vidal, M.: "Small shops for sale! The effects of big-box openings on grocery stores"
2016/13, Costa-Campi, M.T.; García-Quevedo, J.; Martínez-Ros, E.: "What are the determinants of investment in environmental R&D?"
2016/14, **García-López, M.A; Hémet, C.; Viladecans-Marsal, E.:** "Next train to the polycentric city: The effect of railroads on subcenter formation"
2016/15, Matas, A.; Raymond, J.L.; Dominguez, A.: "Changes in fuel economy: An analysis of the Spanish car market"
2016/16, Leme, A.; Escardíbul, J.O.: "The effect of a specialized versus a general upper secondary school curriculum on students' performance and inequality. A difference-in-differences cross country comparison"
2016/17, **Scandurra, R.I.; Calero, J.**: "Modelling adult skills in OECD countries"
2016/18, **Fernández-Gutiérrez, M.; Calero, J.**: "Leisure and education: insights from a time-use analysis"
2016/19, Del Rio, P.; Mir-Artigues, P.; Trujillo-Baute, E.: "Analysing the impact of renewable energy regulation on retail electricity prices"
2016/20, Taltavull de la Paz, P.; Juárez, F.; Monllor, P.: "Fuel Poverty: Evidence from housing perspective"
2016/21, Ferraresi, M.; Galmarini, U.; Rizzo, L.; Zanardi, A.: "Switch towards tax centralization in Italy: A wake up for the local political budget cycle"
2016/22, Ferraresi, M.; Migali, G.; Nordi, F.; Rizzo, L.: "Spatial interaction in local expenditures among Italian municipalities: evidence from Italy 2001-2011"
2016/23, Daví-Arderius, D.; Sanin, M.E.; Trujillo-Baute, E.: "CO2 content of electricity losses"
2016/24, Arqué-Castells, P.; Viladecans-Marsal, E.: "Banking the unbanked: Evidence from the Spanish banking expansion plan"
2016/25 Choi, Á.; Gil, M.; Mediavilla, M.; Valbuena, J.: "The evolution of educational inequalities in Spain: Dynamic evidence from repeated cross-sections"
2016/26, Brutti, Z.: "Cities drifting apart: Heterogeneous outcomes of decentralizing public education"
2016/27, Backus, P.; Cubel, M.; Guid, M.; Sánchez-Pages, S.; Lopez Manas, E.: "Gender, competition and performance: evidence from real tournaments"
2016/28, Costa-Campi, M.T.; Duch-Brown, N.; García-Quevedo, J.: "Innovation strategies of energy firms"

2016/29, Daniele, G.; Dipoppa, G.: "Mafia, elections and violence against politicians"
2016/30, Di Cosmo, V.; Malaguzzi Valeri, L.: "Wind, storage, interconnection and the cost of electricity"

2017

2017/1, González Pampillón, N.; Jofre-Monseny, J.; Viladecans-Marsal, E.: "Can urban renewal policies reverse neighborhood ethnic dynamics?"
2017/2, Gómez San Román, T.: "Integration of DERs on power systems: challenges and opportunities"
2017/3, Bianchini, S.; Pellegrino, G.: "Innovation persistence and employment dynamics"
2017/4, Curto-Grau, M.; Solé-Ollé, A.; Sorribas-Navarro, P.: "Does electoral competition curb party favoritism?"
2017/5, Solé-Ollé, A.; Viladecans-Marsal, E.: "Housing booms and busts and local fiscal policy"
2017/6, Esteller, A.; Piolatto, A.; Rablen, M.D.: "Taxing high-income earners: Tax avoidance and mobility"
2017/7, Combes, P.P.; Duranton, G.; Gobillon, L.: "The production function for housing: Evidence from France"
2017/8, Nepal, R.; Cram, L.; Jamasb, T.; Sen, A.: "Small systems, big targets: power sector reforms and renewable energy development in small electricity systems"
2017/9, Carozzi, F.; Repetto, L.: "Distributive politics inside the city? The political economy of Spain's plan E"
2017/10, Neisser, C.: "The elasticity of taxable income: A meta-regression analysis"
2017/11, Baker, E.; Bosetti, V.; Salo, A.: "Finding common ground when experts disagree: robust portfolio decision analysis"
2017/12, Murillo, I.P; Raymond, J.L; Calero, J.: "Efficiency in the transformation of schooling into competences: A cross-country analysis using PIAAC data"
2017/13, **Ferrer-Esteban, G.; Mediavilla, M.:** "The more educated, the more engaged? An analysis of social capital and education"
2017/14, Sanchis-Guarner, R.: "Decomposing the impact of immigration on house prices"
2017/15, Schwab, T.; Todtenhaupt, M.: "Spillover from the haven: Cross-border externalities of patent box regimes within multinational firms"
2017/16, Chacón, M.; Jensen, J.: "The institutional determinants of Southern secession"
2017/17, Gancia, G.; Ponzetto, G.A.M.; Ventura, J.: "Globalization and political structure"
2017/18, González-Val, R.: "City size distribution and space"
2017/19, García-Quevedo, J.; Mas-Verdú, F.; Pellegrino, G.: "What firms don't know can hurt them: Overcoming a lack of information on technology"
2017/20, Costa-Campi, M.T.; García-Quevedo, J.: "Why do manufacturing industries invest in energy R&D?"
2017/21, Costa-Campi, M.T.; García-Quevedo, J.; Trujillo-Baute, E.: "Electricity regulation and economic growth"

2018

2018/1, Boadway, R.; Pestieau, P.: "The tenuous case for an annual wealth tax"
2018/2, Garcia-López, M.À.: "All roads lead to Rome ... and to sprawl? Evidence from European cities"
2018/3, Daniele, G.; Galletta, S.; Geys, B.: "Abandon ship? Party brands and politicians' responses to a political scandal"
2018/4, Cavalcanti, F.; Daniele, G.; Galletta, S.: "Popularity shocks and political selection"
2018/5, Naval, J.; Silva, J. I.; Vázquez-Grenno, J.: "Employment effects of on-the-job human capital acquisition"
2018/6, Agrawal, D. R.; Foremny, D.: "Relocation of the rich: migration in response to top tax rate changes from spanish reforms"
2018/7, García-Quevedo, J.; Kesidou, E.; Martínez-Ros, E.: "Inter-industry differences in organisational eco-innovation: a panel data study"
2018/8, Aastveit, K. A.; Anundsen, A. K.: "Asymmetric effects of monetary policy in regional housing markets"
2018/9, Curci, F.; Masera, F.: "Flight from urban blight: lead poisoning, crime and suburbanization"
2018/10, Grossi, L.; Nan, F.: "The influence of renewables on electricity price forecasting: a robust approach"
2018/11, Fleckinger, P.; Glachant, M.; Tamokoué Kamga, P.-H.: "Energy performance certificates and investments in building energy efficiency: a theoretical analysis"
2018/12, van den Bergh, J. C.J.M.; Angelsen, A.; Baranzini, A.; Botzen, W.J. W.; Carattini, S.; Drews, S.; Dunlop, T.; Galbraith, E.; Gsottbauer, E.; Howarth, R. B.; Padilla, E.; Roca, J.; Schmidt, R.: "Parallel tracks towards a global treaty on carbon pricing"

2018/13, Ayllón, S.; Nollenberger, N.: "The unequal opportunity for skills acquisition during the Great Recession in Europe"
2018/14, Firmino, J.: "Class composition effects and school welfare: evidence from Portugal using panel data"
2018/15, Durán-Cabré, J. M.; Esteller-Moré, A.; Mas-Montserrat, M.; Salvadori, L.: "La brecha fiscal: estudio y aplicación a los impuestos sobre la riqueza"
2018/16, Montolio, D.; Tur-Prats, A.: "Long-lasting social capital and its impact on economic development: the legacy of the commons"
2018/17, Garcia-López, M. À.; Moreno-Monroy, A. I.: "Income segregation in monocentric and polycentric cities: does urban form really matter?"
2018/18, Di Cosmo, V.; Trujillo-Baute, E.: "From forward to spot prices: producers, retailers and loss averse consumers in electricity markets"
2018/19, Brachowicz Quintanilla, N.; Vall Castelló, J.: "Is changing the minimum legal drinking age an effective policy tool?"
2018/20, Nerea Gómez-Fernández, Mauro Mediavilla: "Do information and communication technologies (ICT) improve educational outcomes? Evidence for Spain in PISA 2015"
2018/21, Montolio, D.; Taberner, P. A.: "Gender differences under test pressure and their impact on academic performance: a quasi-experimental design"
2018/22, Rice, C.; Vall Castelló, J.: "Hit where it hurts – healthcare access and intimate partner violence"
2018/23, Ramos, R.; Sanromá, E.; Simón, H.: "Wage differentials by bargaining regime in Spain (2002-2014). An analysis using matched employer-employee data"

2019

2019/1, Mediavilla, M.; Mancebón, M. J.; Gómez-Sancho, J. M.; Pires Jiménez, L.: "Bilingual education and school choice: a case study of public secondary schools in the Spanish region of Madrid"
2019/2, Brutti, Z.; Montolio, D.: "Preventing criminal minds: early education access and adult offending behavior"
2019/3, Montalvo, J. G.; Piolatto, A.; Raya, J.: "Transaction-tax evasion in the housing market"
2019/4, Durán-Cabré, J.M.; Esteller-Moré, A.; Mas-Montserrat, M.: "Behavioural responses to the re)introduction of wealth taxes. Evidence from Spain"
2019/5, Garcia-López, M.A.; Jofre-Monseny, J.; Martínez Mazza, R.; Segú, M.: "Do short-term rental platforms affect housing markets? Evidence from Airbnb in Barcelona"
2019/6, Domínguez, M.; Montolio, D.: "Bolstering community ties as a means of reducing crime"
2019/7, García-Quevedo, J.; Massa-Camps, X.: "Why firms invest (or not) in energy efficiency? A review of the econometric evidence"
2019/8, Gómez-Fernández, N.; Mediavilla, M.: "What are the factors that influence the use of ICT in the classroom by teachers? Evidence from a census survey in Madrid"
2019/9, Arribas-Bel, D.; Garcia-López, M.A.; Viladecans-Marsal, E.: "The long-run redistributive power of the net wealth tax"
2019/10, Arribas-Bel, D.; Garcia-López, M.A.; Viladecans-Marsal, E.: "Building(s and) cities: delineating urban areas with a machine learning algorithm"
2019/11, Bordignon, M.; Gamalerio, M.; Slerca, E.; Turati, G.: "Stop invasion! The electoral tipping point in anti-immigrant voting"

2020

2020/1, Daniele, G.; Piolatto, A.; Sas, W.: "Does the winner take it all? Redistributive policies and political extremism"
2020/2, Sanz, C.; Solé-Ollé, A.; Sorribas-Navarro, P.: "Betrayed by the elites: how corruption amplifies the political effects of recessions"
2020/3, Farré, L.; Jofre-Monseny; J., Torrecillas, J.: "Commuting time and the gender gap in labor market participation"
2020/4, Romarri, A.: "Does the internet change attitudes towards immigrants? Evidence from Spain"
2020/5, Magontier, P.: "Does media coverage affect governments'preparation for natural disasters?"

IEB
Institut
d'Economia
de Barcelona

UNIVERSITAT DE
BARCELONA

ieb@ub.edu
www.ieb.edu

Public Policies

IEB Working Paper