The Frontier Origins of U.S. Gun Culture

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Abstract

This paper studies the transmission of a county's historical exposure to the U.S.frontier into its consumers' present-day preferences for firearm ownership and regulation. Counties with an additional decade on the frontier between 1790–1890 have 1.2 percent higher rates of firearm ownership between 1999–2019 than their less-exposed counterparts, equivalent to 10 percent of the gap in contemporary rates of firearm ownership between Illinois and Texas. Consumers who live in counties with greater frontier exposure disproportionately purchase more firearms following nationwide demand shocks and increased support for a federal assault rifle ban following the 2017 Las Vegas Mass Shooting Event. The contemporary debate around firearm regulation should account for heterogeneity in its historical antecedents across the U.S.

The government may not simply posit that the regulation promotes an important interest. Rather, the government must demonstrate that the regulation is consistent with this Nation's historical tradition of firearm regulation.

—Clarence Thomas (New York State Rifle & Pistol Association, Inc. v. Bruen)

1 Introduction

U.S. consumers value firearms. One-in-three households owns a firearm, and three-in-four firearm owners say that ownership is "essential to their freedom" (Parker et al. 2017, Miller et al. 2021). Firearm ownership also plays a role in the 120,000 shooting incidents across the U.S. each year—"a serious public health problem" (CDC 2023)—and the potential to improve public health through firearm policy (Weinberger et al. 2018).

Yet, there is considerable disagreement about the design of firearm policy in the U.S. Regulations on the firearm market varies widely across states and in the federal government over time (Hemenway 2004,

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Knight 2013, Luca et al. 2017, Luca et al. 2020). Opinions about firearm regulation are mixed among U.S. citizens—even firearm owners—and politically polarized among state and federal legislators (Parker et al. 2017, Gentzkow et al. 2019, Luca et al. 2020). Lacking clear guidance from the political process, recent decisions by the U.S. Supreme Court have reframed the analysis of contemporary firearm policy around the historical context of firearms in America's past (District of Columbia v. Heller, McDonald v. Chicago, New York State Rifle & Pistol Association, Inc. v. Bruen).

In this paper, I study exposure to the U.S. historical frontier as a determinant of consumer preferences for firearm ownership and opinions about firearm policy in the contemporary U.S. I measure a county's time on the frontier using the methods of Bazzi et al. (2020), and measure its contemporary attitudes using proxies for firearm ownership, measures of handgun purchasing, and opinion polls (Cook 1979, Ansolabehere and Schaffner 2023). Each additional decade a county spends on the frontier increases firearm ownership within the county by 1.2 percent, relative to other counties in the same state with similar geoclimatic conditions. This is a large transmission of historical context to the present day, equivalent in magnitude to 10 percent of the gap in *per capita* firearm ownership between Illinois and Texas. That contemporary firearm ownership varies systematically with the historical process of frontier expansion demonstrates path dependence in the consumer firearms market and heterogeneity in the U.S. tradition of firearm ownership and regulation.

Beyond long-run transmission into the level of firearm ownership, consumers living in counties with greater frontier exposure are more responsive to shocks on the contemporary firearm market. Using unique data on handgun purchasing in California, I measure heterogeneity in the responsiveness of firearm purchasing to nationwide firearm demand shocks, driven by either the 2008 presidential election or the 2012 Sandy Hook Mass Shooting Event (Wallace 2015, Depetris-Chauvin 2015, Studdert et al. 2017). Following a nationwide demand shock, consumers in California's counties with above-median frontier exposure increase handgun purchasing by 40 percent more than consumers in counties with below-median exposure to the frontier. Econometrically, analyzing the dynamics of firearm purchasing over time enables me to condition this analysis on county fixed effects, and identify the differential impact of nationwide demand shocks in counties with high- versus low-exposure to the historical frontier.

Turning to preferences for firearm policy, I use nationwide opinion polls to analyze consumer preferences for assault-rifle regulation following the Las Vegas Mass Shooting Event in 2017 and their correlation with exposure to the historical frontier. In the event's aftermath, each additional decade a county spent on the frontier increased the share of individuals in that county supporting a federal ban on assault weapons by three percentage points. This result is robust to excluding all counties in the Mountain census division, where the nearby shooting may have been especially influential because of geographic proximity and not frontier history. A finding that frontier exposure increases support for a federal regulation runs counter to

the results in Bazzi et al. (2020) and underscores the nuance required when analyzing the history of firearms regulation in the U.S.

The analysis in this paper principally relates to two literatures. Narrowly, this paper contributes to a literature analyzing consumer preferences for firearms. A slate of recent papers have specified and estimated models of consumer demand for firearm purchase, without considering the historical process that brought these preferences into existence (Bice and Hemley 2002, McDougal et al. 2023, Moshary et al. forthcoming, Rosenberg 2024, Armona and Rosenberg 2024). These papers complement a longer literature using surveys to describe present-day characteristics that likely lead an individual to gun ownership (Cook and Ludwig 1996, Hepburn et al. 2007, Azrael et al. 2017, Parker et al. 2017, Miller et al. 2021). A number of other papers take a more dynamic view of consumer firearm purchase by analyzing heterogenous changes in firearm transactions around major shocks to demand (e.g. Depetris-Chauvin 2015, Studdert et al. 2017, Levine and Mcknight 2017, Depew and Swenson 2019, Evans et al. 2022). In this paper, I provide a historical basis for some of the heterogeneity in contemporary preferences for firearm ownership and purchase based on the transmission of historical frontier culture to the present day.

More broadly, this paper relates to the literature on path dependence and the historical origins of contemporary economic phenomena (David 1985). The empirical analysis in this paper extends Bazzi et al. (2020) to focus specifically on firearms, and provides further empirical evidence on the debate around frontier life and individualism—Turner's (1893) "frontier thesis"—discussed therein. I show path dependence both through long-run differences in the *level* of firearm ownership across counties with differential exposure to the frontier and through heterogeneity across counties in their dynamic *response* to tightly defined shocks on the contemporary firearms market.

The general result from this paper is that geographically diverse patterns from U.S. history interact with preferences for firearms and their regulation today. When using the historical record to guide contemporary firearm regulation, as proposed by the U.S. Supreme Court, it is important to consider its variations across time and space.

The remainder of this paper proceeds as follows. Section 2 describes data and measurement. Section 3 presents results on the long-run transmission of frontier culture to contemporary firearm ownership. Section 4 analyzes heterogenous responses to shocks on the contemporary firearms market. Section 5 concludes.

2 Data

This section describes the sources of data in this project.

The key independent variable is a county-level measure of exposure to the historical U.S. frontier. I follow

Bazzi et al. (2020) and measure frontier exposure as decades a contemporary county spent on the frontier during the century of U.S. expansion between 1790 and 1890. I gather data on frontier exposure from the replication archive of Bazzi et al. (2020), and base my analysis on the arguments and validations therein. I further draw an extensive set of geoclimatic county-level covariates (geographic coordinates, average rainfall, etc.) from the replication archive of Bazzi et al. (2020).

My measure of contemporary firearm ownership within a county is the Firearm Suicide Share or "FSS" (Cook 1979). The FSS is calculated as the ratio of firearm suicides to total suicides within a defined location-period. In absence of administrative records of firearm ownership or geographically granular survey-based measures, FSS is a common tool for measuring firearm ownership (Moshary et al. forthcoming). The FSS has been extensively validated and generally found to be an effective proxy for levels of gun ownership (Schell et al. 2020). However, due to small-sample bias in ratios, over-time changes in FSS are invalid proxies for changes in firearm ownership, and I do not make such over-time comparisons with FSS (Kleck 2015). I compute the FSS for counties in the U.S. using morgue records from the Multiple Cause of Death Database accessed via CDC WONDER (2023). To limit the impacts of small sample bias in the FSS proxy, I measure firearm ownership using all years available in WONDER prior to the Coronavirus Pandemic, specifically 1999–2019. I further limit the impacts of small sample bias by restricting my estimation sample to counties with at least 20 suicide fatalities over this period.

To capture over-time changes in firearm purchasing, I use an administrative source of handgun transactions in California between 2005 and 2015 (Studdert et al. 2017). Under the California Code, all legal handgun transactions must be implemented through an entity with a Federal Firearms License and recorded on a standardized form. The Bureau of Firearms at the California Department of Justice collects and digitizes these forms to create a Dealer Record of Sales Database. In 2022, an electronic dashboard produced by the California Department of Justice briefly published aggregate handgun sales counts with county-quarter resolution. I scraped these aggregate sales counts, and I use them to observe over-time changes in handgun sales.

I measure public opinion on firearm policy using the Cooperative Congressional Election Study (Ansolabehere and Schaffner 2023). This yearly survey asks respondents their opinions about a slate of firearms regulations. I focus on opinions about federal assault-weapons bans, which was the only firearm-related question asked every year between 2013–2017. Bazzi et al. (2020, Appendix C) utilize this survey question in a cross-sectional analysis from 2014, while I utilize the sequence of yearly questions to study changes in regulatory views over time.

3 Long-run transmission of frontier gun culture

In this section, I present my primary result about the transmission of frontier gun culture over time, closely following the models and techniques developed by Bazzi et al. (2020).

3.1 Methodology

I consider the following model relating total exposure to the historical frontier TFE_c to *per capita* firearm ownership FSS_c in county c of state s:

$$FSS_c = \alpha_{s(c)} + \beta TFE_c + \gamma X_c + \epsilon_c \tag{1}$$

The coefficient of interest β captures the change in county-level firearm ownership from spending an additional decade on the historical frontier (increasing TFE_c by one unit). The regression model includes state fixed effects $\alpha_{s(c)}$ and county-level geoclimatic characteristics X_c. Thus, the variation in frontier exposure that quantifies β comes from comparing counties within the same state that spent different periods of time on the historical frontier after netting out the aggregate effects of their geography and climate. I estimate the model via OLS and cluster standard errors by 60-square-kilometer cells on a grid covering the U.S. (Bester, Conley, and Hansen 2011). I estimate the model with gun ownership FSS_c either log-transformed for interpretability or standardized for comparison with the magnitudes in Bazzi et al. (2020).

3.2 Aggregate Results

Table 1 presents estimates of of the long-run transmission of frontier gun culture, as summarized by β. My preferred specification in Column 3 shows that each additional decade a county spent on the historical frontier corresponds to a $\beta \times 100 = 1.2$ percent increase in present day firearm ownership, after accounting for state fixed effects and geoclimatic covariates.

The impact of frontier exposure on firearm ownership in Table 1 suggests a strong mechanism of historical transmission relative to patterns of firearm ownership today (Schell 2020). In the contemporary cross-section, 37 percent of Texas residents and 24 percent of Illinois residents live in households with at least one firearm. Thus, an estimate of $\beta \times 100 = 1.2$ implies that each additional decade of exposure to the historical frontier closes approximately 10 percent of the Texas-Illinois gap in firearm ownership. As an alternative metric, national rates of firearm ownership in the U.S. have declined from 45 percent in 1980 to 32 percent in 2016 (Schell et al. 2020). Thus, each additional decade of frontier exposure is equivalent to $1.2/((45-32)/(2016-1980+1)) = 3.4$ years of the post-1980 decline in national firearm ownership.

Column 4 of Table 1 presents estimates of the same model specification using a standardized value of firearm ownership FSS_c as the dependent variable. Each additional decade of frontier exposure increases firearm ownership by 0.05 standard deviations of the nationwide FSS_c distribution. This increase is at least 50 percent larger than all of the historical transmission effects on contemporary policy preferences reported by Bazzi et al. (2020, Table III columns 1–6).

3.3 Nonparametric Results

In this section, I probe the interpretation of β in Equation (1). An implication of the model is that each additional decade a county spends on the frontier increases its value of the dependent variable by β units, on average. However, this assumption of constant average marginal effects can be misleading when both exposure to the frontier and the treatment effect of frontier exposure varies across counties.

To recover potential effect heterogeneity in exposure to the historical frontier β, I consider a non-parametric version of Equation (1). My approach coarsens frontier exposure into mutually exclusive bins: $TFE = 0$, $TFE \in (0, 1)$, $TFE \in [1, 2)$, ... with each bin allowed a separate relationship with firearm ownership, relative to the excluded category of $TFE = 0$. I leave the rest of Equation (1) intact, so that all estimates are conditioned on state fixed effects and county geoclimatic controls.

Panel A of Figure 1 demonstrates that the data do not support the assumption of constant marginal effects embodied in Equation (1). On average, it is not possible to distinguish the effect of frontier exposure on firearm ownership across counties with different levels of non-zero frontier exposure. The analysis in Panel A suggests that, as far as gun culture is concerned, what matters is whether a county was exposed to at least one decade on the frontier, not how much frontier exposure it experienced overall.

Panel B extends this analysis to the first column from Table III of Bazzi et al. (2020), describing individual preferences for cutting public spending on the poor. These estimates also provide no support for the assumption of constant marginal effects in Equation (1).

4 Dynamics in the present day

In this section, I show that exposure to the historical frontier impacts the dynamics of gun culture in the present day. The prior section demonstrated the long-run transmission of culture from past to present. In particular, following a shock to the firearms market, consumer in counties with higher frontier exposure increase firearm purchasing and support for firearm regulation relatively more than their counterparts with less time on the historical frontier.

4.1 Methodology

I demonstrate each result in this section in two ways. I plot the time series of the outcome—firearm purchases or regulatory opinions—stratified by counties with above- or below-median frontier exposure. These plots allow for visual inspection of the underlying patterns in the data.

I also formalize the time series patterns by estimating panel regression models of the following form

$$Y_{ct} = \theta\,(t \geq 0) \times TFE_c + \psi_c + \phi_t + \epsilon_{ct}. \tag{2}$$

The left-hand side is the value of a dependent variable Y in county c at event-time t, measured in periods relative to a shock. The parameter of interest θ captures the effect of an additional decade on the frontier TFE_c following the shock ($t \geq 0$). The right-hand side also includes fixed effects for county ψ_c and event-time ϕ_t. Thus, the variation that quantifies θ comes from the difference in the outcome Y following the event in counties with higher frontier exposure, relative to counties with lower exposure. This type of variation corresponds to a difference-in-differences research design with a continuous-valued treatment: the pre/post variation around the shock is the first difference, and continuous variation in frontier exposure is the second difference. I estimate the model by OLS and cluster standard errors using the same structure as in the prior section.

4.2 Spikes in firearm demand

A feature of the contemporary market for consumer firearms is the existence of large, unpredictable shocks to firearm demand. These shocks can results from unexpected election outcomes (Depetris-Chauvin 2015), unpredictable mass shooting events (Wallace 2015), or unanticipated changes in firearms regulations (Studdert et al. 2017).

In this subsection, I show that counties with longer exposure to the historical frontier experience disproportionately large increases in firearm purchasing following nationwide shocks to gun demand. I focus on the Obama-shock in the quarters after the 2008 U.S. Presidential Election (Depetris-Chauvin 2015) and the Sandy-Hook shock following the mass shooting event in Sandy Hook Connecticut in late 2012 (Levine and McKnight 2017). Due to the regulatory infrastructure in the U.S., county-level records of firearm transactions are generally not available. As described above, California offers a unique regulatory environment in which county-level handgun sales are observable with quarterly resolution. Therefore, the analysis in this section focuses on California alone.

Figure 2 presents average patterns of quarterly handgun purchasing per capita around nationwide shocks

to firearm demand following the 2008 Presidential Election and the 2012 Sandy Hook Mass Shooting Event. To aid in visualization, I partition counties into those with above- and below-median frontier exposure within California.[1] Both sets of counties have similar dynamics of handgun purchasing prior to the shock, and both experience large increases in handgun purchasing after the shock occurs. However, counties with above-median exposure to the frontier increase handgun purchases following the demand shock by 40 percent more than their below-median counterparts.

Table 2 presents controlled estimates of the effects of these nationwide demand shocks on consumer handgun purchasing in California. As with the visual analysis, Californian counties with higher exposure to the frontier respond to demand shocks more strongly than counties with less exposure. To interpret the quantities, following the Sandy Hook Shooting, each additional decade of exposure to the historical frontier contributed 20 additional handgun sales per quarter for every 100,000 residents of a county.

4.3 Spikes in regulatory preferences

Beyond heterogeneity in firearm demand, consumers in the U.S. express heterogeneous opinions on firearm regulation. In this subsection, I examine heterogeneity in the time-path of preferences for firearm regulation around the Las Vegas Mass Shooting Event in 2017.

Figure 2 presents yearly patterns of average support for a federal ban on assault rifles.[2] In years prior to the Las Vegas Mass Shooting, regulatory views were stable across counties with no, low, and high exposure to the historical frontier. Following the shooting, preferences for an assault weapons ban increased in all three groups of counties. However, counties with no frontier exposure increased by 20 percentage points, while counties with any exposure increased by 30 percentage points. Moreover, the increase was more pronounced in counties with above- versus below-median exposure to the historical frontier.

Table 3 presents regression estimates formalizing the effect of the 2017 Las Vegas Shooting on support for a federal assault rifle ban. As with the visual analysis, individuals in counties with longer exposure to the historical frontier respond to the Las Vegas Shooting by increasing support for an assault rifle ban relatively more than their counterparts in counties with less exposure. To interpret the magnitudes, following the Las Vegas Shooting, each additional decade of exposure to the historical frontier increased the share of residents supporting an assault rifle ban by 3.2 percentage points. As a robustness exercise, I find similar results when re-estimating the model excluding counties in the Mountain census division that were geographically proximate to the Las Vegas Shooting.

[1] The median exposure within California is 1.7 decades, which is close to the median exposure within the U.S. of 1.3 decades.
[2] I compute yearly averages using the sample weights provide by the Cooperative Congressional Election Study.

5 Conclusion

Preferences for firearms and their regulation in the U.S. have important welfare implications. Preferences drive consumer firearm purchasing, which can increase risk of injury and fatality downstream (Weinberger et al. 2018). Preferences also drive policy and the ability of regulators to mitigate potential harms of gun ownership (Luca et al. 2020).

In this paper, I show that contemporary preferences for firearms in the U.S. have historical antecedents in frontier culture. A county's time on the historical frontier between 1790–1890 affects its rate of firearm ownership *per capita* more than one century into the future. This historical transmission is powerful, with 1 additional decade on the frontier generating an increase in firearm ownership strong enough to close 10 percent of the contemporary gap in firearm ownership between Illinois and Texas.

Beyond levels of firearm ownership, frontier culture affects how consumers respond to contemporary shocks on the firearms market. When demand for handguns spikes in California, it spikes 40 percent more strongly in counties with more time on the frontier. And when nationwide support for firearm regulation increases after a mass shooting, the increase is especially pronounced in frontier counties.

A set of recent Second Amendment cases at the U.S. Supreme Court (District of Columbia v. Heller, McDonald v. Chicago, New York State Rifle & Pistol Association, Inc. v. Bruen) have made the history of gun culture and firearm regulation key determinants of contemporary firearm policy. In this paper, I show that the history of firearms in the U.S. is no monolith, and has had far-reaching consequences across space and time.

6 References

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7 Tables and Figures

Table 1: Historical Frontier Exposure Transmits to Contemporary Firearm Ownership

	log(FSS)			stand(FSS)
	(1)	(2)	(3)	(4)
Frontier Decades	0.039***	0.019***	0.012***	0.053***
	(0.008)	(0.004)	(0.004)	(0.017)
State FE	N	Y	Y	Y
Controls	N	N	Y	Y
Clusters	460	460	460	460
Observations	2,653	2,653	2,634	2,634
R^2	0.047	0.506	0.546	0.510

Note: Table presents OLS estimates of Equation (1). The dependent variable in columns 1–3 is the log of the Firearm Suicide Share, a common proxy for the gun ownership rate. The dependent variable in column 4 is a measure of the Firearm Suicide Share standardized to have mean zero and variance one across counties in the sample. The independent variable is the time a county spends on the U.S. frontier, as computed by Bazzi et al. (2020). Controls are the geoclimatic covariates used by Bazzi et al. (2020). Standard errors are clustered by 60×60 kilometer grid cells following Bester, Conley, and Hansen (2011).

Table 2: Changes in Handgun Purchasing around Shocks to Firearm Demand

	Obama	Sandy Hook
	(1)	(2)
Frontier Decades*Post Shock	0.00007	0.00020*
	(0.00004)	(0.00010)
Cty FE	Y	Y
Event-time FE	Y	Y
Clusters	12	12
Observations	294	294
R^2	0.88187	0.92216

Note: Table presents OLS estimates of Equation (2) on data from Californian counties. The dependent variable in both columns is quarterly handgun transactions per capita. Column 1 analyzes transactions from four quarters before, the quarter of, and one quarter after Obama's election in 2008. Column 2 analyzes transactions from four quarters before, the quarter of, and one quarter after the Sandy Hook Mass Shooting Event in 2012. The independent variable is the Bazzi et al. (2020) measure of time a county spends on the U.S. frontier interacted with a post-event indicator. Standard errors are clustered by 60×60 kilometer grid cells following Bester, Conley, and Hansen (2011). See Figure 2 for a visualization of the quantifying variation.

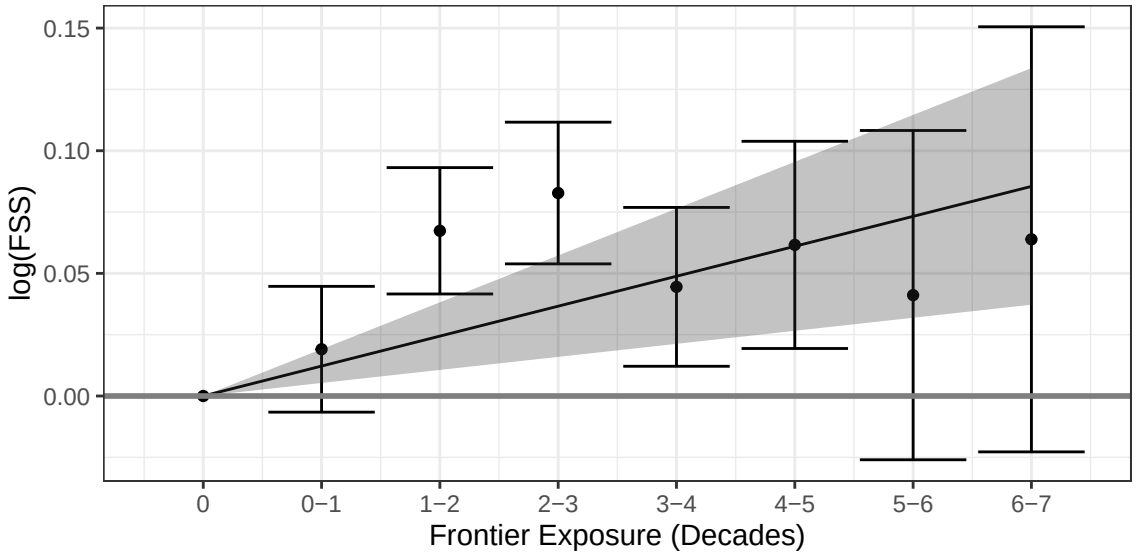
Table 3: Changes in Support for an Assault Rifle Ban following the Las Vegas Shooting

	Full U.S.	Excluding Mountain
	(1)	(2)
Frontier Decades*Post Shock	0.03188***	0.03386***
	(0.00787)	(0.00825)
Cty FE	Y	Y
Event-time FE	Y	Y
Clusters	467	467
Observations	128,563	122,231
R^2	0.08964	0.08581

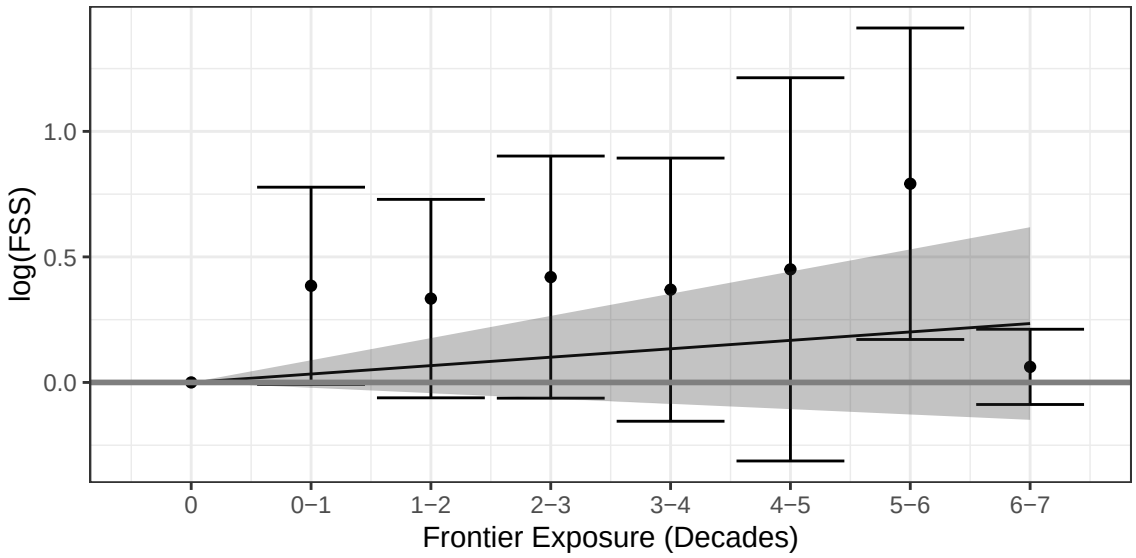
Note: Table presents OLS estimates of Equation (2). The dependent variable in both columns is whether an individual is in favor of banning assault weapons. Column 1 is estimated on data from 2013–2017 for the entire U.S., and Column 2 is estimated for the same years but excluding respondents in the Mountain census division. The independent variable is the Bazzi et al. (2020) measure of time a county spends on the U.S. frontier interacted with a post-event indicator. Data are weighted to be nationally representative each year. Standard errors are clustered by 60×60 kilometer grid cells following Bester, Conley, and Hansen (2011). See Figure 3 for a visualization of the quantifying variation.

Figure 1: Non-parametric Estimates of the Transmission of Frontier Gun Culture

Panel A: Firearm Ownership

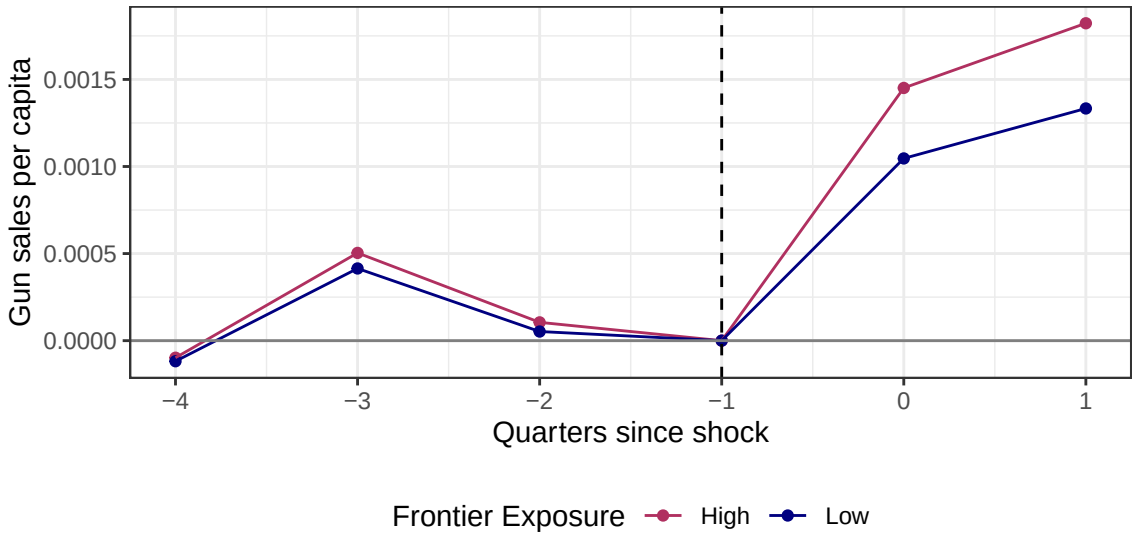


Panel B: Cut Public Spending on Poor



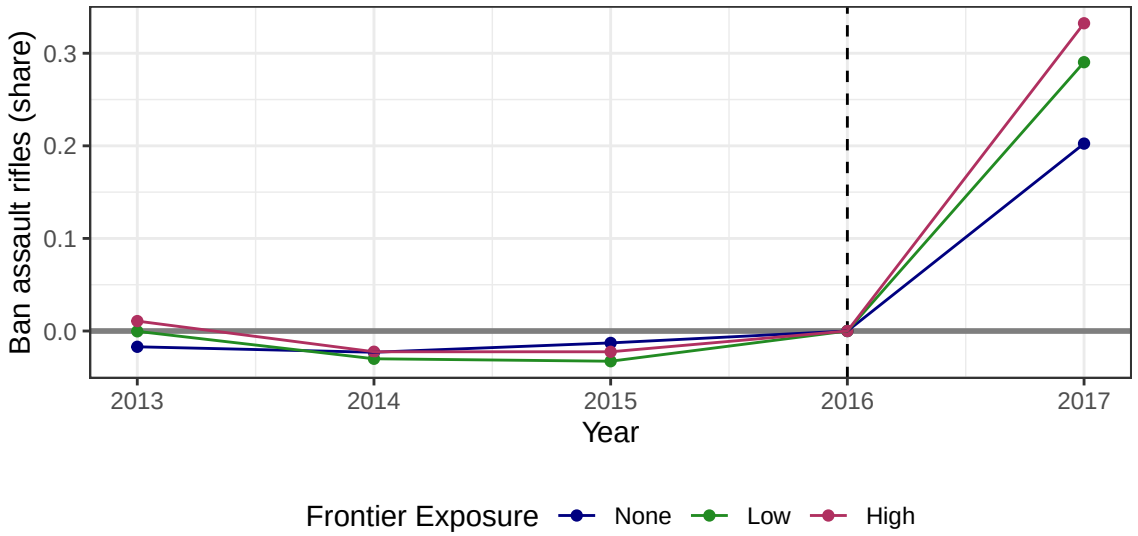
Note: Figure presents non-parametric estimates of model (1). The horizontal axis is a coarsening of the time a county spends on the frontier from Bazzi et al. (2020). In each panel, points presents the non-parametric relationship between this coarsened measure of frontier exposure and a county-level characteristic. The line presents the relationship between frontier exposure and the outcome assuming a constant marginal effect (β from the regression model). In Panel A the vertical axis is the log of the Firearm Suicide Share, a common proxy for gun ownership, as estimated in Table 1. The vertical axis in Panel B is whether a survey respondent supports cutting public spending on the poor, a replication of Table III, Column 1 in Bazzi et al. (2020). 95 percent confidence intervals adjust for clustering by 60×60 kilometer grid cells following Bester, Conley, and Hansen (2011).

Figure 2: Changes in Firearm Purchasing around Shocks to Firearm Demand



Note: Figure presents average changes in firearm purchasing for counties in California around nationwide shocks to firearm demand. The figure averages over two shocks, the election of Obama in 2008 and the Sandy Hook Shooting in 2012. Horizontal axis is quarters since the shock. Vertical axis is handgun purchases per capita. Blue series is the average sales per capita for Californian counties with time on the frontier below the California median. Red series is the average sales per capita for Californian counties with time on the frontier above the California median. Both series are normalized to zero in the quarter before the shock. See Table 2 for regression estimates.

Figure 3: Changes in Support for an Assault Rifle Ban following the Las Vegas Shooting



Note: Figure presents average changes in the share of individuals in favor of banning assault rifles following the Las Vegas shooting in 2017. Horizontal axis is years. Vertical axis is the share of respondents in favor of banning assault rifles, normalized by the share in 2016. Blue series is the share of individuals in favor of a ban who reside in counties that were never on the frontier. Green series is the share of individuals in favor of a ban who reside in counties that were on the frontier for a low period of time. Red series is the share of individuals in favor of a ban who reside in counties that were on the frontier for a high period of time. I define low and high exposure as counties below or above median duration on the frontier, where the median is calculated conditional on having positive duration. Data are weighted to be nationally representative each year.