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STATE AND LOCAL PREVALENCE OF FIREARMS OWNERSHIP: MEASUREMENT, STRUCTURE, AND TRENDS

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ABSTRACT

Of the readily computed proxies for the prevalence of gun ownership, one, the percentage of suicides committed with a gun, performs consistently better than the others in cross-section comparisons. It is readily computed for states and counties and has a high degree of validity when tested against survey-based estimates. It also appears valid as a proxy for changes over time in gun prevalence, at least at the regional level. Our analysis of this proxy measure for the period 1979-1997 demonstrates that the geographic structure of gun ownership has been highly stable. That structure is closely linked to rural tradition. There is, however, some tendency toward homogenization over this period, with high-prevalence states trending down and low-prevalence states trending up.

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About 40% of America's households own at least one firearm. The prevalence of ownership differs widely by region, ranging from 25% in the Northeast and 35% in the Pacific states, to 60% in the East South Central region.[1] Just where a particular state or city falls along this wide spectrum may have a variety of consequences for crime and public health. The probability that a gun is available for immediate use for a suicide attempt, escalating an episode of family violence, or self-defense against an intruder is greater in areas where gun ownership is common than areas where it is less usual. But while firearms prevalence influences availability for these uses, there is no scientific consensus on the ultimate consequences of gun prevalence for suicide, homicide and crime rates.

A systematic analysis of the effects of gun prevalence requires a valid measure of gun prevalence. Prevalence cannot be accurately measured from administrative records, since most states do not require registration or licensing, and compliance is poor in those that do. When available, surveys are a more promising source of data on gun prevalence. A number of national surveys have provided such estimates, but national surveys are not designed to support reliable estimates at the state or local level. While there are occasional state or local surveys with gun-ownership items, they provide only spotty coverage and are in any event not entirely comparable due to differences in survey method, response rate, and wording of items.

The remaining possibility for analyzing the effects of gun prevalence is use of a good proxy that is consistently available at the desired level of aggregation. Finding a valid and reliable proxy is an old problem (Cook 1979), and a number of alternatives have been proposed and utilized, generally in rather *ad hoc* fashion.

In this paper we analyze several plausible proxies for gun prevalence for which the data are readily available at the state and county level over a number of years. We find that among these is a simple measure that "performs" as well or better than the rest; namely, the percentage of suicides committed with a firearm. After validating this measure, we use it to describe the geographic structure of gun prevalence, documenting the wide differences among states and the remarkable stability of these differences over recent decades. We further demonstrate that this stable structure is becoming "flatter" over time, with a trend toward greater geographic homogeneity.

That this proxy performs well in the cross section is no guarantee that it also tracks trends in gun prevalence. However, we find it does track

[1] These statistics are computed from the General Social Survey, 1998.

intertemporal variation in regional gun prevalence over the period 1980 to 1998.

1. Survey Estimates of Firearms Prevalence

Surveys provide the only useful direct estimates of the prevalence of gun ownership. Most states lack any sort of registration or licensing requirement for gun owners. Even in the handful of states that do have such a requirement in place, the resulting administrative records provide little useful information on the number of gun owners; such records are typically incomplete (due to lack of compliance), out of date, and difficult to access. Survey data fill this gap, but only to a limited extent.

The "gold standard" for national surveys of gun ownership is the General Social Survey, conducted by the National Opinion Research Center most years from 1972 to 1993 and biennially since 1994 (Davis and Smith 1998). In its current form the GSS is conducted in person with a national area-probability sample of 3,000 non-institutionalized adults. The response rate has been quite high (for example, 78% in 1994, 76% in 1996, 76% in 1998). Its sample is chosen to be representative of the nation and of each of the nine Census regions, but not of individual states.

Two other readily available survey sources provide some information on the prevalence of gun ownership at the state level. First, between 1992 and 1995 the Behavioral Risk Factor Surveillance System (BRFSS) included gun-ownership items in surveys conducted in 21 states (Powell et al., 1998). These surveys were conducted under the auspices of state health departments using the random-digit-dial telephone technique. The median sample size of adults ages 18 and over was 2,061, and the median response rate was 67 %.[2]

Second, two national surveys conducted on behalf of the Harvard Injury Control Research Center (HICRC) provide the basis for state-level estimates. These surveys were conducted by using the random-digit-dial technique in 1996 and 1999, with sample sizes of 1,900 and 2,500 respectively. States were sampled in proportion to their population relative to that of the United States, producing valid estimates of state-level household gun ownership, albeit with small sample sizes. Detailed information on these surveys has been published previously (Powell et al.

[2] The median proportion of homes with telephones was 95.6%, and the median refusal rate for the firearm section was 2.0%. For states that asked firearm questions in more than one year, the most recent data were used.

1998; Azrael and Hemenway 2000; Miller, Azrael, and Hemenway 2000; Hemenway, Azrael, and Miller 2000).

"Prevalence" may be usefully defined with respect to individuals or households, and with respect to all types of guns or just handguns.[3] (Handguns are of particular interest because they are vastly over represented in crime in comparison with long guns.) The GSS provides enough detail in recent years to estimate all four variants: the percent of households with some type of gun, the percent of households with a handgun, the percent of adult individuals who possess a gun, and the percent of adult individuals who possess a handgun. These four prevalence measures are highly correlated across the nine Census regions. As shown in Table 1, the inter-region correlations are in every case above 90% (based on estimates from the GSS for 1994, 1996, and 1998 combined). Hence a proxy that provides a valid approximation to the geographic structure of, say, household handgun prevalence, likely also provides a valid approximation of other measures of prevalence. On the other hand, the four measures have followed somewhat different trajectories over time at the national level.[4]

2. Alternative Proxy Measures

When survey-based estimates or other direct estimates of gun availability have not been available, social scientists have used proxy measures. Perhaps the first proxy employed in the social-science literature was the fraction of criminal homicides committed with a gun; Brearley (1932) utilized this measure in analyzing the effect of gun ownership on interstate patterns of homicide. Since then it has been used to study the effect of gun availability on homicide rates over time (Fisher, 1976) and across nations (Etzioni and Remp, 1973; Curtis 1974).

Cook (1979) proposed and validated a related measure, namely the average of the gun percent in homicide and with the gun percent in suicide, demonstrating its application in a study of city robbery rates; other analysts have utilized this "Cook Index" as well (Miller, Azrael, and Hemenway 2001; Sloan 1990; Lester 1985). Kleck and Patterson (1993) have offered the most-elaborate proxy, a 5-item factor computed from the percentage gun use in homicide, suicide, assault, and robbery, as well as

[3] The "handgun" category includes pistols and revolvers, while the long-gun category includes rifles and shotguns. While handguns make up only about one-third of the total guns in private hands, they account for over 80% of gun crimes and injuries (Cook 1991).

[4] Since 1980 the household gun prevalence in the United States has trended down, while the prevalence of individual ownership has been close to constant. The explanation for the difference in trends is in the downward trend in the size of households, and in particular the percentage of households that include a man.

the value of stolen guns relative to the total property stolen. These and other studies that utilized proxies computed from crime statistics and mortality statistics are summarized in Kleck (1997, pp. 260-261).

An alternative source of proxy measures is statistical information on participation in gun-related activities. Krug (1968), for example, utilized data on the rate of hunting licenses issued per capita. Recently a prominent study made use of county-level subscription rates to *Guns & Ammo* (Duggan, in press), a magazine oriented to handgun users.

In what follows, we do not attempt an exhaustive analysis of possible proxies, but focus on two types: those based on Vital Statistics-Mortality data, and those based on subscription and membership information. The Vital Statistics data have the virtues of being consistent across time and space, of high quality, and readily available for annual estimates at the national, state, or county level (though only counties with large populations are identified in the public-use data files). We also assess measures based on subscription data for *Guns & Ammo,* and on membership information for the National Rifle Association; these data are available for a number of years at the county level.

The specific list of proxy measures is as follows[5]:

FS/S	Firearms suicides divided by suicides, 1995-97
FH/H	Firearms homicides divided by homicides, 1995-97
Cook	The average of FS/S and FH/H
UFDR	Death rate per 100,000 due to unintentional injury from firearm
G&A	Subscriptions to *Guns & Ammo Magazine* per capita, 1996
NRA	NRA members per capita, 1996

Appendix tables A1 and A2 provide descriptive statistics and source information.

These measures are for the most part positively correlated with each other, as shown in Table 2. The correlation between NRA (National Rifle Association membership) and G&A (subscription rate for *Guns & Ammo*

[5] Various refinements of each of these measures are possible and reasonable. For example, it seems likely that the weapons used in killings of adults may be more representative of household prevalence than killings of adolescents. It also may seem reasonable to standardize the measures with respect to demographic characteristics; for example, women may be less likely to make use of a gun in the house to commit suicide than men, in which case a proxy based on the gun percent in suicide would be affected by the gender mix. In practice, we find that such refinements tend to make little difference in the validity studies we report.

Magazine) is 90%.[6] FS/S (the gun fraction in suicide) is highly correlated with UFDR (73%) but less so with FH/H (just 37%). Correlations between NRA and mortality measures are low or even negative: .35 (FS/S), -.19 (FH/H), .55 (UFDR). Thus these proxies are not interchangeable.

3. Evaluation of the Proxy Measures

The validity of these proxy measures can be evaluated by comparing them with survey data. (See Appendix Table A3 for descriptive statistics and source information.) We note that the survey data are subject to sampling error, which may be quite large for small states, and to both response and non-response errors. But they provide the only direct measure of gun prevalence.

This comparison produces a clear winner, as shown in Table 3:

- FS/S has the highest correlation with survey-based estimates of household prevalence for all three sources of survey data. The correlation coefficient is 90% across the 21 BRFSS states, and not much lower (81%) across the contiguous 48 states using the HICRC surveys, despite the large sampling errors for the smaller states in those surveys.
- On the other hand, FH/H performs poorly in the cross-state analysis, and combining it with FS/S (the Cook index) is not as good as simply using FS/S by itself.
- UFDR performs well enough but not as well as FS/S, and in any event is based on such a relatively rare event (unintentional shooting death) as to render it useless for small-area estimates.
- NRA membership and the G&A subscription rate are also dominated by FS/S in these comparisons, and in the regional comparisons appear worthless.

We conclude that FS/S is a superior proxy measure for cross-section analysis, easily computed from available data for state and larger local jurisdictions and valid against survey-based estimates.

FS/S can also be calculated for counties and other sub-state levels from readily available mortality statistics. To explore the performance of FS/S as a sub-state proxy of firearm ownership we needed to identify states for which sub-state firearm ownership estimates were available. Few states, however, have such estimates. Of the 21 states that included the

[6] We also experimented with the subscription rates for *American Rifleman* and *American Hunter*. The interstate correlation with NRA is 97% for each of them. Presumably it is so high because a subscription to one of these magazines is a benefit of NRA membership.

firearms module in the BRFSS only one state, Colorado, was able to provide us with sub-state survey estimates of household firearms ownership that corresponded to geographic units for which we could calculate FS/S.[7] Colorado collected firearm-ownership estimates (and mortality data) for 12 of the state's 14 Planning and Management Regions (PMRs) in 1996. The 14 PMRs are a partition of the state's counties. Colorado did not estimate household firearm ownership rates for 2 of the 14 PMRs because sample sizes from these 2 PMRS contained too few people (N<50). For the 12 PMRs for which household firearm estimates were available (median sample size=416, ranging from 57 to 2,752) the correlation between FS/S and survey estimates of firearm ownership rates was 0.75 (unweighted). Weighting by sample size increased the correlation to 0.87.

4. Estimation of Gun Prevalence from FS/S

The household or individual prevalence of guns in a particular jurisdiction can be estimated from knowledge of FS/S for that jurisdiction. As it turns out, there is a linear (but not proportional) relationship between FS/S and prevalence over the relevant range. Equations for doing the conversion from proxy value to prevalence estimate are presented below. In order to correct for heteroskedasticity due to sampling error in the surveys, these regression equations are estimated using weighted least squares (WLS), with weights equal to the square root of the sample size for each jurisdiction. The weights take account of the fact that the survey-based prevalence estimates are much more precise in some states than others, given that the smaller states have sample sizes as low as 7.

To begin, Figure 1 depicts a scatterplot of state-level prevalence estimates (from BRFSS) against FS/S. The WLS line is superimposed. Note that the linear fit appears quite good for the range that we observe, even though the underlying relationship must be curvilinear at the endpoints (since the gun prevalence must lie between 0 and 1). Also plotted in Figure 1 are the BRFSS estimates for the household prevalence of handguns, which unfortunately are only available for 10 states.

Reference: Figure 1

Figure 2 depicts a scatterplot of region-level GSS estimates for household and individual prevalence of both firearms and handguns, all plotted against FS/S. The four WLS lines are superimposed. The “fit” is excellent in every case.

[7] Alaska, the only other state that could provide sub-state geographic estimates, could only provide these estimates for four geographic areas.

Reference: Figure 2

Table 4 provides coefficient estimates and statistics on "fit" for these and other WLS regression lines depicted in Figures 1 and 2. It also reports the equation for the regression of household prevalence (estimated from the HICRC surveys) against FS/S across the contiguous 48 states.

As shown in Table 4, there are three equations for estimating household prevalence of firearms, based on quite different sources – GSS for 9 regions, BRFSS surveys for 21 states, and HICRC surveys for 48 states. The three equations are remarkably similar, particularly with respect to the slope coefficient, which is in every case close to 1.0 (implying a one-to-one relationship between household prevalence percentage and gun percentage in suicide).

Appendix Table A4 provides survey-based prevalence estimates for each state together with the fitted values. The largest disparities, unsurprisingly, show up in the states with small survey sample sizes.

5. The Geographic Structure of Gun Ownership

The prevalence of gun ownership has a strong regional pattern, with relatively low rates in the Northeast and Pacific Coast, and high rates in the South and Mountain states. This geographic pattern has been quite stable over time, suggesting that the determinants of gun prevalence have more to do with tradition, culture and childhood experience than with concern about crime or other relatively volatile matters.[8]

To explore the evolution of interstate patterns over time, FS/S was calculated for all 50 states and District of Columbia for each of three different periods. As shown in Table 5, over a 19-year interval the pattern remained essentially unchanged: the correlation across the states between the earliest period (1979-81) and the most recent (1995-97) is 95%.

What underlies this structure? The answer, to a large extent, is rural tradition (Cook and Ludwig 1996). The percent of the state's population that was rural in 1950 is highly correlated (across states) with household gun ownership over four decades later: the correlation with FS/S is 80%

[8] Cook and Ludwig (1996) found that 80% of adult gun owners had grown up in a household with guns.

(for the years 1994, 1996, and 1998 combined), and is almost as high for the survey-based estimates.[9]

Nonetheless, this geographic structure is not immutable. In fact, there is a pronounced tendency of increasing homogeneity. When the states are sorted by 1987-9 values (to avoid regression to the mean), then 13 of the bottom 15 have increased between 1980 and 1996, while all 15 of the highest have decreased. Measures of dispersion tell the same story: From 1980 to 1996, the interquartile range declined from 45% to 37%, while the interdecile range declined from 50% to 42%.[10]

6. The Validity of FS/S over time

Although the results presented above demonstrate that FS/S is a valid proxy for cross-section variation, it is not necessarily true that it is also valid as a proxy for variation. It is possible, for example, that trends in weapon preferences by suicidal individuals, or in the demographic composition of suicide, create a shifting relationship between gun availability and weapon choice.

To explore the validity of FS/S as a proxy for changes in gun-ownership prevalence over time, we once again use data from the General Social Survey. It has included identical items on gun ownership for 14 of the years between 1980 and 1998. As noted above, the GSS sample is designed to be representative at the level of the Census region. Thus it is possible to estimate gun prevalence for a panel of the nine regions by year with only a few gaps. We construct such a panel for the four measures of gun ownership: Individual gun and handgun ownership, and household gun and handgun ownership.

Table 6 reports the results of regressing each of the four measures against FS/S. All regressions include regional fixed effects, so the coefficient estimates on FS/S reflect only inter-temporal covariance with gun ownership.

FS/S performs well in these trials. The coefficients are in each case more than twice the standard error, and perhaps more impressive, very similar to those estimated from cross-section data on states (reported in Table 4), as seen below:

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[9] The correlation across 48 states between "percent rural in 1950" and household gun prevalence estimated from the HICRC survey is 74%; the correlation across 21 states using the BRFSS data is 79%.

[10] Details available from the authors on request. We have not attempted to explore the reasons for increasing homogeneity. It may reflect increased immigration and inter-state migration.

	Cross-section	Panel Data
Household gun	.97	.91
Individual gun	.73	.81
Household handgun	.78	.74
Individual handgun	.55	.55

We conclude that FS/S is a useful proxy for gun prevalence for inter-temporal variation, at least at the level of the Census region. Over time, as across states, a one percentage point increase in FS/S is associated with a one percentage point increase in household prevalence of gun ownership.

Appendix Table A5 elaborates on this validation test, presenting the results of other regression specifications, and also includes a direct comparison with another proxy, the subscription rate for *Guns & Ammo*.[11] FS/S outperforms the other proxy in every test.

7. Conclusion

Of the readily computed proxies for the prevalence of gun ownership, one, the percentage of suicides committed with a gun, performs consistently better than the others in cross-section comparisons. It is readily computed for states and counties and has a high degree of validity when tested against survey-based estimates.

FS/S also appears valid as a proxy for changes over time in gun prevalence, at least at the regional level.

Our analysis of this proxy measure for the period 1979-1997 demonstrates that the geographic structure of gun ownership has been highly stable. That structure is closely linked to rural tradition. There is, however, some tendency toward homogenization over this period, with high-prevalence states trending down and low-prevalence states trending up.

[11] Duggan (in press) utilizes the *Guns & Ammo* subscription rate as his proxy for gun prevalence. His demonstration of its validity for inter-temporal variation is based primarily on a set of regressions similar to those presented in Table A5, but using state-level data. As he notes, the General Social Surveys do not provide representative samples at the state level. For that reason our replication of Duggan's validity test uses the GSS data for regional estimates only.

We conclude that FS/S provides the best of the readily computed proxies for analyzing the influence of gun prevalence on gun use in criminal violence and suicide.

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TABLES AND FIGURES

Table 1
Alternative Definitions of Gun "Prevalence"
Correlation Coefficients Across 9 Census Regions
GSS estimates from 1994,1996, 1998 combined

	Household Gun	Household Handgun	Individual Gun
Household Handgun	.93	1.00	
Individual Gun	.97	.91	1.00
Individual Handgun	.92	.98	.94

Source: Gun prevalence estimates from NORC General Social Survey, unpublished data

Table 2
Correlation Matrix for Proxy Variables
50 States

Proxy	FS/S	FH/H	Cook	UFDR	G&A
FH/H	0.37				
Cook	0.88	0.78			
UFDR	0.73	0.34	0.67		
G&A	0.44	-0.13	0.23	0.43	
NRA	0.35	-0.14	0.17	0.35	0.90

Source: See text

Table 3
Validity of Proxies for Household Gun Prevalence
Correlation Coefficients

	HICRC N=48 States	BRFSS N=21 States	GSS[a] N=9 Regions
FS/S	0.81	0.90	0.93
FH/H	0.02	0.19	0.52
COOK	0.52	0.77	0.88
UFDR	0.61	0.68	0.85
G&A	0.75	0.67	0.51
NRA	0.67	0.55	-0.06

[a]GSS prevalence estimates are here based on pooled data from 1994,1996, and 1998.

Source: See text

Table 4
Predicting Gun Prevalence from FS/S
Weighted Least Squares Regression Results

Data	Intercept (SE)	Coefficient on FS/S (SE)	R^2/Adj-R^2	SEE	Number of Observations
HICRC Household	-0.145 (0.045)	0.980 (0.078)	.78/.77	0.063	48 States
BRFSS Household	-0.202 (0.060)	1.018 (0.109)	.82/.81	0.060	21 States
GSS[a] Household	-0.172 (0.083)	0.968 (0.142)	.87/.85	0.038	9 Regions
GSS[a] Individual	-0.178 (0.048)	0.730 (0.082)	.92/.91	.021	9 regions
GSS[a] Household (handgun)	-0.229 (0.046)	0.781 (0.079)	.93/.93	0.021	9 regions
GSS[a] Individual (handgun)	-0.180 (0.026)	0.554 (.046)	.96/.95	0.012	9 regions

[a]1996 data only.

Source: See text

Table 5
Stability of Cross-Section Structure of Gun Ownership (FS/S)
Correlation Coefficients
50 states

Period	1995-97	1987-9
1987-9	.0.97	
1979-81	0.94	0.97

Source: State suicide statistics from Vital Statistics Mortality data

Table 6
Inter-Temporal Validity of FS/S relative to measures of gun ownership
GSS Panel data, 1980-1998, for 9 Census regions
Regression coefficients and standard errors

	Individual Ownership Prevalence	Individual Ownership Prevalence (handgun)	Household Ownership Prevalence	Household Ownership Prevalence (handgun)
FS/S coefficient (Standard Error)	.812[a] (.285)	.554[a] (.201)	.905[a] (.355)	.742[a] (.246)

a. Significantly different from zero at the 1% level

Notes: Each cell contains the key coefficient estimate and SE from a different regression. Each regression includes regional dummies; the coefficients are not reported in this table. N = 126, annual observations for the following 14 years: 1980-1982, 1984-1985, 1987-1991, 1993-1994, 1996, and 1998. (The GSS was not fielded or did not include the relevant items during the missing years.)

FS/S = % of suicides in region committed with a gun, from Vital Statistics data

Table A1
Proxies from Vital Statistics Mortality Data
50 States, 1995-97

Proxy	Definition	Minimum # of events*	Maximum # of events
FS/S	Firearm suicides divided by Suicides	109	10,519
FH/H	Firearm homicides divided by Homicides	31	9,209
UFDR	Unintentional injury deaths by firearm	0	333

*Least number of suicides, homicides or unintentional deaths across the 50 states for the indicated period

Table A2
Proxies from Subscription and Membership Data
50 States, 1996

Proxy	Definition	Minimum # of subscriptions*	Maximum # of subscriptions
G&A	Subscriptions to *Guns & Ammo Magazine* per capita	1,388	59,729
NRA	NRA members per capita	6,250	224,753

*Least number of subscriptions across 50 states for 1996

Table A3
Definitions and Characteristics of Survey-Based Estimates of Prevalence of Gun Ownership

Survey	Definition and Source	Jurisdictions	# obs. Smallest	# obs. Largest
HICRC*	HICRC RDD Survey 1996 & 1999 combined	48 states	7	517
BRFSS**	1990s	21 states		
GSS***	1996	9 Census regions	101	353
GSS***	1994,1996,1998 combined	9 Census regions	288	1087

* Data come from a national random-digit-dial (RDD) telephone survey, conducted by Fact Finders, Inc., a social science survey firm, in 1996 (n=1900) and again in 1999 (n=2500). The sample is representative of United States households with telephones. (These surveys are described in detail in Hemenway, Azrael, Miller 2000.) Alaska and Hawaii not included in the 1996 survey so are excluded from analysis.

** Data were obtained from 1991 through 1995 surveys of the Behavioral Risk Factor Surveillance System (BRFSS). Details have been published elsewhere (Siegal et al. 1993; Frazier et al. 1992). Briefly, state health departments conduct monthly telephone surveys of randomly selected persons 18 years old and older. Over the 5-year study period, 22 states asked about household firearms (Table 1]. The median sample size was 2061, the median response rate was 66.9%, the median proportion of homes with telephones was 95.6%, and the median refusal rate for the firearm section was 2.0%. For states that asked firearm questions in more than 1 year, the most recent data were used.

***The General Social Survey (GSS) is fielded on a regular basis by the University of Chicago's National Opinion Research Center. The GSS utilizes personal interviews with an area probability sample. It has included items on household gun ownership since 1972, and on individual ownership since 1980. The most recent firearms data available from the GSS are for the even-numbered years of the 1990s. The GSS sample is structured so as to be representative of the populations of each of the 9 census regions, but not necessarily of individual states (Davis and Smith 1998).

Table A4
Firearms Prevalence by State
Estimated from HICRC and from FS/S

Rank	State	Est. Prevalence From FS/S	Est. Prevalence HICRC (N)	Difference (4) - (3)
(1)	(2)	(3)	(4)	(5)
1	Hawaii	11.59		
2	Massachusetts	13.08	16.16 99	3.08
3	New Jersey	15.44	16.26 123	0.82
4	D.C.	20.13		
5	New York	20.19	22.48 298	2.30
6	Rhode Island	22.36	18.75 16	-3.61
7	Connecticut	25.48	16.67 48	-8.81
8	Illinois	29.39	24.86 181	-4.53
9	Delaware	30.74	28.57 14	-2.17
10	California	33.26	33.66 517	0.39
11	Maryland	34.97	38.27 81	3.31
12	Minnesota	35.42	38.75 80	3.33
13	Wisconsin	35.78	48.45 97	12.67
14	Colorado	37.70	50.00 62	12.30
15	Pennsylvania	37.90	47.03 219	9.13
16	Iowa	38.49	50.91 55	12.42
17	Michigan	38.96	44.31 167	5.35
18	Ohio	38.97	33.15 184	-5.82
19	New Hampshire	39.30	35.71 28	-3.59
20	Utah	39.61	51.43	11.82

			35	
21	Washington	40.35	47.50	7.15
			80	
22	Florida	40.51	33.91	-6.59
			230	
23	Nebraska	40.85	51.72	10.87
			29	
24	Maine	42.12	48.00	5.88
			25	
25	South Dakota	42.30	66.67	24.37
			21	
26	Kansas	42.88	42.55	-0.33
			47	
27	New Mexico	42.92	46.88	3.96
			32	
28	North Dakota	43.80	50.00	6.20
			14	
29	Oregon	43.92	57.69	13.77
			52	
30	Vermont	44.40	71.43	27.03
			7	
31	Indiana	45.11	52.78	7.67
			108	
32	Missouri	45.30	50.60	5.30
			83	
33	Texas	46.26	49.32	3.06
			294	
34	Oklahoma	47.64	55.36	7.72
			56	
35	Virginia	47.92	41.38	-6.54
			116	
36	Nevada	47.97	42.86	-5.12
			21	
37	Arizona	48.30	46.27	-2.03
			67	
38	Montana	48.83	76.47	27.64
			17	
39	North Carolina	50.61	50.36	-0.25
			139	
40	Idaho	50.87	76.47	25.60
			17	
41	Alaska	50.91		
42	South Carolina	51.00	47.46	-3.54
			59	
43	Tennessee	52.35	53.26	0.91
			92	

44	Arkansas	52.51	60.00 45	7.49
45	Kentucky	53.20	52.24 67	-0.96
46	Georgia	53.65	54.62 119	0.97
47	West Virginia	54.64	65.63 32	10.98
48	Wyoming	54.78	87.50 8	32.72
49	Louisiana	55.04	61.04 77	6.00
50	Alabama	57.51	57.69 78	0.19
51	Mississippi	60.25	61.54 52	1.29

Table A5
Validity of two proxies relative to four measures of gun ownership
Panel data, 1980-1998, for 9 Census regions
Regression coefficients and standard errors
Log-log specification

Which proxy? (Year dummies?)	ln(%G)	ln(%HG)	ln(%G,hh)	ln(%GH,hh)
ln FS/S (Yes)	2.352[a] (.849)	3.130[a] (1.102)	1.608[a] (.569)	2.385[a] (.821)
ln G&A (Yes)	.200[c] (.118)	.301[c] (.154)	.100 (.080)	.201[c] (.115)
ln FS/S (No)	2.154[a] (.687)	3.264[a] (.891)	1.276[a] (.479)	2.386[a] (.665)
ln G&A (No)	.139 (.109)	.310[b] (.141)	.026 (.075)	.197[c] (.106)

a. Significantly different from zero at the 1% level
b. Significantly different from zero at the 5% level
c. Significantly different from zero at the 10% level

Notes: Each cell contains the key coefficient estimate and SE from a different regression. Each regression includes regional dummies; the coefficients are not reported in this table. N = 126, annual observations for the following 14 years: 1980-1982, 1984-1985, 1987-1991, 1993-1994, 1996, and 1998. (The GSS was not fielded during the missing years.) The four measures of gun ownership are the dependent variables in the regressions.
The two proxies for gun ownership are:

- FS/S = % of suicides in region committed with a gun, from Vital Statistics
- G&A= Subscriptions to *Guns&Ammo* per 1000 residents of region from the Audit Bureau of Circulations

Figure 1
Survey-based state-level household gun ownership vs. FS/S

Figure 2
GSS Region-level Firearm Ownership

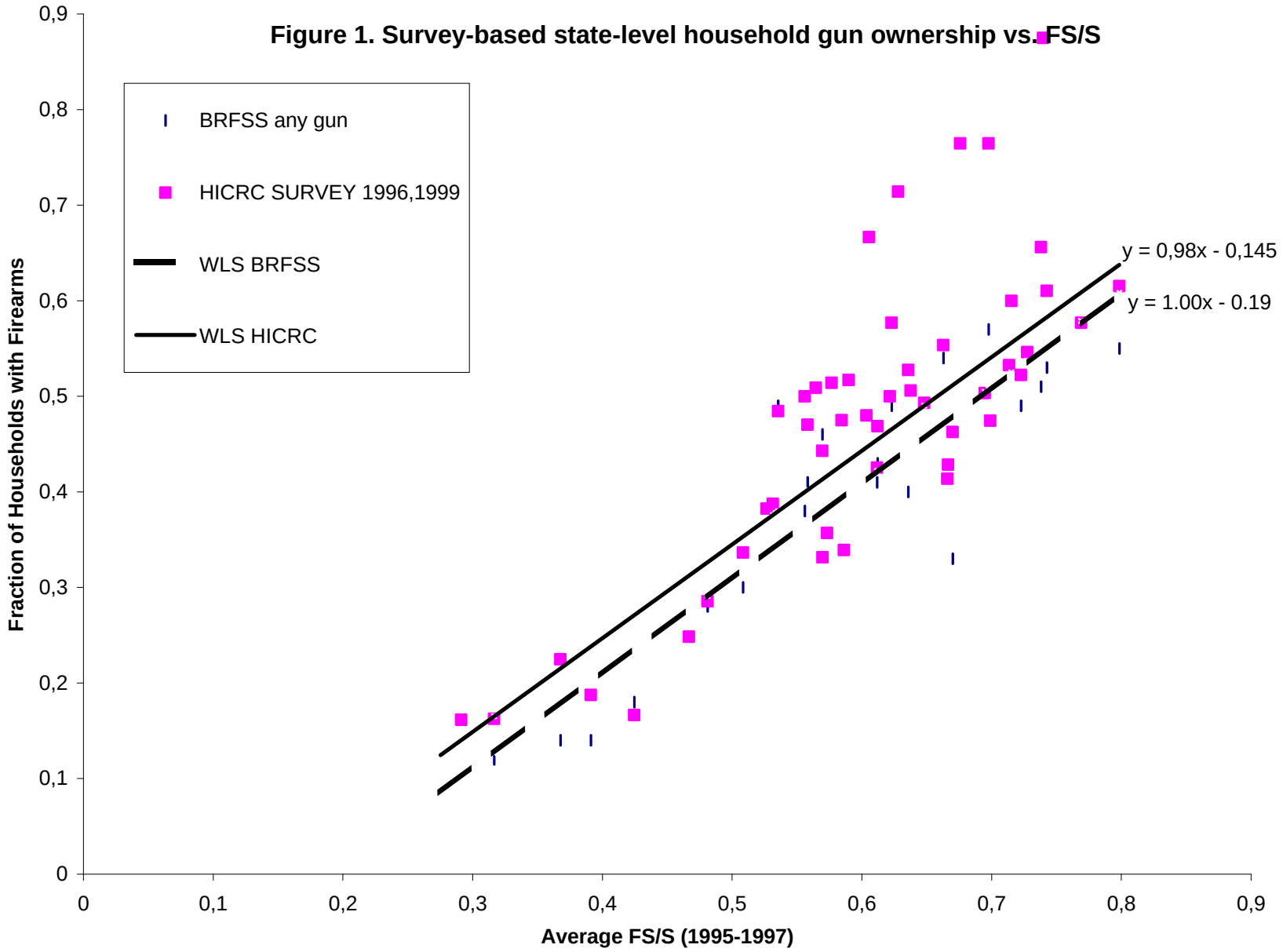
Figure 1. Survey-based state-level household gun ownership vs. FS/S
BRFSS any gun
HICRC SURVEY 1996,1999
WLS BRFSS
WLS HICRC
y = 0,98x - 0,145
y = 1.00x - 0.19
Fraction of Households with Firearms
Average FS/S (1995-1997)
0
0,1
0,2
0,3
0,4
0,5
0,6
0,7
0,8
0,9

Figure 2. GSS Region-level Firearm Ownership