



The effect of perceived risk and victimization on plans to purchase a gun for self-protection

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ABSTRACT

Purposes: To determine if perceived risk of criminal victimization, and past criminal victimization experiences, increases the likelihood of a person owning a gun for self-protection, and to determine if defects in past research concerning the way gun ownership was measured had obscured such effects.

Methods: We analyzed data on over 2,500 U.S. adults, using different ways of measuring gun ownership, and also analyzed future plans (among persons who did not own a gun at the time of the survey) to acquire a gun for self-protection. The latter procedure avoids the causal order problem attributable to the possibility that acquiring a gun might affect victimization risks and perceived risks, as well as the reverse.

Results: The estimated effect of perceived risk and prior victimization changed from being nonsignificant when household gun ownership was the dependent variable (as in most prior research) to being increasingly strong, and statistically significant, when gun ownership of the individual respondent for defensive reasons was measured. Further, once the causal order issue was side-stepped, risk and victimization showed even stronger, significant positive effects on planning to get a gun.

Conclusions: Crime affects gun ownership, in addition to any effects that gun ownership may have on crime.

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Introduction

In both absolute and per capita terms, the United States is by far the most heavily armed country in the world. By the end of 2008, there were probably over 300 million guns in private hands (Kleck, 1997, pp. 96–99; Shooting Industry, 2010 and previous years). Results from a recent national survey indicates that 42 percent (± 4 percent) of Americans have a gun in their home, and that 29% of U.S. adults personally own a gun (Gallup, 2009). These facts have led some scholars to assert that America's high level of civilian firepower is an important factor contributing to the nation's high level of violence (Newton & Zimring, 1969; Sloan & Rivara, 1990; Wintemute, 2008). Others have concluded that, although aggressor's possession and use of guns has many effects on the outcome of violent encounters, the net impact of widespread gun possession, among both prospective victims and aggressors, is probably a statistical wash (Kleck, 1997; Wright, Rossi, & Daly, 1983).

Why do millions of Americans bring deadly weapons into their homes? While national surveys of Americans have consistently shown that most gun owners and long-gun owners in particular, own them primarily for hunting or target shooting, the surveys also reveal that a large subset of gun owners, and most handgun owners, own them

primarily for self-protection (see Kleck, 1997, Ch. 3). In a 1994 national survey, for example, 46 percent of all gun owners reported that the primary reason they owned guns was for self-protection (the National Survey of the Private Ownership of Firearms (NSPOF) - Cook & Ludwig, 1996, p. 38). Further, among persons who owned only handguns, 74 percent reported that protection was their primary reason for owning the gun, with target/sport shooting a distant second (10.8 percent). While those who own only long guns own them primarily for target/sport shooting, even among this subset of owners, 15 percent owned them primarily for protection (Cook & Ludwig, 1996, p. 39). The finding in the NSPOF survey that self-protection is the primary motivator of most handgun ownership is largely consistent with results from other national surveys, and is noteworthy because it is primarily this subcategory of guns that have been the target of the strongest control efforts (Kleck, 1997). This is probably because of the greater involvement of such guns in violent crime, and the fact that gun types within this category (e.g., Saturday Night Specials, assault weapons) are more politically susceptible to government regulation as they are owned by smaller numbers of voters (Cook, 1991; Kleck, 1997).

Understanding the factors that lead people to obtain guns for self-protection is important for both theoretical and policy reasons. Theoretically, the identification of significant individual and contextual determinants will provide for a better understanding of the nature of protective gun ownership. It can also help clarify why high rates of crime and high levels of gun ownership are often found in the

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same places and times. Practically, knowledge of these factors should prove useful to policymakers who consider gun control an effective strategy for preventing violence since these factors will ultimately play an important role in the willingness of defensive gun owners to remove guns from their homes or induce prospective owners to forego acquiring them in the first place (Kleck & Kovandzic, 2009).

The most widely cited theoretical explanation for why people acquire firearms for self-protection, and the focus of the present study, derives from the “fear of crime” or “perceived risk” (hereafter referred to as fear/risk), and “victimization” traditions (Cao, Cullen, & Link, 1997; Dejong, 1997; Kleck, 1997; Williams & McGrath, 1976). This perspective views defensive gun ownership as an individualistic psychological coping mechanism for dealing with the “threat - actual, perceived, or emotional - posed by crime” (Cao et al., 1997; Reid et al., 1998). Thus, fear or perceived risk of criminal victimization could motivate gun acquisition.

Studies assessing the effect of fear/risk and criminal victimization on gun ownership have obtained wildly varying results. The inconsistency of these results may reflect either of two major methodological problems. The first and more easily corrected flaw is the failure to measure the theoretically relevant dependent variable. Fear/risk is not hypothesized to affect all types of gun ownership - no one argues it is a major factor driving acquisition of rifles and shotguns. Rather, fear/risk is hypothesized to affect handgun acquisition. Even more specifically, it is hypothesized to increase the likelihood of handgun ownership for protective or defensive reasons. Since about two thirds of the guns owned by Americans are long guns (rifles and shotguns) (Kleck, 1997), most of the variation in gun ownership across households and individuals is probably due to variation in long gun ownership. Studies that defined the dependent variable as ownership of *any* type of gun were therefore primarily analyzing variation in the ownership of types of guns that are largely irrelevant to the fear/guns hypothesis. Null results concerning fear, risk, or victimization variables are therefore not surprising, but also may say little about whether these factors actually influence ownership of defensive weaponry.

Further, many of the studies failing to find a link between gun ownership and fear/risk or criminal victimization did not establish whether respondents (Rs) personally owned guns. Instead, they were based on surveys that determined only whether *someone* in the R's household owned a gun, and researchers were forced to effectively assume that the respondent owned a gun, even in cases where it might actually have been other household members who owned the guns. On the other hand, fear of crime and prior victimization was measured with regard to the individual Rs interviewed. Thus, gun ownership as measured in studies that only determined household gun ownership did not necessarily pertain to the same persons for whom fear/risk was measured - in many cases, gun ownership pertained to the “wrong” person. This flaw could be conceptualized as a form of random measurement error. Random measurement error in the dependent variable will increase the standard errors of coefficients of the explanatory variables, and thereby artificially favor the null hypothesis. Unless corrective measures are taken, the analyst may commit a Type II error when testing whether fear/risk or victimization has an impact on protective gun ownership - i.e., wrongly conclude there is no effect of these variables.

Second, all of the prior studies suffer from potential endogeneity bias due to reverse causality in the fear/risk, victimization, and gun ownership relationships. Fear/risk might motivate gun acquisition, but once a gun is acquired it can reduce fear or perceived risk of crime victimization. Indeed, that is probably one of the main benefits that the typical defensive gun buyer hopes to gain from gun acquisition. Thus, a person who started out more fearful than average might consequently be motivated to acquire a defensive gun, which reduces his fear level back down to an average level (Wright et al., 1983, pp. 128–129). A one-shot survey would miss the motivational effect of

fear on gun acquisition because it was cancelled out by the fear-reducing effect of gun ownership. Similarly, victimization might stimulate an individual to acquire a gun for self-protection, but gun acquisition might help the gun owner avoid victimization. From a statistical standpoint, if the endogeneity problem is not successfully addressed, what is asserted to be the impact of fear/risk and victimization on protective gun ownership will in fact also include the impact of protective gun ownership on fear/risk and victimization. OLS estimates of the former will suffer from “endogeneity bias” because the regressors (fear/risk and victimization) are themselves endogenous in a system of simultaneous equations, making them correlated with the error term in the structural gun ownership equation.

This study addresses the question of whether there is an effect of perceived crime risk and prior victimization on protective gun ownership, using data from the 1994 National Study of Private Ownership of Firearms in the United States (NSPOF) (Cook & Ludwig, 1996). We take advantage of an item in the NSPOF questionnaire that allows us to avoid endogeneity bias by eliminating reverse causality as a source of endogeneity. Instead of estimating the relationship between the risk-related variables and *current* gun ownership, which could influence those variables, we assess their relationships to an individual's *plans* to acquire a firearm for self-defense in the next 12 months, among those who do not already own a gun. This sidesteps the two-way causation problem because merely planning to get a gun in future cannot influence one's current fear or perceptions of victimization risk. In effect, we are simulating the situation that prevailed among gun owners before they became gun owners, and thus before their gun ownership could have affected their fear, perceptions of risk, or victimization.

Further, since this item pertains to the individual respondent, we also reduce measurement error in the dependent variable by testing links between the *individual's* plans to acquire a gun and the *individual's* personal attributes such as perceived risk and prior victimization.

Section 2 reviews the prior literature on fear/risk and victimization on protective gun ownership, and discusses in detail the survey procedures used in the NSPOF to alleviate the endogeneity problems. Section 3 discusses the data and the analytic strategy used in this study. The results are presented in Section 4, and Section 5 concludes.

Prior research

Effects of personal victimization

Numerous studies have assessed the relationship between gun ownership and criminal victimization, with very mixed results. Lizotte and Bordua (1980) (see also Lizotte et al., 1981), Marciniak and Loftin (1991), and Whitehead and Langworthy (1989) found significant positive associations between gun ownership and criminal victimization, while Cao, Cullen, and Link (1997), Defronzo (1979), Glaeser and Glendon (1998), Jobu and Curry (2001), and Williams and McGrath (1976) did not. Wright and Marston (1975) found an association for some measures of criminal victimization but not others. Importantly, however, none of these studies did anything to resolve the issue of causal order. As discussed above, criminal victimization might motivate gun acquisition, but gun acquisition might help the gun owner avoid victimization.

Effects of fear of crime, perceived risks, and crime rates

Some scholars in this field have treated fear of crime and perceived risk as largely interchangeable concepts. Ferraro and LaGrange (1987) and Ferraro (1995), however, have noted that although fear of crime and perceived risk are conceptually related, they are nevertheless distinct, both conceptually and empirically. Ferraro (1995, p. 23)

argued that fear of crime is best conceptualized as “an emotional response of dread or anxiety to crime or symbols that a person associates with crime” while perceived risk is best understood as

capturing an individual’s cognitive assessment of the risk of victimization (see also DuBow et al., 1979, p. 3). Some individuals might not be afraid of becoming exposed to violence even though they

Table 1
Summary of Studies of the Impact of Perceived Risk, Fear, and Victimization on Gun Ownership

Study; Location; Sample Size	Survey Producer & Year of Interviews	Gun Ownership Measure ^a	Did Study Distinguish Protective from Sport Reasons?	Crime Rates	Perceived Risk	Fear	Results for Perceived Risk/Fear of Crime on Measure of Gun Ownership
Williams & McGrath, 1976; U.S.; n = 1,504	NORC, 1973	H_HGLG H_HG	No	None	None	GSS_FEAR ^b	Fear: H_HGLG, (–, **) Fear: H_HG(+, **)
Defronzo, 1979; Males; U.S.; n = 1,818	NORC, 1973–74, 76–77	H_HG	No	None	None	GSS_FEAR ^b	Fear: H_HG, (+, n.s.)
Stinchcombe et al., 1980; U.S. n = NA	NORC, 1973–74, 76–77	H_HGLG	No	None	None	GSS_FEAR ^b	Fear: H_HGLG, (–, NA, Males; +, NA, Females) ???
Lizotte & Bordua, 1980; Illinois; n = 764	Survey Research Laboratory at U. of IL, 1977	R_HGLG	Yes	3 violent offenses	Perceived crime rate in county relative to other counties	3-item index	Fear: R_HGLG, (+, **) ^c Perceived Risk: R_HGLG, (+, NA, indirect effect through fear of crime) Objective Risk: R_HGLG, (+, NA, indirect through perceived risk and fear of crime)
McClain, 1983; Detroit, MI; n = 1,939	Study author, 1980	H_HGLG	No	None	None	Are you afraid to walk alone at night in your neighborhood?	Fear: H_HGLG, (+, ***, whites residing in low or high risk white areas; –, n.s., whites residing in low risk black areas) Fear: H_HGLG, (+, n.s., blacks residing in high or low risk black areas)
Hill, Howell, & Driver, 1985; U.S. n = 1,358	NORC, 1980	R_HG_NH	No	None	None	GSS_FEAR ^b	Fear: R_HG_NH, (+, * 1-tail, Males; +, n.s., Females)
Young, 1985; Detroit; n = 229 White Males	Detroit Area Study, University of Michigan, 1979	H_HGLG	Yes	None	Neighborhood crime compared to nearby areas	4-item index, mixes risk & worry	Fear: H_HGLG, (+, n.s.) ^d Perceived Risk: H_HGLG, (+, n.s.)
Young, McDowall, & Loftin, 1987; Detroit, MI; n = 219 White Males	Detroit Area Study, University of Michigan, 1979	H_HGLG	Yes	None	Neighborhood crime compared to nearby areas	4-item index, mixes risk & worry	Fear: H_HGLG, (+, n.s.) Perceived Risk: H_HGLG, (+, n.s.)
Smith & Uchida, 1988; Rochester, NY, Tampa-St. Petersburg, FL, St. Louis, MO; n = 9,021	Police Services Study, 1977	H_WEAP	Yes	Neighborhood victimization rate	% who believe crime is increasing in their neighborhood, % with high perceived crime risk for burglary or robbery	None	Perceived Crime Trend: H_WEAP, (+, ***) Perceived Risk: H_WEAP, (+, ***) ^e Objective Risk: H_WEAP, (+, NA, indirect effect through victimization and perceived risk)
Whitehead & Langworthy, 1989; U.S.; n = 2,464	Chilton Research Services, 1982	H_HGLG	No	None	Trend in neighborhood crime	6-item index	Fear: H_HGLG, (+, n.s., Total Sample, Females, Southerners, and Non-Southerners; –, n.s., Males) Perceived Risk: H_HGLG, (+, n.s., Total Sample, Males, Females, Southerners, and Non-Southerners)
Marciniak & Loftin, 1991; U.S.; NA	GSS, 1980, 82, 84, 85, 87	R_HG_NH, R_HG_H	No	None	None	GSS_FEAR ^b	R_HG_NH, (+, n.s.) ⁱ R_HG_H, (–, n.s.) ⁱ R_HG_NH & R_HG_H, (+, n.s.) ⁱ
Sheley et al., 1994; U.S.; n = 17,184	NORC, 1973–91	R_HGLG, R_HGH	No	None	None	GSS_FEAR ^b	Fear: R_HGLG, (–, **) ^g Fear: R_HGH, (–, n.s.)
Cao et al., 1997; 21+; Cincinnati, OH; n = 539	Study Authors, 1992	R_HGLG	Yes	None	Trend in neighborhood crime, Risk of Victimization in next 12 months, Neighborhood Crime Compared to Others in City	How many times have you felt afraid of crime in the last month?	Fear: R_HGLG, (+, n.s.) Perceived Risk: R_HGLG, (+, n.s.) Crime Trend: R_HGLG, (–, n.s.) Relative Crime: R_HGLG, (+, **)
Dejong, 1997; Rochester, NY, Tampa-St. Pete., FL, St. Louis, MO; n = 2,332 Single Adult Households	Police Services Study, 1977	R_WEAP	Yes	None	% who believe crime is increasing in their neighborhood, % with high perceived risk for burglary or robbery	None	Perceived Crime Trend: R_WEAP, (–, n.s., Males; +, n.s., Females) Perceived Risk: R_WEAP, (NA, n.s., Males & Females) ^f
Glaeser & Glendon, 1998; U.S.; n = 6,000–19,000	NORC, 1972–94	H_HGLG H_HG	No	None	None	GSS_FEAR ^b	Fear: H_HGLG, (+, n.s.) Fear: H_HG, (+, ***)
Kilburn & Shrum, 1998; Baton Rouge (Midtown Neighborhood), LA; n = 137	Study Authors, NA (face-to-face)	R_PROT	No	None	None	GSS_FEAR ^b	Fear: R_PROT, (–, n.s.)
Jiobu & Curry, 2001; 18+; U.S.; n = 6,576	NORC, 1982–96	R_HGLG	No	None	None	GSS_FEAR ^b	Fear: R_HGLG, (–, n.s.)

judge their risk of victimization to be fairly high, while others may be very fearful even though they perceive their future probability of victimization to be fairly low. Some scholars have combined survey items measuring perceived risk with fear of crime and avoidance measures (e.g., Young, 1985) to form what the authors treated as a fear-of-crime index. Others have included official crime rates as predictors in their models of gun ownership, using path analysis procedures to assess how the actual prevalence of crime might directly or indirectly (via perceived risk or fear of crime) influence a person's decision to own a firearm (Lizotte & Bordua, 1980).

Table 1 summarizes the results of studies examining the impact of fear of crime or perceived or official risk on gun or weapon ownership. Studies that did not report the results of multivariate analyses involving fear of crime or perceived risk (e.g., Wright & Marston, 1975; Cook & Ludwig, 1996) were excluded. Only one of the eighteen studies attempted to address the simultaneity problem between fear/perceived risk and gun ownership. DeFronzo, 1979) estimated simultaneous equation models of gun ownership and fear using combined sample data on males from the 1973, 1974, 1976, and 1997 GSS surveys conducted by the National Opinion Research Center. The results indicated that fear of crime was positively associated with increases in handgun ownership, but the estimate was not significantly different from zero. On the other hand, handgun ownership was found to have a significant negative association with fear of crime. To achieve identification, DeFronzo excluded age (p. 336) from the gun ownership equation and religion from the fear of crime equation. He argued that prior research had demonstrated that age was an important correlate of fear but that “there was no reason to expect that age has an independent effect of handgun ownership” (p. 336). Based on this reasoning, DeFronzo argued that age was a valid instrument (i.e. uncorrelated with the error term in the handgun ownership equation) and thus could be properly excluded from the handgun ownership equation. Contrary to DeFronzo's unsubstantiated claim that age is not a determinant of gun ownership, the weight of the evidence suggests gun ownership is more prevalent among middle-aged and older adults (Glaeser & Glendon, 1998; Jioubu & Curry, 2001; Lizotte, Bordua, & White, 1981; Kleck, 1997; Miller & Hemenway, 2007). On this ground, DeFronzo's instrumental variable estimate of the effect of fear of crime on handgun ownership was likely to be biased and inconsistent since age could not be properly excluded from the handgun equation, and thus was not a valid instrument.

Only six of the studies distinguished protective gun or weapon ownership from hunting/recreational ownership. Most of these studies found the expected positive relationship between fear/risk and protective gun ownership, but many of the coefficient estimates were nonsignificant. Significant positive associations were found by

Lizotte and his colleagues (1980, 1981), Smith and Uchida (1988), and Cao et al. (1997). The studies by Lizotte and colleagues were exemplary in many ways. In addition to using a more theoretically relevant measure of gun ownership, the authors distinguished between firearms owned by the respondent and remaining members of the household, used a more reliable measure of fear of crime by using a three-item index, and used path analysis procedures to explore the possibility that the effects of risk might operate indirectly on protective gun ownership by elevating levels of fear. Although limited to a sample of Illinois residents, the authors found that fear of crime was significantly directly associated with defensive gun ownership but that crime rates and perceived risk were not directly related. The path analysis, however, also showed that crime rates were significantly and positively related to perceived risk, which in turn was significantly and positively related to fear of crime, which in turn was significantly and positively related to defensive gun ownership.

Smith and Uchida (1988), using a three-city sample (Rochester, St. Louis, and St. Petersburg), reported that defensive household weapons ownership was positively associated with both measures of perceived crime risk. Moreover, the authors found that the effect of perceived risk on protective ownership was largely contingent on household income: households in which respondents reported a greater chance of being victimized in the future were more likely to own a defensive weapon, an effect which strengthened as household income increased. Further analyses also revealed an indirect impact of neighborhood crime on protective weapons ownership through past household victimization and perceived risk. Lastly, in their mail survey study of adult residents in Cincinnati Ohio, Cao et al. (1997) reported that gun ownership for protection significantly increased when people perceived crime in their neighborhood to be higher than in other parts of the city, but was unrelated to whether they believed crime in their own neighborhood was increasing. They also found that respondents who expressed a high risk of future victimization and who were more fearful of crime were more likely to own guns for defensive purposes, although none of the coefficients were significant.

Findings were substantially less likely to show effects of crime-related variable among the twelve studies that did not distinguish protective gun ownership from sport ownership. Most reported no significant positive association between fear, risk, and gun ownership in their full samples or for overall gun ownership (i.e. handgun and long gun combined). Nevertheless, even some of these studies found significant positive associations for some subsamples or gun types: Hill, Howell, and Driver (1985, for males but not for females), Young (1986, for people raised in the non-South, not for people raised in the South), McClain (1983, for whites in low or high risk white areas but not for blacks residing in high or low black areas). Pointing to the

Notes to Table 1

*P<.10, **P<.05, ***P<.01.

a. Measures of gun ownership: H_HGLG, Household gun ownership, handgun or long gun; H_HG, Household gun ownership, handgun only; R_HGLG, Respondent gun ownership, handgun or long gun; R_HG, Respondent gun ownership, handgun only; R_HGLG_NH, Respondent gun ownership, handgun or long gun, nonhunter only; R_HG_NH, Respondent gun ownership, handgun only, nonhunter only; R_HG_H, Respondent gun ownership, handgun only, hunter only; R_HGH, Respondent gun ownership, handgun or long gun, handgun in household.

b. The GSS item measuring fear of crime is as follows: Is there any area right around here—that is, within a mile—where you would be afraid to walk alone at night?

c. Lizotte and Bordua (1980) subsequently discovered a programming error which affected the published results in the paper. Corrected findings are reported here and were published in a corrigendum (Lizotte, Bordua, and White, 1981). The three fear of crime items include the GSS item, whether the R was afraid to be at home at night, and the importance of crime to the R.

d. Young also tested for the existence of an interaction between racial prejudice and perceived neighborhood crime on defensive gun ownership. The results indicated perceived crime was positively associated with protective gun ownership for highly prejudiced white males, although the coefficient was not significantly different from zero.

e. Smith and Uchida reported the existence of an interaction between perceived risk and household income. For households in which R's reported a high risk of future victimization, defensive weapons ownership increased with higher household income.

f. Similar to Smith and Uchida, Dejong tested for and found an interaction between perceived risk and income, although in this case the interaction was only significant for males.

g. Sheley et al. tested for interactions between gender and fear of crime on both measures of respondent gun ownership. The results indicated fear of crime was negatively related with respondent gun ownership (R personally owns a handgun or long gun) for males but not for females. The interaction was not significant in the other respondent gun ownership model (i.e. R personally owns a handgun or long gun and there is a handgun in the household).

h. The GSS item measuring perceive risk is as follows: How about at home at night—do you feel safe and secure, or not?

i. These results pertain to those reported by the study authors in Table 2. For each handgun owner group (i.e. hunters and nonhunters), the comparison group are respondents who do not own handguns.

possibility that crime-related factors did affect defensive gun ownership, both and Williams and McGrath (1976) and Glaeser and Glendon (1998) found fear to be significantly and positively related to handgun ownership but not to gun ownership in general.

Two studies even reported significant negative associations between fear and gun ownership (Sheley, Brody, Wright, & Williams, 1994; Williams & McGrath, 1976). While Williams and McGrath (1976) reported a significant positive association between fear of crime and handgun ownership, the sign on the fear of crime variable was negative and significant when the authors included long gun owners in their gun ownership measure. This finding highlights the importance of excluding sport owners from statistical models attempting to explain why civilians own firearms for self-defense. Lastly, Sheley et al. (1994) also reported the existence of a negative relationship between fear and gun ownership but found that this relationship prevailed among males, but not females. One plausible explanation would be that gun ownership reduces fear, but the effect is large enough to outweigh the motivating effect of fear on gun ownership only for males. For females, the positive motivating effect of fear on gun ownership may be so strong that it cannot be outweighed by any fear-reducing effects gun possession may have.

The summary of prior research reviewed in Table 1 indicates that most of the eighteen studies have found no impact of fear/risk on gun ownership, but that all of this research was compromised by the failure to adequately address potential simultaneity between fear/risk and gun ownership. Fear/risk may initially motivate gun acquisition, but once a gun is acquired it can have a reassuring, fear/risk-reducing effect. Regardless of whether one considers the belief rooted in actual defensive effectiveness of guns, national surveys have repeatedly documented that defensive gun owners believe their guns make them feel safer (Kleck, 1997, pp.165–167). Most recently, an October 2006 Gallup poll asked: “Do you think having a gun in the house makes it a safer place to be?” Among Rs in gun owning households, 76 percent agreed with the sentiment that a gun in the home “makes it a safer place to be,” while only 17 percent felt it made the home a more dangerous place (Gallup, 2006). In sum, the null associations that some scholars have found may be consistent with the hypothesis that fear does motivate defensive gun acquisition, but that the reassuring effects of having a gun cancels out any initial differences in fear between owners and nonowners (Wright et al., 1983, pp.128–129).

The standard solution to the reverse causality problem is to estimate the defensive gun ownership equation using the method of instrumental variables (IV). As is well-known, however, the primary challenge in using IV methods is the difficulty of finding suitable instruments. In the present context, this would require identifying variables that are strongly correlated with perceived risk and criminal victimization (i.e., they possess “instrument relevance”), but that are exogenous with respect to protective gun ownership and that a priori reasoning and evidence suggest can be excluded from the defensive gun ownership equation (they possess “instrument validity”).

The present study instead uses a novel procedure that takes advantage of a question included in the NSPOF survey and that allows us to sidestep the potential reverse causality problems of previous studies. We relate current measures of perceived risk and prior victimization among nongun owners (i.e. people who currently have no guns in their household) to their *plans* to get a firearm for self-protection against crime in the near future. Since merely planning to get a gun for protection against crime cannot affect whether a nongun owner was recently victimized, and is unlikely to influence their current perceptions of victimization risk, it can be presumed that reverse causality is no longer a source of endogeneity bias.

The other serious methodological problem discussed earlier is error in measurement of the dependent variable, gun ownership. As seen in Table 1 (column 5), most of the previous studies asked only about household gun ownership, making it impossible to know if the firearm actually belonged to the respondent (R) whose fear of crime

was being assessed, or to another member of the household. The designers of the NSPOF survey avoided this measurement problem by asking about prospective gun ownership of the respondent, not just the household.

Data and methods

Sample

Data for the present study were drawn from the National Survey of Private Ownership of Firearms (NSPOF) (Cook & Ludwig, 1996). The NSPOF, which was sponsored by the National Institute of Justice, was a national telephone survey devoted to the subject of private ownership and use of firearms by adults.¹ The researchers interviewed a large, nationally representative sample of noninstitutionalized adults (fluent in English or Spanish) using a list-assisted random-digit dial sampling method. The use of a nationally representative survey sample increases generalizability over previous non-GSS studies of a single state or city, or of a few metropolitan areas. To account for differences in the probability of selection in the NSOPF, the data were weighted using a person weighting variable (called “rweight9” in the NSOPF dataset). A full description of the data and methods can be found in Cook and Ludwig (1996).

Plans to purchase a gun for self-protection

Each interview began with a few basic questions about the Rs’ perceptions of crime in their neighborhood and about gun control. Following these questions, the questions on gun ownership were phrased as follows: “Do you or any members of your household 18 years of age or older currently have any firearms in your home, car, or elsewhere around your home? Do not include airguns, toys, models, or starter pistols.” This was the question used to measure household gun ownership.

Those who replied “no” were then asked, “Are you *planning* to get a firearm for protection against crime anytime in the next 12 months?” Of the 2,516 (weighted) Rs who provided a valid (“yes” or “no”) response to the household gun ownership question, 1,550 (61.6%) reported no guns in the household. Of these 1,550 Rs, 108 (7.1%) reported they were planning to get a gun for protection in the next 12 months and 1,404 (90.6%) said they did not. Thirty eight Rs (2.5%) indicated they “did not know” if a self-protective gun was in their near-term plans, or refused to answer the question. These respondents were coded as missing and dropped from the analysis. Another 397 respondents were dropped from the analysis because of incomplete information on one or more key control variables. The resulting study sample consisted of 1,115 nongunowning Rs, of whom 91 (8.2%) reporting plans to purchase a gun for self-defense (coded 1) and 1,024 (91.8%) of whom reported no such plans (coded 0).

Those who reported that there were guns in their household were asked: “Does the gun [do any of these guns] belong to you personally?” Those who responded “yes” were coded 1 on personal gun ownership, those who responded “no” or who had reported no household guns were coded 0. Finally, those who had reported personally owning a gun were asked: “What is the most important reason why you own a handgun [long gun]?” Those who responded that self-defense or protection was their most important reason for owning either a handgun or a long gun were coded 1 as personal self-protection gun owners, and other Rs were coded 0.

Perceived risk of crime

The NSPOF measured the R’s cognitive assessment of *perceived* risk, as opposed to their *affective* states of fear. Specifically, there are two items in the NSOPF measuring R’s perception of perceived risk (RISK): “How safe would you feel being outside alone at night in your

neighborhood, that is, within a mile of your home?” and “How safe would you feel being home alone?” Responses were measured on a 4-point ordinal scale ranging from “very safe” to “very unsafe,” higher values reflecting higher levels of perceived risk. Respondents who stated they did not go out at night were coded as missing since it was not possible to determine clearly if risk/fear, as opposed to other reasons (e.g., too ill/old, nowhere to go, family responsibilities), was the most significant factor that prevented them from going out after dark. Responses to the two perceived risk items were standardized and the average of two scores was computed to produce a perceived risk scale (Cronbach's alpha = .68).

Control variables

In order to mitigate omitted variable bias, an attempt was made to statistically control for those social and demographic variables that previous research has identified as being significant correlates of individual-level gun ownership (see Kleck, 1997, Ch. 3 for a review of the empirical literature). The control variables included in the logistic regression model are listed in Table 2, which displays each variable's name, a brief description, its mean and its standard deviation. Most of the control variables were binary, indicating the presence or absence of a trait, with 1 indicating the R possessed the trait, and 0 indicating that the R did not. Complete item wordings can be found in the NSPOF codebook (Police Foundation, 1998).

Estimation procedures

Since the dependent variable is a binary variable (1 = R plans to get a gun, 0 = R does not plan to get a gun), logistic regression methods were used to estimate models. We converted the logit coefficients to the more intuitive odds ratios using the exponential function, e^b , where e = the base of the natural log and b is the logit coefficient. The odds ratio for continuous-level variables may be interpreted as the effects of a one-unit change in the explanatory

variable on the odds that a person plans to get a gun. The odds ratio for a dichotomous independent variable compares (a) the odds of a R planning to get a gun for the category of the independent variable coded 1 to (b) the odds for the category coded 0. We also follow the recommendations of Peng, Lee, and Ingersoll (2002) and report Hosmer-Lemeshow's (H-L) goodness-of-fit statistic to assess the fit of the logistic model against actual outcomes, and the likelihood ratio score to assess the overall fit of the model.

One potential pitfall with using individual-level cross-sectional survey data is that the standard formula for standard errors assumes independence, i.e. it assumes that the disturbance term is uncorrelated across individuals. A potential reason for the failure of the independence assumption in the present study is omitted variables. For example, state-level variables such as gun control laws could affect Rs in that state but not in other states. The effect of this “clustering” is to overestimate the preciseness of our estimates, i.e. make the standard errors too small (Moulton, 1990). To address this problem, we used the “cluster” subcommand in the Stata (Release 11.0) logistic regression procedure to get estimates of standard errors that are “robust” to clustering (StataCorp, 2010).

Analytic strategy

We wanted to show both results based on models we regarded as inappropriate, but commonly used in past research, as well as results based on more appropriate models, for the sake of showing why past research may have been misleading and showing how much difference it can make to introduce certain improvements. Therefore, we begin by first estimating a model in which the dependent variable is household gun ownership, then a model in which the gun ownership variable is improved by pertaining specifically to the respondent (i.e., the same person to whom the risk and victimization variables pertain), then a model in which the dependent variable pertains more specifically to respondent gun ownership for self-protection. In the final model, we address the causal order problem by shifting from a model pertaining to present gun ownership to one addressing plans to acquire a gun for self-protection in the near future. If fear/risk and victimization really do increase the probability of acquiring a gun for self-protection, and these methodological variations truly are improvements, the estimated coefficients for fear/risk and victimization variables should increase as the improvements are introduced.

Results

Table 3 reports the results from logistic regression analyses examining the effect of perceived risk and prior victimization on gun ownership or plans to purchase a gun for self-protection in the next year. Recall that the sample for the latter analysis was restricted to individuals who reported living in households with no guns, and that we use cluster-robust standard errors to adjust for potential state-level effects on individual-level observations. The likelihood ratio test indicates the overall fit of the logistic regression models are quite good and are to be preferred to the intercept-only model (the null model). The H-L test results, calculated from a contingency table of 2×10 , indicate that the goodness of fit is satisfactory for both the personal gun ownership ($p = .32$) and plans to purchase a gun for self-protection models ($p = .20$). On the other hand, the H-L test results for the household gun ownership and personal self-protection models indicate that both forms of gun ownership are not significantly different from those predicted by the model and that the overall model fit is not good. This is consistent with the hypothesis that the models are not using dependent variables that the models are well-suited to predict or explain.

To judge whether changes in the kind of gun ownership measured, and use of a strategy for side-stepping causal order problems, does

Table 2
Variables Used in Logistic Regression Analyses

Variables	Description	Mean	SD
Dependent Variables			
GUN_HSHLD	R lives in a household with a gun	0.38	0.49
R_GUN	R personally owns a gun	0.25	0.43
R_PROTGUN	R personally owns a gun for self-protection	0.11	0.32
GUN_PLANS	R plans on purchasing a gun for self-protection within the next 12 months	0.07	0.26
Independent Variables			
RISK	R's perception of safety alone at night in neighborhood/home, 2-item index	-0.08	0.84
ROBVICT	Victim of robbery in past year	0.05	0.23
BURGVICT	Victim of burglary in past year	0.03	0.16
MALE	R is male	0.48	0.50
BLACK	R is black	0.12	0.32
AGE	Age in years	43.64	17.44
MARRIED	R is presently married	0.65	0.48
EDUCATE	R is college graduate or higher	0.23	0.42
INCOME	Family income (eight-point scale)	5.41	1.99
EMPLOY	R is employed full-time	0.53	0.50
PROT	R is Protestant	0.45	0.50
CONSERVE	R is somewhat/very conservative	0.43	0.50
CHILD	Number of children under the age of 18 living in household	0.89	1.26
BIGCITY	R lives in city with more than 250,000 population	0.20	0.40
ARREST	R previously arrested for non-traffic offense	0.06	0.24
PROHIBIT	R reports she/he is legally prohibited from owning a gun	0.01	0.11

a. Means and standard deviations are based on weighted data for all cases with valid data on a given variable.

b. Except where noted, variables were coded 1 for cases with the indicated attribute, 0 for cases without.

Table 3
Odds Ratios from Logistic Regression Analyses Predicting Gun Ownership or Plans to Purchase a Firearm for Self-Protection

	Model 1	Model 2	Model 3	Model 4
	Household Gun	R Personally Owns Gun	R Personally Owns Gun for Self-Protection	R Plans to Get Gun for Self-Protection
Primary Variables of Interest:				
RISK	1.05 (0.08)	1.13 (0.10)	1.53* (0.15)	2.09* (0.48)
ROBVICT	0.85 (0.25)	1.21 (0.47)	1.49 (0.41)	2.22 (1.20)
BURGVICT	1.27 (0.32)	1.44 (0.42)	1.41 (0.55)	0.03* (0.04)
Control Variables:				
MALE	2.10* (0.35)	7.40* (1.53)	3.01* (0.68)	2.88* (1.03)
BLACK	0.52* (0.09)	0.54* (0.08)	1.08 (0.19)	3.16** (1.56)
AGE	0.99 (0.00)	1.01 (0.01)	1.01 (0.01)	0.99 (0.01)
MARRIED	1.28+ (0.19)	1.01 (0.18)	0.88 (0.15)	1.19 (0.71)
EDUC	0.49* (0.09)	0.54* (0.11)	0.70+ (0.15)	0.51 (0.31)
INCOME	1.19* (0.04)	1.16* (0.05)	1.23* (0.05)	1.08 (0.15)
EMPLOYED	1.17 (0.21)	1.60** (0.37)	1.50 (0.38)	0.51** (0.15)
PROT	1.54* (0.22)	1.64* (0.27)	1.31+ (0.20)	0.91 (0.43)
CONSERVE	1.37** (0.18)	1.44* (0.17)	1.54* (0.19)	2.86* (0.79)
CHILD	0.87** (0.05)	0.90+ (0.05)	0.88 (0.08)	0.86 (0.17)
BIGCITY	0.66** (0.13)	0.75 (0.17)	0.90 (0.21)	0.28* (0.10)
ARREST	0.92 (0.28)	0.89 (0.25)	0.99 (0.27)	1.36 (1.00)
PROHIBIT				17.46* (14.24)
Overall model evaluation				
Likelihood ratio test	$\chi^2(15) = 168.7^*$	$\chi^2(15) = 257.2^*$	$\chi^2(15) = 142.2^*$	$\chi^2(16) = 222.7^*$
Goodness-of-fit test				
Hosmer & Lemeshow	$\chi^2(8) = 17.8^*$	$\chi^2(8) = 9.17$	$\chi^2(8) = 20.4^*$	$\chi^2(8) = 11.1$
N (weighted)	1,939	1,870	1,870	1,115

Cluster robust standard errors in parentheses.

+ significant at 10%; * significant at 1%; ** significant at 5%.

strengthen the estimated effects of fear/risk and victimization, readers should focus on how the estimated odds ratios for these variables change from Model 1 to Model 4, reading from left to right. Consistent with expectations, each time the model was improved, the estimated effect of perceived risk of victimization became stronger and more positive. When risk was related to household gun ownership, the association was weak (OR = 1.05) and not significantly different from zero (Model 1). This result echoed the findings of prior studies that also used tried to use household gun ownership as a proxy for the R's personal gun ownership. The association strengthened somewhat (OR = 1.13) when the dependent variable was changed to the individual R's personal gun ownership status, though it was still not significant (Model 2). It strengthened again (OR = 1.53) when the dependent variable specifically measured personal ownership of guns for self-protection, and became statistically significant (Model 3).

Up through Model 3, nothing had been done to reduce the causal order problem. In Model 4, however, the dependent variable changed from being current gun ownership to planning to acquire a gun for self-protection in the immediate future, among persons who lived in households without any guns. With this change, the estimated effect

of perceived risk of victimization became even stronger and highly significant (OR = 2.09, $p < .001$), indicating that each unit increase in perceived risk doubled the odds of a person planning to get a gun for self-protection. In short, fixing or reducing the causal order problem yielded results indicating a substantial effect of perceived risk of crime victimization on gun acquisition. It should be noted that PROHIBIT could only be included in Model 4 because it was measured with a question asked only of persons without guns in their household. The survey asked nonowners why they did not own guns, and one response could be that the person was legally prohibited from owning a gun. Thus, it was a question that was not asked of gun owners, and PROHIBIT could not be included in analyses of mixed samples of owners and nonowners. We reestimated Model 4 without PROHIBIT, and the results were substantially identical – the odds ratio was 1.92 ($p = .0015$, 1-tailed) for RISK, 2.38 ($p = .05$) for ROBVICT, and 0.03 for BURGVICT ($p = .02$).

The results for robbery victimization likewise indicated that as the measurement of the dependent variable becomes more theoretically relevant, and the causal order problem was reduced, its estimated effect become larger, with the odds ratio increasing from less than one (OR = 0.85, indicating a negative, though nonsignificant, association) in Model 1 to a substantial 2.60 in Model 4. Despite a sample size of over 1,100, however, the association never became significant, due in part to the large standard errors that result from a variable having so little variation – only five percent of Rs had been a victim of robbery in the previous year (Table 2).

The results for burglary victimization were not so supportive. Consistent with expectations, its odds ratio increased when the dependent variable was changed from household gun ownership (Model 1) to respondent personal gun ownership (Model 2), but it decreased when the dependent variable was changed to personal gun ownership for self-protection (Model 3). In the final model, burglary victimization's coefficient even became negative. This does not make substantive sense, but may be explainable from a purely technical statistical standpoint. There is very little variation on victimization variables in surveys of the general population – only 2.7% of this sample (c. 30 people) reported a burglary, so only a handful of victims would have to falsely deny plans to get a gun in order to create a negative association. Some burglary victims may have misstated their intentions for an obvious reason – they had just been burglarized within the previous year, and now some stranger was asking them whether they were planning to get a gun (a highly stealable, valuable item) in the near future. In this light, it would not be surprising if some burglary victims who were in fact planning to get a gun denied it.

Perhaps the most curious finding in Table 3 was that individuals who self-reported not currently owning a gun because “gun laws don't allow me to have one” (PROHIBIT) were actually *more* likely to report plans to purchase a gun for self-protection. The positive coefficient we found for PROHIBIT seems at first counterintuitive, suggesting that being banned from legal gun ownership actually serves to stimulate plans to get a gun. This variable, however, may simply serve as a proxy for criminality. Criminals are more likely to be victimized, so they should also be more motivated to acquire a gun for self-protection. (Our control for ARREST at best only partially controls for criminality.) PROHIBIT may also be an indirect proxy for the strictness of gun laws in the R's area, since the stricter the laws, the more likely a given resident is to be prohibited from possessing guns. But since gun laws are generally stricter in places with high crime rates, and we could not control for crime rates, this variable's coefficient may be an indirect indication that people in higher crime areas are more likely to be planning to get a gun.

Conclusions

Once measurement and causal order problems are reduced, the evidence indicates that perceived risk of criminal victimization

increases the probability of getting a gun for self-protection. Actual robbery victimization in the recent past also appears to increase the likelihood of doing so, though the results are not supportive of an effect of burglary victimization. The implication of these individual-level findings for macro-level research is that positive associations between crime rates and gun ownership levels may reflect the effect of the crime rates on gun ownership, rather than (or in addition to) the other way around. Thus, methods suitable for modeling possible two-way relationships, such as instrumental variables methods, are called for in macro-level research on this topic. Most macro-level studies of the topic do not adopt such methods, either effectively ignoring the issue, or using ineffective methods such as relating lagged gun ownership to current crime rates.

One policy implication of these findings is that dissuading people from acquiring or retaining guns may be difficult, to the extent that gun (especially handgun) acquisition and ownership is motivated by perceived risk of crime. Perceived risk can be a powerful motivator of behavior, and is probably a stronger motivator than the pleasure derived from sporting uses of firearms such as target shooting and hunting.

These conclusions are subject to some limitations. First, we do not know how many of who stated that they planned to get a gun for self-protection actually did so, and understand that the two are not the same. Thus, the use of this variable introduces some unknown degree of measurement error as the unavoidable price of this strategy for reducing causal order problems. Second, there are other interpretations possible regarding the fact that risk/gun associations got stronger when the dependent variable was planning to get a gun. This not only reduces causal order problems (because such plans are unlikely to reduce perceptions of risk or victimization), but could also reduce social desirability and other response error problems. Rs who are reluctant to report actual current gun ownership for various reasons (they are not sure their ownership is lawful, they think the information might reach government authorities intent on taking their guns away, they fear the caller might be a burglar, etc.), may be more willing to report merely planning to get a gun. Finally, although our data were drawn from a survey fielded in 1994, and levels of perceived risk and victimization have changed since then, we know of no reason to believe that the relationship between these variables and gun ownership or planning to get a gun has changed in the interim.

Future research could benefit from a panel design in which the same set of individuals are interviewed on two or more occasions, allowing researchers to test whether changes in levels of fear or perceived risk, or victimization experiences, are associated with changes in personal gun ownership status. This would also help address causal order problems, but without the limitations of analyzing plans to get a gun.

Note

1. The survey was conducted by Chilton Research Services of Drexel Hill, Pennsylvania between November and December of 1994, with a response rate of 44 or 59 percent for the NSOPF depending on which of the two definitions of response rate was used in the calculations (Cook & Ludwig, 1996).

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