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Gun prevalence and suicide☆

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ABSTRACT

In light of the ongoing debate over tighter firearm regulations, this paper considers the relationship between gun prevalence and suicide. I exploit a reform in Switzerland that reduced the prevalence of military-issued guns in private households. In Switzerland, military service is compulsory for men, and military-issued guns account for nearly half of the total number of firearms available. The results show that the firearm suicide rate decreases by 9% for a reduction in gun prevalence of 1000 guns per 100,000 inhabitants. The elasticity of gun suicides with respect to firearm prevalence is +0.48, but converges towards zero for low levels of gun prevalence. The overall suicide rate is negatively and significantly related to firearm prevalence, which indicates that non-gun methods of suicide are not perfect replacements for firearms.

1. Introduction

Over the past three decades, gun control has been a prominent topic in the policy arenas in many countries. An often overlooked issue in this debate is how gun access affects suicide. However, suicide is a major public health concern that is responsible for almost one million deaths each year worldwide, more than homicide and war combined (World Health and Organization, 2009). In the U.S., suicide is among the top five leading causes of death for adults of working age, and the socioeconomic burden associated with suicide is estimated to be approximately $56 billion of work loss cost per year (Centers for Disease Control and Prevention, 2015). The situation in the European Union is similar, and countries on both sides of the Atlantic have invested in preventive measures for reducing suicide rates (World Health and Organization, 2014).

Governments are particularly concerned about gun suicide because using a firearm is one of the most common methods (Anglemyer et al., 2014) and because it is the most effective (Elnour and Harrison, 2008). For these reasons, policymakers often advocate stricter gun ownership laws. However, little evidence that restricting access to guns actually reduces the number of gun suicides or suicides in general exists, primarily because determining whether gun availability affects suicide presents a difficult identification problem (Lang, 2013). The positive correlation between gun prevalence and the suicide rate might be driven entirely by selection, and in addition, individuals who are willing to commit suicide could substitute guns with other methods if access to firearms is restricted (Duggan, 2003).

To understand the roots of this public health issue, I analyze the impact of firearm prevalence on suicide. To address identification, I utilize a unique natural experiment in Switzerland. Switzerland has a high prevalence of firearms among the population, largely due to the militia system of the Swiss Armed Forces. Between annual training courses, soldiers store their personal weapons at home, which makes military-issued guns available in Swiss homes throughout the year. Moreover, when soldiers complete their military service, they have the choice of transferring their military gun into private property. In 2003, the Swiss Armed Forces underwent a reform that abruptly reduced the number of troops. This reduction in troops,

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combined with a stricter regulation on former soldiers' option of keeping their military weapons, decreased gun prevalence among Swiss households. I use this exogenous variation in gun availability to estimate the causal effect of firearm prevalence on suicide rates in an instrumental variable (IV) framework.[1]

The main results, based on a regional-level panel for 20 years, show that reducing firearm availability decreases the rate of both gun suicides and suicides in total, with no significant impact on non-gun suicides. Instrumental variable estimates indicate that the firearm suicide rate decreases by 9% for a reduction in firearm prevalence of 1000 guns per 100,000 of the population. This effect corresponds to one less gun suicide for every 200,000 inhabitants. The overall suicide rate decreases by 3.5% for a reduction in gun prevalence of 1000 guns per 100,000 of the population. The elasticity of gun suicides with respect to firearm prevalence is approximately +0.48, suggesting that a 1% decrease (increase) in firearm prevalence decreases (increases) suicide by nearly 0.5%. The elasticity is heterogeneous and quickly converges towards zero for low levels of gun prevalence. This result intuitively implies that stricter gun ownership policies are likely ineffective in regions where gun prevalence is low.

By performing the analysis by gender, I find that the entire effect is driven by men. Both the reduced form and the second stage for women are not statistically different from zero. This finding is consistent with the literature regarding gender differences in suicide methods (Värnik et al., 2008) and the limited availability of military and ex-military firearms among women. Subsample analysis by age reveals that larger effects on the rate of both gun suicides and total suicides are found among males aged 30–44 at the time of the reform. Since men aged 30–44 are the most likely to possess a military gun and are the most affected by the reform under consideration, these additional findings endorse the validity of the identification strategy.

In sum, the results suggest that non-gun methods are not perfect substitutes for firearms, thus supporting the view that restriction of means may be an effective policy for reducing suicide. This paper presents novel causal evidence that a change in access to firearms can strongly affect the numbers of both gun suicides and total suicides per inhabitant. The evidence for Switzerland is useful for other countries with widespread gun ownership, such as the U.S., which also has comparable gun prevalence and overall suicide rates. However, it is imperative to recognize that my results are only a small part of the multidimensional societal cost-benefit analysis that should drive gun policy decision-making and suicide prevention campaigns.

The findings of the present study contribute to the economics literature exploring the role of firearms in determining economic and social outcomes. Although the focus in this literature is primarily on the relationship between guns and crime (see Braga, 2017, for a recent review) there are some notable papers analyzing the effect of firearm accessibility on suicide.[2] A positive relationship between gun access and suicide has been observed both cross-sectionally (Ajdacic-Gross et al., 2010; Miller et al., 2002, 2007; Killias et al., 2001; Lewiecki and Miller, 2013) and over time (Ajdacic-Gross et al., 2006; Lang, 2013; Rodríguez Andrés and Hempstead, 2011; Miller et al., 2006; Phillips, 2013), but the causal pathway remains unclear since many unobserved factors explain both high gun ownership rates and high gun suicide rates (Duggan, 2003).

Studies relying on IV approaches or policy changes to identify the effect of gun prevalence on suicides report mixed results. Vitt et al. (2018) use firearm background checks in a given state-year as a proxy for gun ownership rates and instrument their proxy with state-level Google search intensity for constitutional rights of firearm owners and phrases that reflect fear of future gun shortages. Their results show that an increase in firearm sales has a positive and statistically significant impact on firearm suicide rates. In contrast, Duggan et al. (2011) utilize geographic variation in gun shows and find that neither homicides nor suicides respond to gun shows in nearby zip codes. Among the studies[3] investigating how policy changes related to firearm legislation affect suicide rates, only Leigh and Neill (2010) find statistically significant declines in gun suicides following the adoption of tighter gun ownership legislation for the entire sample considered. Ludwig and Cook (2000) and Leenaars and Lester (1996) find statistically significant effects only for subsamples of the population under analysis. One recent study by Edwards et al. (2018) examines the effect of mandatory handgun purchase delays on suicides and homicides. By exploiting within-state variation across time in the introduction of gun purchase delays, they show that the existence of waiting periods reduces firearm-related suicides but not homicides.

I combine the two approaches and use a policy-induced change in gun ownership as an IV to estimate the effect of gun access on suicide rates. I add to the literature in two dimensions. First, I go beyond the reduced-form analysis and quantify the relationship between gun prevalence and suicide rates. Second, the military reform I consider has the advantage of having impacted gun prevalence indirectly. Any reform that focuses specifically on firearms will raise public awareness of crime, gun homicides, and gun suicides. Therefore, whether a decline in gun suicides is due to tighter legislation or to more public awareness and prevention campaigns remains unclear. The aim of the military reform I consider was a reduction of troops, and the change in gun prevalence was an indirect consequence. The reform was conceived neither to decrease gun prevalence nor to prevent suicide, which mitigates the risk of increased public awareness. The literature on suicide presents two studies that have a similar setting: the detoxification of household gas in the 1960s (Lester, 1990) and the introduction of catalytic converters in cars (Amos et al., 2001). In both cases, each reform had an indirect impact on the accessibility to a method of suicide, in turn leading to a reduction in suicides.

The remainder of this study proceeds as follows. Section 2 gives an overview of the institutional background and the military reform in detail. Section 3 presents the data set, some descriptive statistics, and the econometric approach. Section 4 presents and discusses the results and analyzes substitution effects of gun and non-gun suicide methods. Section 5 performs a series of robustness checks, and Section 6 concludes.

2. Institutional background

2.1. Gun policy and suicides in Switzerland

Guns in Switzerland are regulated by the Federal Law on Arms, Arms Accessories and Ammunition. In Switzerland, the right to private gun ownership is not guaranteed by law, and citizens willing to purchase a firearm must obtain a license. An applicant for a firearm

[1] My paper is not the first to connect this military reform to changes in suicidal behavior. Reisch et al. (2013) examine a single time series at the national level and find that after the reform, the number of suicides per 100,000 inhabitants decreased. I discuss the relative contributions of the previous work and the present study in Section 2.2.

[2] In some countries, attempting suicide is illegal and thus punishable (e.g., Kenya and Singapore). In the present study, suicide is not categorized as a crime.

[3] Leenaars and Lester (1996) analyze the 1977 Canadian gun control legislation, Koper and Roth (2001) the 1994 U.S. Federal Assault Weapon Ban, Ludwig and Cook (2000) the 1994 Brady Handgun Violence Prevention Act, and Leigh and Neill (2010) the 1997 government gun buyback program in Australia.