**Public Provision of a Private Good: The Case of Police Response to Electronic Alarms[[1]](#footnote-1)**

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**Abstract**

Burglar alarms are an effective single deterring or preventive measure to burglars. Alarms provide net social benefits to the community, but police response is 94-99 percent to false activations. Solving the false alarm problem could free up the equivalent of 35,000 U.S police officers. Response to false alarms is a private good while response to an actual crime is a public good. The nature of this good, whether public or private, is revealed only after the service has been provided. False alarm problems are especially acute in large cities where police responses to false activations preclude or delay response to actual public security tasks. Police provision of this private service is shown to have significant opportunity costs to the security of the community. The paper analyzes a Public-Private-Partnership policy called Verified Response (VR) where the initial response is provided under a competitive setting, and police respond only if a crime is verified. A case study of Salt Lake City, Utah is conducted using synthetic control methods to evaluate this program. The paper relies on Public Choice theory to explain why a socially efficient solution is not adopted in the vast majority of cities.

**1. Introduction**

In most North American communities, police respond to burglar alarm activations, which typically comprise 10 to 20 percent of calls to police, and each call involves 911-dispatcher time of approximately 11 minutes. Physical police response is usually by two officers for 20 minutes, and in total comprise an estimated 10 to 20 percent of urban patrol officer time. This occurs while 94-99 percent of these activations are false, resulting from users’ and technological errors. The police make the determination that response was to a non-event or was false. The annual estimated police cost of false alarm response in the US was $1.8 billion in the early 2000s, or the equivalent of 35,000 police officers (Blackstone et al., 2005). The out-of-pocket cost per police response ranged between $36 and $95 in 2003 (Blackstone et al; 2005:233). In 2016, the estimated cost of police response ranged between $75 and $160 (Goldfine, 2016)[[2]](#footnote-2). Responding to false alarms generates little, if any, social benefit to residents while imposing high opportunity costs in terms of police time amid strong demand for socially beneficial police services.

Numerous solutions have been implemented to solve the extensive number of false activations with limited lasting success. These solutions include educating repeat activators, collecting fixed or escalating fines for repeat false activations, ceasing police response after a set number of false activations, and even imposing criminal charges on repeat activators (Blackstone et al, 2005). However, regardless of such actions, the rate of false activations remains well above 90 percent (Blackstone et al., 2005; Sampson, 2007).

This study focuses on a policy solution to this problem, called Verified Response (VR). VR requires physical or visual verification of an actual or attempted penetration before police are dispatched. Thus, alarm owners designate individuals, including themselves, or private response companies to attend physically the premises, or using cameras and smartphones to check visually the premises. In the analysis that follows, we first present false alarm statistics from cities that have implemented VR over the past two decades. A case study of Salt Lake City (SLC) that follows analyzes the effectiveness of VR. Detailed data on police response time were provided by the City’s police department, which made such analysis possible.

This paper introduces a good whose nature, whether public or private, is revealed only when the service is completed. The paper empirically analyzes whether police response to false alarms entails opportunity costs in delivering other public security services. Hence, we investigate whether police alarm response provision impacts police response to all emergency calls and whether this situation is an efficient use of police resources. This case study might help other cities that struggle with the social and police costs of response to false alarms.

Section 2 presents the background of the burglar alarm industry and the source of the false response problem, as well as a view of the impact of VR on cities that have adopted the program. In section 3, we analyze the public and private characteristics of police response to burglar alarm activations. Section 4 presents the Salt Lake City, Utah case study, including synthetic control estimations related to the allocative efficiency of police alarm response. The analysis includes trends in policing variables after the shift to VR. Section 5 employs public choice theory to explain why a socially efficient solution is difficult to attain, and section 6 provides the summary and conclusions.

1. **Background**

Empirical studies have identified burglar alarms as an efficient mechanism for deterring burglars from penetrating homes and businesses. When a burglary occurs, alarm systems also reduce the time spent by burglars at the premises, yielding a lower value of stolen properties, and reduce the occurrence of violence against the residents. Two surveys found that an increased perception of security is the ultimate objective of security measures and a burglar alarm is the preferred such measure (Hakim, 1991 and 1995). A burglar alarm on its own reduces the probability of burglary more than any other preventive or deterring measure (Fishman et al., 1998). Indeed, a detailed Social Cost Benefit Analysis of burglar alarms shows significant net benefits where the benefits accrue to the alarm owners, while most of the costs accrue directly to police and indirectly to non-alarm owners, and owners of alarms that do not falsely activate their systems (Hakim and Shachmurove, 1996).

The social cost of alarm systems is the opportunity cost of police is responding to the large number of false activations. Alarm activation on the premises is signaled through wired or wireless phones to a central station that then typically makes a verifying call to the premises. If someone at the premise answers the call and does not provide the pre-specified code, or the phone call is not answered, the central station contacts police for a physical check of the premises.

Given that only 1 to 6 percent of all alarm systems calls are burglary related, police in most communities assign a low priority to all burglar alarm calls, thus reducing alarm effectiveness. This reduction in effectiveness is compounded since burglars are probably familiar with police response time in their target communities. Response time to alarms is inversely related to the size of the city; in large cities police often ignore such calls or respond only after a long delay. Even in a medium size city, like SLC, before VR was implemented, police responded to an alarm, on average, in 40 minutes (Salt Lake City Police Department, 2001), while private response companies typically respond in 6-15 minutes. Moreover, a study of California cities found that only 8 out of 16,000 burglary alarm responses yielded an arrest (Gaines, 2007). Indeed, with both the high rate of false activations and the low priority normally given to burglar alarm responses, such low apprehension rates are to be expected.

Police departments have responded in different ways to attempt to reduce false alarms. Most communities use a fine program to discourage repeat false activation. Some communities have taken more drastic steps in response to the lack of success with fine programs. For instance, police in Cobb County Georgia, population 700,000, instituted a no response list that included over 3,000 homes who were repeat offenders for tripping false alarms. Anytime any of these homes have a tripped alarm, the police department does not respond at all (Campbell 2016). This situation leaves many homes paying for a service they think is included within their alarm purchase, and is not being provided.

Nonetheless, alarm systems appear to be effective burglary deterrents for both residences and businesses (Fishman et. al., 1998; Hakim and Fishman, 1998). Homes without alarm systems are, on average, 2.71 times, and commercial properties without alarms are, on average, 4.57 times at greater risk of being burgled than homes and businesses with an alarm. Further, as the value of residential and commercial properties rise, the effectiveness of alarms rises. The yard sign alerting the presence of an alarm system is also a crucial deterring factor. Forty percent of alarm-equipped homes that were burgled had no sign. Audible alarms cause burglars who attempt to penetrate a home to escape before entry. Of all incomplete burglaries, 74.3 percent are attributed to the siren sound. The average value of property stolen from alarmed homes is 74 percent of the value stolen in homes without alarms. In addition, burglaries are sometimes associated with violent attacks when the premises are occupied. Thus, avoided burglaries prevent such violent attacks, and burglars’ concern that police are notified shortens any stay in the premises. The best indication of the effectiveness of electronic alarms is that 94 percent of alarm owners are satisfied with their system and almost all alarm owners who move install a system in their new location (Hakim and Blackstone, 1997: 66-70, and Hakim et al., 2002). Thus, burglar alarms provide net benefits to the community of greater security perception and better safety from burglary.

A similar detective measure to burglar alarm is Lojack, the stolen vehicle recovery system. Ayres and Levitt (1998) discussed the effectiveness and the positive externalities of Lojack that helps police retrieve stolen vehicles. Once installed, information is available to all police agencies and on many police vehicles. In general, the owner of the vehicle reports the theft to the tracker that interfaces with the National Crime Information Center, and makes the information available to police cars in the vicinity of the stolen vehicle. The positive spillovers generated by Lojack arise because potential car thieves can’t identify which cars have them and which do not. Spillover benefits accrue to car owners who do not install Lojack but benefit from the reduction in car theft. Ayres and Levitt concluded that only 10 percent accrue to the owners while society gained the rest, and thereby there was substantial social underinvestment in Lojack. Unlike burglar alarms, Lojack has no false alarms because the owners report on the actual missing vehicles.

Similar to Lojack, changes in private security provision have been linked to changes in crime rates. Instead of private security simply displacing crime from the protected home or business to unprotected targets (specific deterrence), evidence suggests changes in security guard provision generate spillover effects on the general level of crime in an area (general deterrence). Meehan and Benson (2017), find increases in private security are associated with reductions in burglary rates, as well as robbery and overall property crime rates. MacDonald et al. (2016) find private security services at the University of Pennsylvania generate positive spillovers to neighborhoods adjacent to the university by reducing both violent and property crimes in these areas.

We investigate the impact of VR on burglary rates in Salt Lake City, as this should be the most closely related crime, and could easily be impacted by VR. VR could affect the number of burglaries in two ways. If the VR ordinance increases the demand for private security guard services, as security firms consequently increase the quantity supplied, this puts more security guards on the streets, which could generate the same type of spillover benefits indicated by these previous studies. VR could also affect burglary rates by increasing the productivity of police when responding to burglaries. The separation of these two impacts on burglaries is extremely difficult to achieve. In order to provide some evidence of the impact of VR on police productivity we also present evidence of changing average response times for police to actual burglary calls.

3. **Public and Private Goods**

In order to determine the optimal level of government intervention, it is important to understand the theoretical foundations and characteristics of public goods. Samuelson (1954) was first to distinguish between public and private goods. This treatment of public goods focused on non-rivalry, as he defined the pure public good as a product where every constituent enjoys the full extent of the output while the marginal cost of adding additional consumers is zero. This original understanding of a public good did not consider excludability. Musgrave (1969) expanded the definition of public goods to include non-excludability, meaning that it is impossible or prohibitively expensive to exclude individuals from consumption (See Desmarais-Tremblay 2014), and thus there is a strong incentive for individuals to become free riders.

Samuelson’s definition of a public good also ignores the possibility of congestion that causes the publicness to be finite. Buchanan (1967) further refined the definition of public goods by introducing local public goods. He claimed that only few goods satisfy Samuelson’s pure public definition. In his Club Theory, the degree of publicness is negatively affected by population size. As population of the community rises, congestion occurs, causing marginal costs to increase and in turn public good service per consumer to fall.

Alarm response appears to be a quasi-public good. It is unknown a-priori whether an alarm activation is false or whether a burglary or attempted burglary occurred. Only ex-post, when the officers are at the premises, or when the service has been provided, can they determine whether it was a real or a false activation. If police interrupt a burglary, they provide a local public good by possibly reducing the pool of criminals in the area through arresting and punishing those who are committing property crimes. Thus, they are providing positive externalities for those citizens within the impacted neighborhood, and the community collectively consumes this service. Exclusion from the spillover benefit of valid alarm response may be very costly and is typically not observed. Thus, they are providing positive externalities for those citizens within the impacted neighborhood, and the service is collectively consumed by this neighborhood. If the alarm is valid, there are both private benefits to the burgled property and public positive benefits to the community.

The situation differs when police respond to a false alarm. User error or a technological problem could be the cause of a false alarm. For example, a user error could occur when a person enters the premises without punching in the right code onto the control panel. A technological problem occurs when a sensor malfunctions and the alarm is accidently activated. When police respond to a false activation they bear monetary cost, while no one else in the community benefits from that response. If a car is disabled on a private driveway, the City does not get involved, but police service is provided for malfunctioning alarm systems or for those who falsely activate their system.

 In addition, some police services might be denied elsewhere in the community.

Education is a similar good to burglar alarm response. Education provides mostly private but also external benefits. Thus, funding of education may suggest proportional contributions by the users and the public at large (Stiglitz, 1974 and Buckley et al., 2015). Caplan, 2017 (chapter 6) argues that in the specific case of higher education, the benefits are only enjoyed privately and thus no public funding is justified. Noteworthy, the nature of each individual burglary response is a-priori unknown as are the externalities generated by the individual student that receives funding. According to Weissmann (2014), only 55.1% of undergraduate students that enrolled in college in 2008 had completed a degree program six years later. Many of these students drop out in the first or second semesters. For many of these students college is primarily a private consumption good. The externalities generated by higher education may be focused on relatively small set of degree programs, STEM majors for example. Obviously, many of these students receive subsidized loans to attend college. A-priori a large amount of uncertainty exists about the public and private characteristics of an individual alarm response and individual subsidized higher education funding.

One could reasonably argue that the cost and associated price of monopolistic police providing a private good is higher than the cost would be under a competitive setting. Wages of private security officers reflect the market wages for this slice of the workforce and are about 47 percent of those of public police officers where labor is the primary cost of police response (Blackstone and Hakim 2010: 362, Blackstone and Hakim, 2013). In addition, VR shifts the financial burden from non-false activators and non-alarmed property owners to those who cause the alarm and receive this private service. In other words, the burden shifts from the general ledger paid by taxpayers, most of whom don’t have burglar alarms, to user fees where those that cause the expense pay for it. Evidence suggests that the effectiveness of response also improves under VR; the combined time of response, including both that of the private company and police for a verified burglary, is generally lower than when police solely respond to an activation. For example, southern California police respond to an alarm activation at low priority within an average of two and a half hours (Hakim and Blackstone, 1997: 220). Private security officers respond, on average, within 15 minutes, and in case of a burglary, they request police dispatch, which occurs within 10 minutes. Thus, in case of an actual burglary, the joint public-private response is significantly faster, and increases the probability of apprehending the burglar (Hakim and Blackstone, 1997: 220).

Monitoring and emergency response are not new roles for private individuals and security services. The history of monitoring and response by private security is older than that of public police services. In London, for instance, the first public police agency was established in 1829, while private patrol units were in operation before, during, and well after this period. In 1828, private police units existed in 45 parishes within a ten-mile radius of London. Some of these areas had subscription based foot patrols (Davies, 2002: 165), a precursor to private security patrols and alarm response. More recently in Amarillo, TX, the City authorized Allstate Security to respond to burglar alarms with its own private security personnel starting in 1982. As Benson (1998: 150) states: “The police department was relieved of responding to an average of eight alarms per day and saved an estimated 3,420 person-hours per year… Since private security personnel are less expensive than public police officers are, the result was a reduction in the monetary costs of alarm response. Significantly, the cost is also shifted from general taxpayers to the individuals who actually use and benefit directly from alarm services.”

Nevertheless, the situation depicted above of a private security response company contracted by police is still suboptimal. Indeed, it generates competition at the contract stage but after the contract is signed, the city faces a private monopoly, and bears transaction and monitoring costs until the conclusion of the contract. Initial alarm response is a private good while responding to a bona fide activation is a public good. Accordingly, competition by any public and private entities is appropriate. Contracting-out as in Amarillo for initial response is necessary only for a public good.

Private goods and services, such as most alarm responses, are sometimes bundled with closely related public goods and funded by government. For example, Langdein (2004) examines the case of music performances in U.S. public schools where a sufficient number of “vocal” parents pressure local government to subsidize this “quasi” public good (pg. 96). The alarm industry, which supplies a private good, tends also to be supported by a very “vocal” interest group.

1. **The Salt Lake City Experience with VR**

We include basic data on eight of the 33 North American communities that have adopted VR and a detailed case study of Salt Lake City (SLC)[[3]](#footnote-3). Table 1 shows the dates of VR implementation and the pre- and post- implementation false alarm numbers. Unfortunately, city police departments rarely keep burglar alarm response data for extended periods. In fact, among cities that have adopted VR, Salt Lake City is unique in the quality and length of these data. Unlike crime data collected by the FBI, burglar alarm response data are very rare. After contacting numerous police departments with alarm units, only the ten cities used in this study had alarm response data for more than ten years. Even among these 10 cities that collected an extended time series of data, collection methods over the past two decades have changed from paper based to electronic. This has also complicated the process. This contributed to a number of years of data being lost even among these ten cities used in this study, and these data had to be interpolated. The vast majority of the data used are not interpolated, although a handful of observations are. The data on alarm response from 1998-2016 are unique to Salt Lake City, and we have to rely on these time trends.

By 2016, thirty-three communities, mostly small cities in the western US, and two in western Canada, implemented VR type measures. Some large cities that have adopted VR include Milwaukee, WI in 2004, Madison, WI in 2007, and Detroit, MI in 2011. Indeed, most of these cities shifted to VR by an action of the police chief, probably prompting less resistance from the electronic alarm industry than happened in Salt Lake City, which changed its burglar alarm ordinance.

**[Table 1 about here]**

In the short run, it appears that the implementation of VR is associated with reductions in the number of false alarms. As indicted in Table 1, these reductions ranged from just 7 percent in Broomfield, CO to 97 percent in Milwaukee, WI over just a two-year period. The additional synthetic control comparison and time series data collected from Salt Lake City provides a picture of what occurred in this city over a longer time horizon. This general trend exhibited in Table 1 supports the assertion that VR is likely to be responsible for a significant decline in police responses to false activations. Many of these cities are very different geographically, demographically, and politically but all adopted VR and exhibit significant reduction in false alarm calls. The detailed study of SLC shows that the impact is of long-term duration. We first present the raw time series data from Salt Lake City and then employ the synthetic control model to examine if these data trends are attributable to VR implementation in the city.

In SLC, the rate of police responses to false activations was 99 percent in 14 of the years between 1998 and 2013, and 98 percent in the remaining two years. The new VR ordinance, which became effective December 1, 2000 required physical verification of an actual or attempted burglary before police respond. The alarm response companies in SLC usually charge $35 for each physical response. Unlike police, private security officers must obey all traffic rules while approaching the target and are merely supposed to check the exterior of the property. Upon witnessing evidence of intrusion, they request police dispatch. Private responders are not supposed to confront intruders unless lives are in danger. If signs of intrusion exist, police respond to the call as a priority 1 case, which is a change from the low priority response before the ordinance change.

Even after the new ordinance was enacted, valid alarms maintained the same low percentage. However, police responded to over 8,200 activations a year from 1998 through 2000 before dropping to less than 900 in 2001, mostly for false panic, robbery, and duress cases. These activations fell even more as the years progressed, showing a consistent decline to 350 in 2016 (Figure 1).

**[Figure 1 about here]**

SLC was the second city in the U.S. to implement VR, and first through a change in its ordinance[[4]](#footnote-4). The ordinance’s change in SLC prompted the industry aggressively to prevent the change, probably fearing a “snow ball” effect. Indeed, once the VR ordinance was implemented in SLC, the benefits became evident in the form of significantly reduced police responses to false burglar alarms. The city also witnessed associated lower costs for patrol.

Until December 2000, the alarm ordinance in SLC provided four free police responses to false alarms and $100 fine for each false alarm response thereafter. The owner of the alarm system was responsible for the payment of the fine. In 1999, the SLC Police Department estimated their cost per response as $60 on 10,542 responses, or a monetary cost of $632,520 a year. In addition, police response time to high priority calls appears to be adversely affected by the large number of responses to the false burglar alarms, being over 10 minutes in 1999, slightly below the national average of 11 minutes (Table 1; Bialik, 2013).

After the new VR ordinance was approved, police no longer respond to alarm activations unless physically verified by a designee of the alarm owner, usually a private response company. Police responses became subject to an escalating fine; $50 for the first false response, $100 for the second, $200 for the third, $300 for the fourth, and $400 for all subsequent false activations in a year.

To examine the impact of the ordinance, we analyzed data from 1995 through 2016. This long-term analysis is helpful to determine if short-run reductions in police response time are maintained years later. These data show a suggestive relationship between the ordinance and the response time variables, although this analysis is by no means claiming causation.

The SLC Police Department data enable a breakdown of the total response time to its two components, namely, average received call to dispatch time, and police physical response from dispatch to arrival at scene. This analysis will focus on the time the call reaches the police officers from dispatch through the police arriving on scene. Focusing on this analysis allows us to observe some of the trends in the use of scarce police officer time, which is our focus in this analysis. Thus, we have defined response time as the time from dispatch to arrival on scene. Further, the data allow us to analyze police response to priority 1 & 2 calls separately as well as calls to burglary. Figures 1 through 3 present police response time data, the number of false alarm responses, and the number of burglaries in SLC over the 1995-2016 period.

Table 2 and Figure 1 show that the response time from police dispatch to arrival at the scene for the average high priority 1 call declined from 12:04 minutes in 2000 to 5:23 minutes in 2002, to 4:05 minutes in 2003, and stabilizes to around 5 minutes for the rest of the data period. With the new alarm ordinance, police response to burglar alarms also became a priority 1 call. Even police response time to priority 2 calls declined from 11:54 minutes in 2000 to 8:42 in 2002 and to 6:53 in 2016. This pattern identified in Figure 1 suggests that the reduction in false alarm responses allowed police to more efficiently respond to both high priority 1 and lower priority 2 calls. In addition, the average total time of response to priority 1 calls, including the time each call comes in to a 911 dispatch center, from call receipt to police arrival at the site declined from 20:12 in 2000 to 12:54 minutes in 2008 (SLCPD, 1998-2015). The reason for faster dispatch is attributed to reduced pressure on the 911 system of 8,500 fewer false burglar alarm activations calls. Hence, SLCPD data suggest that VR saved on both the dispatcher and police response time by 8 minutes for priority 1 calls and by close to 7 minutes for priority 2 calls from 2000 to 2008. While this analysis focuses on the police time allocation, this impact on dispatch time suggests that VR could increase the efficiency of the entire emergency response system within cities.

While we cannot rule out all other possible explanations for these declines, we know of no other factors that played a role in reducing response time during that period. What is also interesting is the fact that the number of patrol officers did not increase over this period. In fact, the number of patrol officers declined from 239 in 2000 to 198 in 2001, and by 2016 reached 164 (SLC Annual Budgets, Staffing Documents, Police, Operations Bureau). Hence, the decline in the number of patrol officers, if anything, should have increased the time of response while a decline in response time is evident.

The decline in response time could be partially attributed to the significant decline in patrol response to false alarms[[5]](#footnote-5). Moreover, other possible affecting environmental and control variables usually do not significantly vary over a two-year period. Thus, the short-run (2000-2002) reduction in response times suggest that VR may well be an important reason for faster response to priorities 1 & 2 calls. Even though the number of police patrol officers fell over this period, the number of false alarms responses per patrol officer fell by a substantial margin, as shown in Figure 2.

**[Insert Figure 2 around here]**

Specifically, the decline in the number of false alarm responses per patrol officer from 39.5 in 2000 to 2.4 in 2016 corresponds to the significant reduction in response time (Figure 2). The reduction in the number and time allocated to false alarm responses per patrol officer likely led to faster response to other public security tasks.

Another contributing factor for the reduction in response time is the change in false alarms as a percentage of the combined priority 1 & 2 calls. The rate diminished from 56 and 65 percent in 1998 and 2000, respectively, to only 5 percent in 2001 and continuing to decline to less than one percent in 2016. The sharp decline in response time to both priority 1 & 2 occurred in the few years following the change in ordinance, suggesting the most significant impacts of VR may occur very quickly with only a slight lag. Finally, the decline in response time to both priority 1 & 2 calls shows the cost borne by the entire community of police providing response to false alarm calls.

Tables 3 and 4 provide rough estimates of the gains and losses to the affected groups in SLC, including non-activators, an average alarm company, and alarm activators by number of activations per year. The $60 cost of police response consists primarily of the time spent by two patrol officers and the appropriate cost of vehicles. False alarm activators of 1 to 4 times a year were proportionately subsidized in the range of $60 and $240[[6]](#footnote-6).

It is not surprising that the group of 1-4 false alarm activators would favor and were easily mobilized to prevent changes in the ordinance. Since the average number of responses per alarm owner per year was 0.712, it is evident that the majority of activators gained net benefits as the community at large subsidized them. In fact, an average alarm owner received a modest subsidy of $42.60 per year. Under the old ordinance, repeat activators of up to nine were subsidized; those who falsely activated their system 10 times in a year obtained no subsidy, and those falsely activating their systems 11 and more a year overpaid for the service, yielding reverse subsidization of the community. However, it is unlikely that many had 11 or more false activations. Thus, most false alarm activators had a strong incentive to maintain the old ordinance. False alarm activators up to four a year were subsidized by the community for a private service they obtained from the police. The prices charged by police for the response service were unrelated to police costs and actually “encouraged” alarm owners to consume up to four false alarms in a year.

**[Insert Table 3 about here]**

**[Insert Table 4 about here]**

We compare the $60 cost to police, to the price of $35 charged by alarm response companies in 2015. The annual savings to the community arising from the transfer of initial responses from the police to the private companies is $25 for each response or a yearly saving of $233,615. These cost savings may be relatively small compared to the efficiency gains to the police from VR. Finally, if the new ordinance were simply restricted to VR and the fine structure remained unchanged, repeat activators were still better off with the old ordinance.

 **[Insert Figure 3 here]**

As indicated by Figure 3, the new ordinance had a restraining effect on the purchase of new alarm systems. New alarm permits which were and are still required by the City declined from an annual average of 1,518 a year between 1996 and 2000 to 569 in the years 2001 through 2005, or a decline of 62 percent[[7]](#footnote-7). The evidence suggests that the alarm industry in SLC has been adversely affected by the adoption of VR. At the same time, the alarm industry nationally seems to have done well. For example, nationally alarm installations per dealer increased from an average of 348 per year to 518 over the same period, or an increase of 66 percent (Security Sales & Integration, 2006). The adverse effects of VR on SLC operating alarm companies was likely significant.

One might expect that this adverse impact on alarm ownership would encourage burglaries within the community, as the number of burglar alarms falls, or the number of new alarm systems stagnates, rational burglars may respond by increasing their efforts. The synthetic control results presented in Figure 5 finds an opposite impact, a reduction in burglary relative to the control group of cities. As mentioned above, the most significant change to social welfare due to VR may be the increased police efficiency due to reductions in time devoted to false alarm response. This translates into reductions in average response times for both priority 1 and 2 calls, as observed in Figure 3. If police are quicker to respond to burglaries, the probability of burglar apprehension increases, thus increasing the perceived costs of undertaking any burglary. Rational burglars will reduce their activities in the City, as is observed in Figure 3. Except for 2002, when burglaries increased, burglaries have trended down through 2016. Overall, burglaries decreased in Salt Lake City between 1996 and 2016 by 43 percent, from 3,015 burglaries in 1996 to 1,727 in 2016. Immediately prior to the VR ordinance change, burglaries were around 2,200 in 1999 and 2000. The reduction from the period one year before implementation, 1999, to 2016 was 19 percent. The long-term trend observed in Figure 5 provides a more in depth picture of the fluctuations relative to the synthetic SLC, where this downward trajectory in burglaries post VR implementation is obvious. The lag in the reduction of the number of burglaries is predictable, as information about the improved effectiveness of response to burglaries probably would not occur immediate, and it might take years for this information to be observed by potential criminals. This impact may not be concentrated on burglaries. If VR improves the allocative efficiency of police resources, we should see spillover impacts on other types of crime control Future research could examine the long-term impact of VR on property and violent crime. In this paper, we focus on the direct impact on the closest related crime, burglary.

As expected, VR yielded a decline in the collection of alarm fines by 51 percent from an average of $144,624 a year in the 5-year period 1996 through 2000 to an average of $78,281 a year in the subsequent five years. This decline is attributed to both the VR element of the new ordinance and the significant increase in fines that begin with the first false activation.

We continued the trend of police responses that had existed from 1996 through 2000 to generate what might have been police alarm responses under the old ordinance without VR, and the old fine system for the years 2001 through 2015. We then calculated in real prices how much police saved assuming their average variable cost, which is also an average total cost, to still be $60 and the community’s resource cost under private response to be the $35 price charged by the local private response companies. The annual savings for police ranged between $357,000 and $445,000 in the 5 years following the new ordinance. Community savings over the same period ranged between $149,000 and $186,000. There is a difference because competitive private response is priced at $35 while the cost for police response to the same false activations was at least $60. The higher cost for police probably arises from their monopoly position, contributing to inefficiency and the higher waged officers (Blackstone and Hakim, 2010).

**5. Synthetic Control Analysis of VR in Salt Lake City**

In this section, we introduce the synthetic control empirical model. We also present evidence from this model as it pertains to VR in Salt Lake City. We use the synthetic control approach to estimate the impact of VR on police alarm response and burglaries within Salt Lake City.

Using a similar notation to the pioneering synthetic control study of Abadie, Diamond and Hainmueller (2010), as well as Ando (2015). Let $Y\_{it}=Y\_{it}^{N}+ α\_{it}D\_{it}$ be the equation for the outcome variables, in this case, both police alarm response and the number of city burglaries. $Y\_{it}^{N}$ is the synthetic variable, which represents the outcome variable in the absence of the VR policy treatment. This variable is essentially the counterfactual in the absence of VR, $α\_{it}$ is the effect of VR on city $i$ in year$ t$, $D\_{it}$ is a treatment indicator, which takes values as follows:

$D\_{it}=\left\{\begin{array}{c}1 If VR is active in city i in year t \\0 otherwise \end{array}\right.$ Within this comparative case study analysis only Salt Lake City ($i$ =1) is a treated unit, and the first year of the treatment is 2001 ($t$ = 2001) and is active for each year during and after 2001. $D\_{it}$ = 1 if $i$ =1 (Salt Lake City) and $t\geq T\_{0}$ where $T\_{0}$ is the first year of the treatment (2001). $The variable α\_{it}$ is estimated such that:

$$α\_{1t}=Y\_{1t}-Y\_{1t}^{N} for t\geq T\_{0}$$

The outcome variables for Salt Lake City $Y\_{1t}$is observed, but the “synthetic” outcome $Y\_{1t}^{N}$ is estimated to get $α\_{1t}$. The estimation of $Y\_{1t}^{N}$ uses a weighted average of the control units in the donor pool, the nine cities other than Salt Lake City and the pre-treatment (VR) values for burglaries and alarm responses in SLC.[[8]](#footnote-8) Table 4 and Table 6 show these optimal weights attributed to each city used to construct the synthetic SLC. These weights can be represented by a vector $\left(K×1\right)$ of weights$ W=(w\_{2},….,w\_{k+1})'$, as indicated by Table 6 and 8, each city weight is greater than or equal to zero yet less than one, and the summation of these weights is equal to 1. A vector of optimal weights $W^{\*}=(w\_{2}^{\*}….,w\_{k+1}^{\*})'$ is used to estimate $Y\_{1t}^{N}$ as the weighted average of $Y\_{kt}. α\_{1t}$ is estimated such that:

$$\hat{α}\_{1t}=Y\_{1t}-\sum\_{k=2}^{K+1}w\_{k}^{\*}Y\_{kt}$$

 Weights are estimated such that $W$ minimizes the difference between the predictors during the pre-VR period for the treated unit (SLC) and the weighted average of these predictors for the control units within the donor pool. The values of these predictors are provided in Table 5 and 7, they show the constructed synthetic values from the donor pool and the actual Salt Lake City values. Table 6 and 8 show the weights used for each of the cities within these estimations, Figure 4 presents the alarm response model results, and Figure 5 the estimation results of the burglary model.

**[Insert Table 5 here]**

**[Insert Table 6 here]**

**[Insert Table 7 here]**

**[Insert Table 8 here]**

**[Insert Figure 4 here]**

**[Insert Figure 5 here]**

One indication for the accuracy of the synthetic model is how closely the synthetic predictors match the actual treated SLC figures. As evidenced from Table 5 and Table 7, these predictors are very close. The results from Figure 4 suggests a large divergence in the predicted (synthetic) alarm response numbers and the actual data for Salt Lake City. The gap between the two is very large and persists over time. The Figure 5 results also indicate a difference between the “synthetic” burglaries in SLC and the actual numbers a year after the VR program was implemented. This analysis provides strong suggestive evidence that VR did have an impact on Salt Lake City alarm response, which should have reduced resource pressures on the police department. The results from Figure 5 suggest this reduced resource pressure contributed to reductions in burglaries.

**6. A Public Choice Solution to the Problem**

The evidence above suggests that use of city police to respond to burglar alarms is a socially inefficient outcome. This outcome persists because of lobbying efforts of groups with stakes in promoting a solution that favors them. Not only does this result in a subsidy to alarm activators but it adds to the adverse effects of delayed response time to all police calls, and appears to impact the effectiveness of police crime control.

The groups affected by the change of ordinance are alarm owners, non-owners of alarms, alarm companies, and the police. Under the old SLC alarm ordinance, the average alarm owner was subsidized by $42.72 (Table 4). As Tables 3 and 4 show, the community subsidizes alarm owners who falsely activated their systems up to 10 activations a year. An average repeat false activator loses annually $104.24 from the new ordinance while those who falsely activate their system 1 to 4 times a year were the most adversely affected alarm owners. Alarm owners who falsely activated their system four times a year were subsidized by $240 and those who falsely activated one more time overpaid on the fifth false activation by $40 (Table 3). Table 4 illustrates that on average, an alarm company lost $5,411 gross profit annually between 2001 and 2015 after covering the $4 monthly monitoring cost (Hakim and Blackstone, 1997: 126, 128-136). Those losses are forgone annual recurring revenues on non-installed systems after the new ordinance was enforced. At the same time, the gain from the new ordinance that accrues to a non-activator alarm owner or non-alarm owner household per year is merely $8.19. In addition, the entire community benefits from faster police response for both priority 1 & 2 calls. Incidentally, alarm owners who experienced intrusion also lost because of delayed police response, and subsequent increases in the probability of being burglary victims, which is a hidden social cost.

Alarm owners comprise 16-18 percent of households, while at most 13 percent of all households falsely activate their alarm systems. It seems that the majority (87 percent) of households in the community, and the police should favor a VR ordinance. Alarm owners in general may resent the potential for fines because they cannot predict whether they will be false activators. While the groups that benefit from maintaining the pre-existing ordinance are small their monetary losses from adopting VR are high, and the majority’s gains from VR are very low. Thus, the benefitting group of alarm owners who falsely activate their systems 1-4 times and the alarm companies operating in SLC are motivated to lobby members of City Council to reject a VR based ordinance.

An ordinance that is relatively standard in North American cities and has been in effect for many years may be difficult to change. Table 4 shows that when VR is implemented, the projected subsidy from each household in SLC to the alarm activators amounted to $8.19 per year. This small amount probably does not motivate the general population to congregate and exert political pressure to impose a user’s fee on false alarm activators; the opportunity cost of an action by a householder is higher than the modest savings, leaving the majority of households apathetic to the lobbying efforts to maintain the pre-VR ordinance. Accordingly, given an estimated benefit of as much as $240 to false alarm activators (Table 3), it is understandable that this group would support “free” responses. Further, the alarm companies had a strong interest in maintaining largely free police responses. After all, they almost certainly expected, and indeed the experience proved they were correct, that substituting private guard verification contributed to reduced sales of alarm systems. The industry’s actions in opposing verified response are quite understandable (e.g. Jimenez, 2007; NESA, n.d). The monetary gains and losses reflect the relative incentive of each group to maintain the provisions of the old ordinance. An average alarm company has 127 times greater monetary incentive than an average alarm owner to exert pressure for maintaining the old ordinance. It also explains why an average alarm company and an average activator have 661, and 52 times, respectively, the monetary incentive to exert pressure to maintain the old ordinance than for a non-alarm owner to exert pressure to change to VR**.**

Enforcing the VR ordinance appears socially desirable. It shifts the burden from non-alarm owners and alarm owners that do not falsely activate their system to those that cause and obtain the response service. A City Council can implement user fees that are measurable for false alarms at relatively low transaction costs. At the same time, imposing the burden on those who activate the false alarms provides incentive to avoid such false activations.

As much as “innocent” households should not subsidize alarm activators, as was the case under the old SLC ordinance, there is little justification for a government monopoly to price higher than the marginal cost of response on repeat activators to subsidize the community. Punitive pricing in a competitive market setting is not common, since competitive pressures will yield a lower price service than in the monopolistic case. Police should view the charge for response as the price of service delivery. As long as police provide alarm service along with other public services and from the same budget, police should charge their long run average cost, $60 in 2000, and avoid cross-subsidization with other groups and services provided to the community. Both private and public providers should be allowed to compete to offer alarm response services. Indeed, the Public Administration literature suggests that government could either shed private services, or maintain such service but allow private firms and other public entities to enter on a “level playing field basis” (e.g. Savas, 2008). When the pre-2000 ordinance in SLC allowed four free false police responses a year, it was not economically feasible for private firms to offer response service since most alarm owners had 0-4 false alarms a year.

If police end their monopolistic stance by not providing free responses, and replace the arbitrary fines with their real costs, private response companies could, and in the SLC case did, enter the market. Competition among providers should yield efficient provision of the initial response service. In addition, lower prices resulting from increased competition, even if there is no change in productive efficiency, will raise the consumer surplus, which reflects an increase in social welfare.

Allowing private security to respond initially to alarms gives police departments the ability to reallocate resources to higher valued public security uses, including response to all emergency calls. As the case study suggests this reallocation of resources can improve response times to emergency calls. By improving emergency and real-crime response, the city should subsequently reduce crime in the long-run. This also encourages specialization and thus more efficient alarm response by private security companies, as well as police who may choose to maintain the service under a competitive setting. As specialization increases, productivity tends to increase, reflecting improved response times in SLC. Competition among public and private response entities unleashes innovation on both alarm systems and the management of response services.

Replacement of a public monopoly with competition also yields probable redistribution effects. Alarm ownership, and resulting police response to false activations, is more prevalent with affluent members of the community (Hakim and Buck, 1991: 81-91). Thus, a reduction of police response to false activations shifts police resources to mostly less affluent neighborhoods and may serve an equity objective of government.

In small suburban and rural communities, police might wish to maintain their response to all alarm activations. One reason for doing so is to prevent annexation of police with adjacent communities, or possible contracting out of the police department. In such a case, if police wish to maintain alarm response, entry of competing private companies and even other adjacent public police departments should be allowed. Police response could then be competitively priced.

The fine structure for police response to false alarms, in particular escalating fees, is a product of monopolistic police pricing. Such a punitive price structure becomes obsolete in a competitive setting. Interestingly, the electronic alarm industry generally supports escalating fines that adversely affect a small number of repeat activators. These high activators are mostly banks and high value commercial businesses that are required by their insurers to install alarm systems, and thus they have price inelastic demand for alarm systems (Margulies, 2014). However, the alarm industry objects and lobbies against the adoption of VR, which adversely affects all false alarm activators. Adding an additional charge for initial response to alarm owners makes their ownership of an alarm system more expensive, therefore reduces the purchase of new systems (Figure 3), and possibly reduces usage of existing systems. The industry support for continuing police response is not surprising given the subsidy the industry and the alarm owners lose when a VR ordinance is adopted.

Butterfield (2003) presents an example of alarm companies imposing political pressure on local communities to continue subsidizing police response to alarms. In response to the potential implementation of VR, Southern California alarm companies came together to pay Cerrell Associates Inc. for lobbying efforts to keep the police responding to all alarms. These lobbyists attended local city council meetings, and spread negative information about the effectiveness of VR in SLC. These alarm companies obviously have an incentive to engage in “rent seeking” (Tullock, 1967; Krueger, 1974). Indeed, this situation may have held back the spread of VR in cities across the U.S.

The 2000 ordinance also involves police charging the alarm company rather than the alarm owner for the false activations of alarm owners. This new practice replaces collecting fines from possibly 12,244 alarm owners to just the 25 alarm companies operating in SLC in 2015. This change was intended to ease the collection of fines for police and thus reduce their transaction costs. However, fining the alarm company, a third party, instead of the violators themselves yields both an additional layer of transaction costs and difficulties for the alarm companies in collecting the fines. In case of a dispute about the appropriateness of the fine, the two involved parties, the police and the alarm activators, do not face each other. In a noteworthy development, the electronic alarm industry justifiably opposed a 2014 Chico, California ordinance that fines the alarm companies. The alarm organization noted that a similar imposition was ruled unconstitutional in a Fontana, California case (Margulies 2014).

**7. Summary and Conclusions**

This paper considers police response to burglar alarms, which is a public good if an actual or attempted burglary exists, and a private good if response is to a false alarm. Whether it is a public or private good is determined only when the service has been provided. The good has an a-priori probability of 1-6 percent to be a public good while 94-99 percent to be a private good. Verified Response (VR) is an efficient method of Public-Private-Partnership in the delivery of the service to deal with the good’s ambiguous nature.

Noteworthy, Lojack provides support to VR since police act only after verification of an actual theft, thereby eliminating or greatly reducing the false alarm problem.

The second contribution of the paper is in measuring the opportunity costs of patrol when responding to false burglar alarms. Conventional wisdom suggests that when police are diverted from their routine activities to respond to a burglar alarm activation, the opportunity cost is zero; instead of riding around, patrol is diverted to alarm response. Past research has demonstrated that changing the allocation of police resources does have an impact on crime. Benson et al. (1991) find that increasing police resources allocated to drug crimes is associated with higher rates of property crime. As police spend more time, effort, and resources pursuing drug crimes the marginal cost of engaging in property crimes falls and property crimes tend to increase. Our empirical findings for SLC support these findings by examining a different type of police resource allocation; when patrol responses to false alarms are reduced, significant time is saved and used instead for patrol response to other police services. This includes faster response to valid burglar alarms, which seem to correlate with reductions in annual burglaries. Both response times and burglaries have fallen in SLC after VR was introduced.

The third contribution of the paper is in explaining why VR type policies are slow to be adopted by cities. A small group facing significant losses from shifting to a VR based ordinance might exert successful resistance by “mobilizing” city council to avoid a change. In principle, this case is similar to lobbing groups that prevent reducing subsidies to farmers, where the social cost to society is higher than the value of jobs saved. When the federal government imposed a restriction on importing Japanese cars, prices of both Japanese and American manufactured cars increase. The benefits are concentrated in some additional automobile industry employment and probably higher incomes for their workers and owners while the costs are thinly spread on the buyers of cars. Public Choice theory explains the persistence of these programs by pointing to the significant benefits to a relative few while the costs are dispersed thinly over a much larger population. The incentive to resisting such a program is small for the large paying group and high for maintaining the program by the small benefitting group. In the case of alarm response, constituents are also unaware of the real opportunity costs of delayed police response to other calls, and the costs associated with existing false alarm response are spread thinly over the entire community. However, the added costs for private response are well recognized by the repeat alarm activators and especially the alarm companies.

The SLC community in the post 2000 era ordinance enjoys faster dispatch and police response time to both priority 1 & 2 calls. If police respond to an actual burglary and capture criminals, the entire community benefits both from the reduction in the pool of burglars and from punishing lawbreakers.

The example of VR in SLC resolves the ambiguity of the public or private good nature by requiring physical private response or internet connected cameras and smartphone verification to the activation, followed by police response only if an actual or attempted burglary occurs. The experience of SLC shows that VR appears successful, long lasting and a suggestive policy to other communities.

The reduced response time also provides a public good if it deters future burglars from attempting a burglary even if they do not catch one, assuming no displacement of crime. The perceived cost of committing a burglary rises as response time decreases. The marginal benefit of the burglary falls because expected time to burglarize goes down and the marginal cost of the burglary goes up as the probability of apprehension increases. This is consistent with the experience of Salt Lake City, as response time has decreased over time so has the number of burglaries.

Adoption of VR has and will reduce both the usage of burglar alarms and the purchase of new systems since the subsidization of alarm activators stops. Free or below cost responses to false activations artificially encouraged purchase and use of alarm systems.

Noteworthy, providing police responses at no charge for most alarm activators reduces the incentives for alarm owners to install technologically updated systems. Indicative of this is the much older age of alarm systems compared with other similar electronic devices like smartphones, TVs, and computers. Such subsidization may even reduce the incentive to develop more sophisticated alarm systems that reduce false alarms.

Finally, the problem of response to false burglar alarm activations has generated numerous intuitive solutions by both local governments and the burglar alarm industry. Indeed, communities have adopted a variety of ordinances without significantly reducing the problem. It seems that VR, which relies on economic principles, should be considered for adoption.

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**Table 1**

**Cities with VR and False Alarms**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **City** | **Date VR Implemented** | **False Alarms 1 yr. Before VR** | **False Alarms 1 yr. After VR** | **False Alarms 2 yr. After VR** | **2 yr. percentage change in false alarms** |
| Salt Lake City, UT | Dec, 2000 | 9439 | 898 | 803 | -92% |
| Breckenridge, CO | Jan, 2004 | 738 | 617 | 562 | -24% |
| Broomfield, CO | May, 2004 | 2508 | 2411 | 2334 | -7% |
| Lakewood, CO | June, 2004 | 7111 | 3666(7 mo. of data) | 5979 | -16% |
| Burien, WA | Oct, 2004 | 1041 | 580 | 119 | -89% |
| Milwaukee, WI | Sept, 2004 | 16343 | 662 | 530 | -97% |
| Aurora, CO | Dec., 2004 | 14311 | 13181 | 13180 | -8% |
| Dallas, TX | March, 2006 | 57,307 (all alarms responses) | 31,358 (all alarm responses) |  | -45% (1 yr.) |

**Table 2**

**False Alarm Time Series Data (Salt Lake City)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Permits** | **Police Responses** | **Valid Responses** | **False Alarm Rate** | **Police Response Time Priority 1** | **Burglaries** | **Police Response Time Priority 2** |
| 1995 | 830 |  |  |  |  | 2950 |  |
| 1996 | 1168 |  |  |  |  | 3015 |  |
| 1997 | 1761 |  |  |  | 10:06 | 2911 |  |
| 1998 | 1753 | 10542 | 97 | 0.99 | 10:03 | 2831 |  |
| 1999 | 1780 | 8236 | 23 | 0.99 | 9:02 | 2244 | 10:09 |
| 2000 | 1130 | 9439 | 64 | 0.99 | 12:04 | 2169 | 11:54 |
| 2001 | 750 | 898 | 5 | 0.99 | 11:12 | 2209 | 11:02 |
| 2002 | 580 | 803 | 10 | 0.99 | 5:32 | 2512 | 8:42 |
| 2003 | 470 | 658 | 8 | 0.99 | 4:05 | 2350 | 8:37 |
| 2004 | 507 | 634 | 5 | 0.99 | 4:09 | 2353 | 7:49 |
| 2005 | 540 | 577 | 5 | 0.99 | 4:10 | 2172 | 7:34 |
| 2006 | 640 | 473 | 7 | 0.98 | 4:34 | 2244 | 7:20 |
| 2007 | 591 | 635 | 8 | 0.99 | 4:58 | 2049 | 7:06 |
| 2008 | 937 | 619 | 7 | 0.99 | 4:39 | 2022 | 6:53 |
| 2009 | 640 | 594 | 6 | 0.99 | 4:54 | 2175 | 7:00 |
| 2010 | 604 | 461 | 6 | 0.99 | 4:47 | 2177 | 6:57 |
| 2011 | 774 | 504 | 7 | 0.99 | 4:56 | 1658 | 6:46 |
| 2012 | 631 | 391 | 6 | 0.98 | 5:21 | 1824 | 7:00 |
| 2013 | 487 | 323 | 4 | 0.99 | 5:30 | 2005 | 7:31 |
| 2014 | 775 | 420 | 4 | 0.99 | 4:42 | 1691 | 7:53 |
| 2015 | 751 | 307 | 3 | 0.99 | 5:53 | 2018 | 8:15 |
| 2016 | 1319 | 350 |  |  | 6:08 | 1727 | 8:13 |

**Table 3**

**Gains and Losses to the Affected Groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Groups in the City** | **Cumulative** **Gain (+) Loss (-) to** **Group****Inc. Subsidy****(2000)** | **Cumulative** **Out-of-Pocket to Group****(2000)** | **Cumulative****Gain (+) Loss (-) to Group Inc. Subsidy****(2002)** | **Cumulative Out-of- Pocket to Activator[[9]](#footnote-9)** **(2002)** |
|  | **Before** | **Before** | **After** | **After** |
| **Non-Activating Alarm Owners and Non-Alarm Owner[[10]](#footnote-10)** | -$8.19 |  | +$0.89 |  |
| **Alarm Company** | + |  | -$5,411 |  |
| **5x repeat False****Activators[[11]](#footnote-11)** | -$100 |  | -$175 to –-$1,225 |  |
| **Average Alarm Owner Gain** | $42.72 |  | -$61.52 |  |
| **Alarm Owner Accumulated Gain (loss) by Number of False Activations:** |  |  |  |  |
| **1** | +$60 | $0 | -$35; -$75 | -$35;-$85 |
| **2** | +$120 | $0 | -$70; -$170 | -$70; -$220 |
| **3** | +$180 | $0 | -$105;-$265 | -$105; -$445 |
| **4** | +$240 | $0 | -$140;-$360 | -$140; -$790 |
| **5** | +$200 | -$100 | -$175; -$455 | -$175; -$1050 |
| **6** | +$160 | -$200 | -$210; -$550 | -$210; -$1650 |
| **7** | +$120 | -$300 | -$245; -$645 | -$245; -$1850 |
| **8** | +$80 | -$400 | -$280;-$740 | -$280;-$2250 |
| **9** | +$40 | -$500 | -$315;-$835 | -$315;-$2965 |
| **10** | $0 | -$600 | -$350; -$930 | -$350; -$3400 |
| **11** | -$40 | -$700 | -$385-$1025 | -$385;-$3835 |
| **12** | -$80 | -$800 | -$420;-$1120 | -$420;-$4270 |

**Table 4**

**Before-After Winners and Losers per Year**

|  |  |  |  |
| --- | --- | --- | --- |
| **Group** | **Before** | **After** | **Net Gain/Loss**  |
| **Non-Alarm Owners**  | -$8.19 | +$0.89 | +$8.19 |
| **Average Alarm Company[[12]](#footnote-12)** |  |  | -$5,411 |
| **Average Alarm Owner** | +$42.72 | -$60.52 | -$103.24 |

Table 5

Control Variables for Alarm Response Synthetic SLC and Actual SLC

|  |  |  |
| --- | --- | --- |
|  | Treated | Synthetic |
| Number of free police responses | 4 | 3.529 |
| Population | 175901 | 176258.3 |
| City Police Officers | 404.33 | 405.191 |
| Unemployment Rate | 3.2667 | 3.927 |
| Income Per Capita (2015 $) | 37421.51 | 37415.42 |
| 2000 Alarm Responses | 9439 | 9448.33 |
| 1998 Alarm Responses | 10542 | 9837.8 |

Table 6

Cities used in Donor Pool to Construct Synthetic SLC for Alarm Response

|  |  |
| --- | --- |
| City | Weight used to construct Synthetic SLC |
| Fayetteville, NC | .216 |
| Honolulu, HI | .102 |
| Asheville, NC | .563 |
| Leawood, KS | .023 |
| Orlando, FL | .096 |
| Evansville, IN | 0 |
| Irvine, CA | 0 |
| Greensboro, NC | 0 |
| Stockton, CA | 0 |

**Table 7**

 Control Variables for Burglary Synthetic SLC and Actual SLC

|  |  |  |
| --- | --- | --- |
|  | Treated | Synthetic |
| Number of free police responses | 4 | 3.529 |
| Population | 175901 | 176258.3 |
| City Police Officers | 404.33 | 405.191 |
| Unemployment Rate | 3.2667 | 3.927 |
| Income Per Capita (2015 $) | 37421.51 | 37415.42 |
| 2000 Burglaries | 2169 | 2172.342  |
| 1998 Burglaries | 2831 | 2834.946  |

**Table 8**

**Weights used to construct Synthetic SLC for Burglar Alarms**

|  |  |
| --- | --- |
| City | Weight used to construct Synthetic SLC |
| Fayetteville, NC | .017 |
| Honolulu, HI | .003 |
| Asheville, NC | 0 |
| Leawood, KS | 0 |
| Orlando, FL | .236 |
| Evansville, IN | .412 |
| Irvine, CA | 0 |
| Greensboro, NC | .061 |
| Stockton, CA | .272 |

**Figure 1\***

VR Ordinance Dec. 2000

\*Simple correlation coefficients between False Alarm Responses and Priority 1 & 2 is 0.77, and 0.74 respectively

Figure 2\*\*

\*\* Simple correlation coefficient between false alarm response per patrol officer and priority 1 response time is 0.77.

Figure 3\*\*\*

\*\*\* Simple correlation coefficient between priority 1 response time and number of burglaries is 0.40.

Figure 4



Figure 5



1. Erwin A. Blackstone, Simon Hakim, and Brian Meehan. Drs. Blackstone and Hakim are professors of Economics and members of the Center for Competitive Government at Temple University, Philadelphia, Pennsylvania. Dr. Meehan is Assistant Professor of Economics at Berry College, Campbell School of Business, Berry, Georgia. For email contact hakim@temple.edu

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2. These costs do not include program management, billing, or court costs. [↑](#footnote-ref-2)
3. These are the communities, which were able to provide us with the requested data. Data were obtained directly from the police departments. [↑](#footnote-ref-3)
4. Las Vegas was the first to implement VR in 1991 by a change in police policy. However, the next police chief could easily change the policy and accordingly may not attract as much attention and resistance from the adversely affected electronic alarm industry. This analysis focuses on SLC because of the quality of data provided by the city. Similar data were not available for Las Vegas over this period. [↑](#footnote-ref-4)
5. From 2007 on, introduction of GPS to patrol cars is probably partly responsible for the low response times. The data on the number of patrol officers that respond to emergency calls may have been lower than we observed in the annual budgets for SLC. Some patrol officers operate on bikes and some specialized units which are included in patrol but do not respond to alarm calls. Thus, our observations are more conservative (interview with SLC police executive, November 13, 2017). [↑](#footnote-ref-5)
6. To be conservative, we are using the cost for police response of $60 for the entire period. Therefore, we are understating the savings to SLC for recent years. [↑](#footnote-ref-6)
7. Our analysis is based on alarm permits. Since no penalty exist for not registering an alarm system, some may choose not to register their system. However, the issue of not registering existed through the entire period. [↑](#footnote-ref-7)
8. We do not use all of the pre-treatment data on burglaries and alarm responses, in accordance with the suggestions presented by Kaul, Kloβner, Pfeifer, and Schieler (2015). [↑](#footnote-ref-8)
9. The out-of-pocket cost refers just to the false alarm activators. The cells provide the cost of

just the private response company and the cost when both police and the private company respond. Clearly, the latter is the maximum possible out-of-pocket cost. [↑](#footnote-ref-9)
10. This category includes also alarm owners that do not falsely activate their system. [↑](#footnote-ref-10)
11. In 2000, a five times false activator a year paid $100 on the 5th activation. Under the new ordinance enacted at the end of 2000 the same activator paid $35 for each activation to a private response company ($175) plus the maximum of $1225 in case that police responded as well to all activations. [↑](#footnote-ref-11)
12. We subtracted from the expected number of installations in SLC assuming no change in ordinance the actual number of installations to determine the number of lost installations attributed to the new ordinance for each year 2001 through 2015. Then we multiplied the number of lost installations by the annual incurred profits and summarized the profits for all 15 years, 2001 through 2015 and divided it by 15 in order to obtain the average

annual per installer lost profit of $5,411. [↑](#footnote-ref-12)