Congestion in Delivery of Emergency Services in Urban Areas: The Case of Police Response to Burglar Alarms

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ABSTRACT

Urban governments and in particular large cities face an increasing demand for emergency services. These services have both public and private attributes. If the call for service is real then public involvement but not necessarily provision is justified. However, in case of a false incident it is a private good, and the efficient solution involves market provision. Whether the service is indeed public is unknown until the service is actually delivered. This attribute of this newly defined public good suggests a public private partnership to deliver the good in a socially efficient manner. This solution differs from existing practices.

The emergency service analyzed in this paper is police response to burglar alarms. Such response comprises twenty percent of police efforts. Further, 94 to 99 percent of the burglar alarm calls for service are false. They are thus essentially a private service. This paper suggests an initial private response to an activation followed by police response if an actual burglary is evident. The private response portion in most areas can be provided competitively.

1. **Introduction**

Urban Governments throughout both North America and Western Europe, including in particular Great Britain, experience congestion on both their 911 systems and in police response to emergencies. Government provides most emergency services for equity and/or efficiency reasons. Society chooses for equity reasons to make rescue from life threatening situations generally available so that the poor cannot be denied assistance. Market prices would often be too high to be afforded by the poor. In the case of ambulance, hospital emergency, or Coast Guard services the threat is mainly to human life while in the response to burglar alarms it is invasion of property rights and possibly violent incidents.[1] In the case of fire protection the public interest lies in preventing the spread of fire, a negative externality that threatens both lives and property. Government has usually subsidized these services so prices are below market levels in order to make the service affordable to all. As a consequence, individuals may abuse the system and claim they have an emergency in order to obtain the public service.

This paper discusses the problem of congestion in 911 emergency services that is prevalent in large metropolitan areas. Emergency services often have both private and public attributes. We introduce a new type of public good whose attributes dictate a mixed delivery by public private partnerships. We show that society's welfare could be improved by shifting some production and financing responsibilities to the private sector where competition for delivery prevails; in some cases government can effectively compete with private providers.

The analysis is applied to police response to burglar alarms. Response to false alarms causes congestion on the 911 lines, reduces police response to real and serious events, imposes cost on police, and increases the threat of accidents from rapid police response. The false alarm problem is particularly acute in large cities where the police are already burdened with much crime and where the absolute number and growth of alarm ownership yields a large number of false activations. In Philadelphia, for example, in 2000 only 3,022 out of 140,604 alarm responses involved actual or attempted burglaries. For panic alarms, 430 responses out of 18,247 were bona fide robberies. On the average each Philadelphia system was activated twice compared to 1.3 for the U.S. as a whole, suggesting that the false alarm problem is most serious in

[1] In about 4. percent of all break-ins an assault occurred (Hakim and Blackstone, 1997: 82).

large cities. Further, other crime tends to be more prevalent in large cities, implying that their real cost for alarm response is probably greater.

To determine an efficient provision of response to requests for emergency services, including alarms, requires understanding the nature of the service. Since government delivers the service, it is helpful to discuss the theoretical evolvement of public goods. Samuelson (1954) was first to identify a "pure" public good. Such a good may not be produced at all or in non-optimal amount under free market conditions. However, the good can provide net social benefits and only government which represents the public interest would supply the optimal quantity. It is very costly or even impossible to exclude any one from consuming a public good, and each and every person consumes the full amount of the output. Without government forcing all to share the cost, each person would have a strong motive in becoming a "free rider" or to pay less than the socially optimum amount. Thus, there is essentially no alternative but for government to take responsibility for the supply of public goods. Clearly, however, government does not need to produce the good and could let that be done under competitive market conditions.

The assumptions necessary to classify a good as a pure public good are seldom completely met in reality. For pure public goods the size of the interacting group is the entire society, and the entire supply is commonly consumed. If either or both the requirements of non-exclusion and non-rivalry fail to be met then it falls into the general category of an impure public good. These impure public goods incorporate the notion of congestion cost or excludable benefits. Unlike pure public goods, a larger number of consumers may cause congestion in the consumption of impure public goods. Examples include swimming pools, tennis clubs, golf courses, and highways. (Cornes, and Sandler, 1986: 4).

Buchanan (1965) and Olsen (1965) elaborated on Samuelson's work by defining a more narrow type of impure public good that is frequently found in local communities. In the case of Buchanan's Club good, the entire supply is commonly consumed; however, the size of the interacting group is small. The level of individual benefits decline with the size of the population and the distance from the source of supply.

Another "variant" public good that is similar to a Club good is the local public good. It assumes congestion but does not incorporate excludability for the population within the jurisdictional level. Examples include local schools,

public libraries, or public parks. Police patrol that provides an "umbrella" of security to the community can also be classified as a local pure public good.

Buchanan's and Olsen's definition of Club good assumes that consumers travel to a defined geographical area where the service is provided. However, a "variant" local public good can also be provided at the consumers' own location as long as the two assumptions of excludability and congestion are satisfied. For example, patrol officers educating children at their schools about the dangers of illegal drugs are still providing a local public good. This is a public responsibility since significant externalities exist.

Local governments often provide emergency services because of life threatening conditions and/or a significant level of externalities. In case of a major disaster, like an earthquake, emergency services need to be in place in order to serve the general population. Emergency services include fire protection, police response to alarms, stray animals, gas odor, and ambulance services. The Coast Guard, a federal agency, provides quasi-local services to stranded boaters. These are all local rather than pure public goods since congestion occurs, and residents in other adjacent localities are excluded from enjoying the services. Government provides these services because of their significant externalities and potential life threatening conditions.

Emergency services are distinctively different in one important aspect from local and "variant" public goods. The output of both local and the "variant" local public goods is *a priori* certain at a high probability level. Emergency services have a common attribute; it is unclear whether a real emergency exists at the time service is requested and the emergency crew is sent out. Only when the service is actually rendered does its "emergency" nature become known. For example, poor people without medical insurance often arrive for emergency treatment at expensive hospital emergency rooms where service can normally not be denied even when it turns out to be a non-emergency situation. Indeed the service is often delivered before its emergency status is known. Public ambulances are also often dispatched for what turns out to be non-emergency events. The case of police response to burglar alarms is another example. When police are dispatched it is *a priori* unclear whether a real break-in has occurred. Only after the officers actually provide the service is it known whether an actual break-in is in progress or has occurred. Hence, in all these cases of emergency services, the probability of a real event is less than one. For example, in the case of police,

ex ante response to false alarms will be shown to be a public good at a probability level of at most 6 percent.

In case of a real event, public intervention can be justified. However, in case of non-real event, public financing or intervention is unwarranted. When a real break-in occurs, the public interest requires that police attempt to catch the burglar. Apprehending burglars diminishes the pool of burglars and reduces the probability that others will become victims of burglary. Apprehension also has a deterring effect by raising the cost of criminal activity, and thereby may even reduce the future supply of burglars.

When a false alarm occurs it is a private good and government intervention is unjustified. If a water pipe in the home breaks, it is obviously an emergency; however public intervention is not warranted. Similarly, when an alarm is falsely activated, no one else in the community derives any benefit from the response to the false alarm.

2. **The false alarm problem**

False alarms are a significant problem in all emergency services. For example, 53 percent of 911 calls in Atlanta during 1997 were of a non-emergency nature and added to the congestion on the system (FCC Docket on Assignment of 211: 7). During the year 2000, Philadelphia police reported that 96 percent of their responses to fire alarms, 97 percent for robbery alarms, and 75 percent of medical alarms were of a non-event nature.[2]

We chose police response to alarms as a case study for all emergency services. Alarm systems are purchased from alarm dealers. Dealers sign up the alarm owner for monthly monitoring by a central station. Large dealers usually have their own central station while smaller dealers contract out monitoring to central stations that serve customers of many dealers and enjoy economies of scale.

When an activation occurs, a signal is sent to a central or monitoring station. The central station is supposed to verify whether an intrusion or attempted intrusion occurred. In case of a suspected real event, the protocol is for the central station to request police response. In most situations two officers respond in one or two vehicles. More than one officer is required

[2] Material provided by the Bureau of Administrative Adjudication for Philadelphia P.D. for all alarm codes.

because of the possibility of a violent confrontation if the burglar is on site. Further, most police departments will not accept a central station's cancellation of the request for police response once the police have been dispatched.

The problem is that 94 to 99 percent of all activations are false. For example, DeKalb Georgia police in 2000 found that only 39 out of over 144,000 alarm calls were actual or attempted burglaries (SDM, January 2001:51). In Seattle Washington 97.5 percent of 30,000 police responses to alarm were false and only 40 burglars were actually apprehended. Chicago Police annually respond to over 300,000 activations, 98 percent of which are false. The corresponding figures for West Palm Beach, Florida are 66,000 and 99 percent (Kern, November 2000: 43).

Alarm ownership increases annually by eight to ten percent, yielding an almost identical rise in false activations. Seventy-six percent of false alarms are caused by subscriber error, ten percent by equipment malfunction, and the remaining fourteen percent by weather or telephone problems. On the average, each system activates falsely 1.3 times a year. The commercial rates are three times the residential rate. Banks, schools, and municipal facilities falsely activate seven to ten times the residential rate (AIREF, 1999: 10).

The cost of responding to false activations is substantial. The cost includes the value of the time spent by one or two officers in one or two vehicles. Additional cost items include the time spent by the dispatchers, vehicle costs, and the expected cost of accidents attributed to the response required under mainly emergency situations. Indeed, police officers in Topeka, Kansas; King County, Washington; and Calgary, Canada died in the late 1990s in highway accidents while responding to false alarms. Administrative costs include supervision and data management by police and possible court costs. For example, Seattle Police Department's calculation adjusted for overhead cost yields a $52 average cost per response in year 2000.[3] Further, communications costs of false alarms for the 911 systems are substantial. For example, Seattle, Washington in 2000 incurred $303,237 just to process 911 alarm activations calls.[4] Table 1 illustrates the cost of false alarms for a sample of communities.

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[3] Seattle's calculation were direct police labor ($32.41) + 911 communicator ($10.24) + adjustment for capital and overhead costs ($9) equals $52 per response.

[4] Information obtained from the alarm coordinator for the Seattle Police Department, March 22, 2001.

The cost of patrol officers is a partial indication of the significance of the false alarm problem. Portland, Oregon estimated in 1998 that the equivalent of 45 full time officers responded to false activations. Winston-Salem, North Carolina utilizes the equivalent of 7 officers, Philadelphia 52, and Los Angeles 100. Nationwide, most communities claim that ten to twenty percent of police resources are devoted to false alarm activations. In fact, false alarm calls for police response comprise ten to twenty percent of all calls; for example, in 1998 in Ft. Lauderdale the percentage was 14.7; in Redmond, Washington 12.4; and Coral Gables, Florida 10.3, and in Palm Beach County, Florida the percentage was especially high, 23.6. In West Palm Beach, Florida, alarm calls comprised as much as 25 percent of patrol duties.

Not surprisingly, police responding to mainly false burglar alarms apprehend relatively few burglars. Consequently the cost per arrested burglar is high. In Seattle as a result of alarm activations in year 2000 the cost was $38,500 for each of the 40 apprehended burglars. Such a high per burglar cost raises the issue that the social benefits of alarm response may well be less than the costs. However, some police departments set a low priority for patrol response to alarms. This policy reduces the chance of apprehending burglars.

The cost of false alarms rests on police departments and over time the problem is becoming more acute since police budgets rise at less than three percent annually while false alarm response rises by almost ten percent. Hence, police need to divert patrol officers from security activities that benefit the community, a public good, to serve alarm owners who falsely activate their systems, which we argue, is a private service. Furthermore, officers who are trained to handle crisis situations are expecting to confront a burglar and instead deal with a non- event.

Table 1
Calculated Cost of False Alarms

CITY	YEAR	NUMBER OF FALSE ACTIVATIONS	CALCULATED COST	TOTAL COST	REFERENCE
(1)	(2)	(3)	(4)	(5)	(6)
Nationwide	2000	36 m	$50	$1.86+	Security Sales, 2001, Vol. 22 No. 12 P.8.
Philadelphia, PA	1995	147, 074	28	4.3 m	Hakim and Blackstone, 1996 Percent false 97.4%.
Dade County, Fl.	1995	121, 717	24	2.9 m	Hakim and Blackstone, 1996.
Reno, Nv	1995	11,185	72	0.8 m	Hakim and Blackstone, 1996
Phoenix, Az	1995	47,075	73	3.4 m	Hakim and Blackstone, 1996.
Salt Lake City,	1999	8,213	60	0.5 m	Material supplied by Salt Lake City.

3. Practices to solve the problem

Police departments across North America, Great Britain, and elsewhere struggle with the false alarm problem. Municipal governments have experimented with their ordinances to try to reduce the problem. Ordinances have been adopted that increase and escalate fines for repeat activators, cease response after a certain number of false activations in a calendar year, require education of chronic false activators, mandate registration of alarm systems, and require dispatching calls to use 900 lines.
Some ordinances have even deceased fines. No study has been conducted to evaluate the relative effectiveness of the numerous policies. Such research would lead to a social cost-benefit calculation for each policy/practice to determine the most appropriate alarm ordinance.

A common practice is to increase fines and also to introduce an escalating fine structure for multiple false alarms during a given time period, typically one year. Beset with a large number of false alarms, Clearwater, Florida in 2000 increased its false alarm fine from $30 to $50. New Orleans assesses a fine of $25 for the sixth false alarm in a year with increases to $75 for the fifteenth. Itasca, Illinois charges $75 for the fourth and escalates to $750 for the tenth. Montgomery County, Maryland assesses as high a fine as $4000.

Communities normally allow some free false activations before fines are assessed. The rationale is that alarm owners ought not to be penalized for equipment malfunctions or user error unless the problem occurs often. Montgomery County, Maryland is fairly typical in its allowing three free false alarms in a calendar year. New Orleans allows five such activations. However, Seattle, Washington charges $50 from the first false alarm.

Some experimentation with ordinances to reduce the false alarm problem has involved lowering false alarm fines. Beaumont, Texas stopped charging for false alarm response in December 1977 and instead substituted a $50 charge for reinstatement, which meant that police officers would resume response. Under the new ordinance, officers would respond to eight alarm activations in a year at no charge but then would cease response until a $50 reinstatement fee was paid. An additional false alarm would require a $100

reinstatement fee to once again obtain police response. Under the former ordinance, a fine of $50 was assessed for both the seventh and eighth false activations. The new ordinance has led to an increase in the number of false alarms, a reduction in the revenue obtained from alarm response, and an increase in the number of locations on no- response status from 19 in 1998 to 76 in 1999 (Zarazua, 2000). Similarly, Bartow, Florida in November 2000 was considering increasing the number of free alarms from two to three and reducing the maximum fine from $500 to $250. It was also considering the elimination of fines for those who repaired their malfunctioning alarm systems (Kern, 2000: 43).

Municipalities sometimes assess different false alarm fines for residential and commercial establishments. Commercial establishments have a higher propensity for false alarms, have usually greater ability to pay, and are often required by insurance companies to purchase and operate an alarm system. Commercial establishments are thus more likely than households to pay fines, even if they are high, to maintain continued police response. Irvine, California, for example, fines commercial establishments twice as much as residences. The maximum fines in Montgomery County, Maryland for residences and commercial establishments are, respectively, $1000 and $4000.

Some ordinances are confusing and complicated and make compliance difficult. Confusing ordinances diminish the deterrent effect for alarm owners and confuse dealers who typically operate in many localities. For example, in Vancouver, British Columbia charges for false alarms begin with the fourth, which is $75 for residential, $125 for commercial, and $250 for large commercial users. The fifth through the seventh in a calendar year are then free, but the eighth false alarm is twice the fourth or $250 for commercial alarm owners. Obviously, such a cumbersome structure has limited deterrence effect and serves to confuse all involved. Palm Beach County, Florida charges different registration fees for alarm owners depending upon the total false alarm experience of the dealer from whom the alarm system was obtained. Alarm consumers would have to base their purchase decision on the seemingly unknowable future false alarm experiences of the dealer's other customers. The intent obviously is to provide the dealer with a strong incentive to reduce false alarms. However, such a practice is unfair to careful alarm owners who happened to contract with a dealer that serves other repeat activators.

Registration of alarm systems is also used by municipalities to reduce the number of false alarms and to pay the fixed cost of maintaining the alarm unit, usually within the police department. The normal practice is for the municipality to charge an annual registration/permit fee of between $10 and $50 for the privilege of having an alarm system. Southlake, Texas, for example, has an ordinance that requires annual permits of $10 for residences and $20 for commercial establishments but permits are not required for residents at least 65 years old (Kern, 2000: 43). Permits can be revoked or a policy of no response adopted after five false alarms in a calendar year. Nassau County New York requires a permit in order to have police response to an alarm (SDM, 2000: 28). Port Hueneme, California adopted in 2000 a differential fee structure for permits for residential and commercial alarm systems. The city expects to collect sufficient revenue to increase the number of patrol officers and to reduce the number of false alarms (SDM 2000: 28). Similar to the fine situation some cities like Chicago require only businesses to obtain alarm permits.

Registration of alarms involves substantial resources and is often difficult to achieve. In Redmond, Washington in 2000 only 1200 alarm systems were registered out of an estimated total of 12,000 (SDM, 2000: 28). Registration in Redmond has been unsuccessful even though the police will not respond to activations at unregistered locations.

Non-response to repeat alarm activations is also used to reduce their number. New Orleans police will not respond to burglar alarms for repeat violators, defined as more than 20 in a year. In 2000, 280 locations with alarms were on the Department's list for no response (Philbin, 2000: Metro, p.2). Seattle, Washington, which suspends response after six in a twelve-month period, typically has between 8 and 50 locations on a no response policy (AIREF 1999: 88). Irvine, California suspends response after the seventh false activation in a year. Kenner, Louisiana police do not respond to business alarms during daily peak false alarm periods. They also do not respond to business activations during very intense thunderstorms, which typically cause sensitive systems to activate falsely (Hyman, 1999: Metro, p. B1).

Non-response is a serious problem for the industry, since alarm owners will either stop using their systems and consequently stop paying for monitoring of their systems and/or non owners will be reluctant to purchase a system. High fines could lead to the same result. Toronto, Ontario in 1996 started assessing high ($77) fines from the first false activation and ceased

response after the fourth. Private response quickly developed to cover over 90 percent of the systems in Toronto.

Education of consumers and sometimes dealers, is also used to reduce the number of false alarms. The rationale is that user error accounts for 76 percent of false alarms and also that about 20 percent of users account for 80 percent of false alarms. West Palm Beach, Florida residents on their third false alarm can pay a $250 fine or attend alarm school. The one-hour class is designed to show the attendees the magnitude of the false alarm problem and to provide repeat activators with suggestions on how to reduce such activations (Kern, 2000: 43). New Orleans police have had a seven-hour class for alarm companies deigned to reduce their false alarms. The Department also loans videos to alarm system owners on how to reduce false alarms.

The Fort Lauderdale, Florida police have been especially active in educating consumers and dealers. The police department's alarm coordinator had a meeting to which 250 alarm companies were invited while only 23 sent representatives. The purpose of the meeting was to focus effort on those alarm owners who had the largest number of false alarms in 1998. The attendance of less than ten percent of the alarm companies indicates lack of interest for the program. However, one alarm company with a large percentage of the false alarms in 1998 did attend and even assigned a technician to work with the police department's alarm coordinator. The coordinator, along with an alarm industry representative, visited alarm owners who had the greatest number of false alarms. One automobile dealership reduced its false alarms from 100 per year to none. Overall the education efforts have reportedly reduced false dispatches by 8 percent (AIREF, 1999 48).

The alarm industry established two programs to work with police departments to reduce false alarms. The above Fort Lauderdale effort was part of the second program, the Model States Program, towards which the industry contributed over $900,000. The alarm industry also developed and provided municipal officials at no charge software using dealers' databases with their current information on alarm owners and their addresses. This information is thought to be helpful to the police in updating their database to better conduct their enforcement activities.

An effort directed at dealers occurs in Toronto Ontario where police impose the false alarm fines on the alarm dealers who then have to charge

their customers or absorb the fines themselves. This reduces the transactions costs for the police who are now involved with only 70 companies instead of thousands of alarm owners. The dealers are challenging the police department practice in court. Making dealers responsible for collecting fines and then suspending police response to all the customers of the non-compliant dealer is strongly opposed by the industry.

Another practice that has also been strongly opposed by the industry is requiring calls for police response to alarm activations to be made on 900 lines. Riverside County, California enacted ordinance number 753 which mandated such a policy. The ordinance was to become effective on August 5, 1996. All calls had to be made on the special 900 lines with an automatic $5 charge to the central station. The alarm industry secured an injunction preventing enforcement of the ordinance on the ground that requiring crime victims to pay to report a crime and request assistance violated the due process and equal protection provisions of the Constitution (California Alarm Association, 1996).

Finally, the alarm industry as represented in its Model States Report supports allowing physical response by police to be cancelled if the central station learns after dispatching police but before police arrive at the location that the alarm is indeed false. It further supports strong enforcement of the alarm ordinances, registration of alarms, and reasonable and escalating fines. It encourages suspension of response for non-payment of fines or for exceeding the maximum number of allowed false alarms, verification of all alarms by central stations, and education of alarm system owners.

4. Evaluation of Current practices

The above practices may produce a reduction in false alarms. For example, not responding to alarms for repeat activities obviously reduces false alarms. Targeting repeat activators for intensive education may work short term as well. However, such programs and policies may reduce the perceived and actual level of security, since owners may not arm their systems. Such punitive policies may not be socially efficient; the social cost of reduced security may be greater than the social benefit of reduced false alarms and the resulting cost of police response. These policies also may not account for the public good portion of alarm response, namely, the benefits of apprehending burglars.

The alarm industry claims that response to false activations is a normal police function, a public good. In essence, the industry disputes both the private nature of response to false activations and the related argument that such public police response is socially inefficient.

The basic problem is that no one except the police has an inherent interest in solving the problem. The alarm owner on the average falsely activates her system 1.3 times a year. Since most communities allow three false activations a year, alarm owners usually incur no charges.

Alarm dealers view police response as a gift to their business. They sell a system, charge monthly fees for monitoring the alarm system, and when necessary, obtain police response that is essentially paid for by the general taxpayers. Dealers consider false activations to be an issue merely between the police and the customers. There is also little apparent interest by individual dealers to spend resources to solve their own customers' and the communal problem. The latter is the regular "free rider" problem. Individual dealers view their private cost of reducing their customers' false activations to be greater than their private benefit. Thus, dealers and the alarm associations contest police efforts to cease response, except for non-payment or for repeat activators. They also object to shifting responsibility for their customers' fines to them or to the central stations. The alarm industry prefers that police rather than private companies respond because police response usually makes their product less expensive to customers and thus more appealing. Increased fines for more alarm system

owners will also reduce the purchase of new systems. It is quite ironic that private industry prefers government intervention in the marketplace rather than allow new forms of business, companies offering alarm response, to develop.

Central stations are supposed to verify that an actual intrusion took place and only then to dispatch to the police. However, suppose that a call is verified as false, but a real break-in did indeed occur. In such a case, the central station is liable for breaching its obligation and is likely to suffer negative publicity with perhaps sizable liability suits. Indeed, the central station bears no cost for dispatching police to a false activation while the cost could be high for not dispatching to a real event. Hence, the central station dispatches the police even when the probability of a break-in is extremely small. Sometimes the central station determines that the call was false after the signal was dispatched for police response. Central stations then attempt

to cancel police response. However, police most often do not accept cancellation after they have been dispatched. Cancellation with its added calls itself adds substantial cost to the 911 system. For example, Seattle Washington incurred $97,000 in 2000 for processing cancelled alarm calls.

The alarm associations with a broader view of the just industry realize that the false activations will eventually mean deteriorating business for dealers and central stations. Indeed, the industry has tried to solve the problem. However, the associations as part of the industry would like the police to maintain their free service that benefits their constituents, and in any case the associations have limited influence on their members to curb false activations.

The intuitive practice of ceasing response is economically inappropriate. Suppose that a person has a habit of slamming the garage door and breaking it. As long as the person pays the bill, the repair company will send technicians to repair the damage. No company will deny response after a certain number of calls. The more calls, the better it is for the garage door repair company. In the same vein, there is no reason to deny response to false activations as long as the violator pays the full cost, where no one else is made worse off. The socially efficient solution requires that price reflect the social cost of response.

There is also no reason to cease response during peak alarm periods. The charge should simply be higher, reflecting the straining at capacity. After all, garage door companies still respond when business is booming as long as the customer pays the required charge. Similarly, the police should not decide arbitrarily when to provide services. The socially efficient solution requires response at all times as long as social costs are recovered.

Police often charge higher fees for commercial establishments than for residences, and they normally exempt municipal facilities from charges. Businesses pay higher fees because their demand for response to alarms is more inelastic than is the demand by households. In addition, business owners are often non-residents so that local politicians view them as a desirable source of revenue. Since prices are not cost based, price discrimination is occurring, a practice common under monopoly conditions and often not socially efficient.

Sometimes the public good aspect of alarm response is ignored. Toronto, Ontario police charge for all responses to burglar alarms including

actual events (Hyman, 1999: Metro, p. 81). The probability of catching a burglar and benefiting the community means that the price in the event of an actual or attempted burglary in Toronto is in excess of the correct price. When an activation involves a real or attempted burglary, social efficiency and equity principles suggest that no charge should be imposed.

Local ordinances sometimes impose high charges to discourage false activators. It seems intuitively correct but punitive action causes a misallocation of resources. If the charge is higher than the real cost to the police department, some households and businesses will refrain from buying alarm systems and some owners will not activate their systems. Society will then suffer from a lower level of security. Pareto optimality conditions require that prices be set at their long run marginal cost. The same is clearly true for charges that are lower than their real cost. In such a case, the purchase and use of alarm systems, and false activations are artificially encouraged beyond their social optimum. In addition, there is unjustified provision of below cost service to some, or cross subsidization, of essentially a private service.

Most communities utilize escalating fees for response to repeat false activations. If the marginal cost to the police remains the same, then again escalating fees will discourage uneconomically the purchase and use of alarms. Evidence indeed suggests that repeat visits to the same address do not impose higher costs on the police.

Repeat activators are often municipal facilities like schools or churches that do not have to pay fines or commercial establishments like banks that pay the fines and consider them as inescapable business expenses. One Illinois bank budgeted $12,000 annually for paying the police for false alarm fees. One Texas church in 1998 had 52 false alarms and paid no fees. In many of these cases prices are divorced from cost because of the monopoly power of police. Free response induces careless behavior and at the same time imposes cost on the police. Schools after all have to pay for electricity; they should also pay for police response to false alarms. Social efficiency requires no subsidization of any users.

Police departments, alarm companies, and associations expend enormous efforts to update police registration records. Alarm dealers and their central stations are normally updated with the correct addresses of alarm owners. However, new alarm owners often do not notify the police about the installation of their systems. Frequently, the address provided at registration

differs from the address to which the central station dispatches the police. Different addresses impose costs on the alarm unit in its effort to charge after police response is provided for false activations. In any event, the police normally respond to a signal whether or not the system is registered and an annual fee was paid.

The purpose of a registration fee is to cover both the administrative cost of maintaining and updating alarm ownership records, and the prosecution cost for unpaid fees. It is almost ritualistic that alarm data be collected, updated, and maintained. We question whether such data are needed. These alarm administration units are growing in size. In Philadelphia the number of workers handling unresolved and unpaid response fees rose in a few years from two to eight. Still, the number of unresolved cases where fines cannot be collected is growing significantly. Registration fees are inefficient and inequitable. They are collected from all alarm owners, including those that are cautious and seldom activate their systems. Thus, careful owners with no apparent justification subsidize alarm activators. In the case of false activations, the users are clearly identified and therefore there is no reason for the general taxpayers or even all alarm owners to pay for this service. Moreover, if the transaction cost of collecting and managing the data exceeds the revenues collected from the fees then it would be desirable simply to incorporate the cost in the response fee.

Government provision of response to alarms has had other undesirable consequences. The police and government in general have treated false alarm violators almost like criminals instead of as customers of a service. For example, Pennsylvania State law makes false alarms in excess of three a summary criminal offense with a fine of $300. (Security Sales, 2000: 24). The ordinances are designed to "punish" those who falsely activate their systems. It is even conceivable that alarm activators could be arrested and handcuffed.[5] Let us return to the example of the person who breaks his garage door, discussed previously in this section. Under market conditions there is no punishment involved. The repair or user's error is merely a market transaction that depends upon the forces of supply and demand. The same principle should be applied to alarm response; charges for response by police should reflect cost and involve no punitive aspect.

[5] A 2001 U.S. Supreme Court decision permits the arrest f those charged with even a summary of offense punishable by a small fine. See Linda Greenhouse, "Dividend Justices. Back Full Arrest on Minor charges," New York Times, April 25, 2001, p.A1.

Even if we accept a punitive function for false alarm fines, the price inelasticity of demand for response precludes any significant reduction. A successful policy to reduce false alarms requires a price elastic demand. However, evidence suggests that high fines have a very limited effect. For example, Jeffersontown Kentucky in 1999 increased fines from zero to $95 for the third and much more for subsequent false responses. Yet, the number of false alarms for the same period in 2000 decreased by only two percent. (SP&T News, 2001: 21). Similarly, New Orleans Police expected that stiff false alarm penalties would yield a 30 percent reduction in false alarms. However six months into the higher penalties, false alarms decreased by only 5 percent (Times Picayune, 2000: B6). Therefore, high fines that are in excess of cost are the wrong policy unless the intention of the fines is merely to punish activators or to raise revenue from a "secure" source. Clearly, since alarm activities yield negative net revenues, the latter objective is not being met.[6]

Cumbersome ordinances like the previously mentioned Vancouver example cause unduly high transaction and administrative costs to police, the alarm industry, and alarm owners. The purpose of these ordinances is to deter false activations. However, alarm owners are often unaware of the details of these complicated ordinances so that the deterrence effect is lost. Alarm companies usually monitor systems from many communities; the different ordinances and practices by police departments make their efforts to control false activations difficult. One advantage of such programs as the Model States is to encourage development of more uniform ordinances. If the ordinance obeys economic principles and improves economic efficiency, it could be desirable. Finally, police have provided only one quality of service: consumers of alarm response do not enjoy the choices that consumers normally have under free market conditions. They can not select the quality of response and its associated price that maximize their utility. Consumers have lacked the empowerment that normally comes from the competition of multiple providers.

When police respond to false activations, non-alarm owners and alarm owners that are careful about their systems subsidize the profligate. There is no justification for such cross-subsidization. Since the cost of false alarms is imposed on the police and thereby the community, there is no justification for

[6] In most communities funding for the alarm unit is part of the general ledger. The net income (registration fees collected minus the unit's expenses) is usually negative. Hence the general taxpayers subsidize alarm activators.

any free responses. False activations should be charged from the first false activation.

5. Market oriented solution

All the solutions that have been implemented by police departments and the alarm industry either achieved a minimal reduction or a temporary reduction of false alarms. Police chiefs and the industry magazines have been bemoaning about the problem for over fifteen years. It can only be overcome if the nature of the good is recognized and an appropriate competitive market solution is implemented.

Adam Smith in his 1776 book **Wealth of Nations** stressed the power of competitive markets in increasing efficiency. Social welfare is maximized through the unimpeded operation of prices or the "invisible hand". Smith further contemplated a relatively limited role for government intervention in the economy. Although Smith was obviously unaware of the false alarm problem, his solution has been successful for many other markets and will work here as well, if market conditions can prevail.

Efficiency in response to burglar alarms requires that both the public and private sectors be involved. Private response should be dispatched to all activations. In the case of an actual or attempted intrusion, private security from the scene requests police response. Since police no longer respond to a large number of false activations they will rapidly respond to an actual event, which is indeed a public good. Each alarm owner will contract with a private company for such a service. Clearly, since response to alarms is labor intensive, the extent of economies of scale is limited. In large urban areas we can expect many alarm response companies to compete. For example, in Philadelphia in 1995 there were 54 establishments providing detective and armored car services, all of which employ guards. (U.S. Dept. of Commerce 1995 : 151). These firms could easily enter the alarm response market. Additional competition will occur from companies or even police departments in surrounding jurisdictions.

Another factor that contributes to the spread of private response is the possible existence of scope economies. Experience shows that some companies will offer a bundle of related services like response, patrol, vacation services, and stationary guards (Usher, 1992 and Hahn, 1999). Another type of scope economies may arise when alarm companies offer

installation, monitoring, and physical response to alarm activations. For example, Protection One that was among the first to offer the entire array of security services has become the second largest alarm company in the U.S. in 2001 (SDM, May 2001: 55). Also, since consumers like to deal with one provider for the entire package, demand was high for alarm response services of these companies. Scope economies may permit low prices and encourage development of private response.

When private response develops in a region, the false alarm problem will finally be solved for the police. Competition among providers will enhance adoption of technology and reduce costs. Consumers will be able to use lower-cost labor as initial responders. The major reason for the lower cost of private companies is their lower labor cost. Indeed, response to false alarms does not require a sworn officer that costs 1.5 times that of a private guard (Blackstone and Hakim, 1996 a: 19-20). In fact, evidence shows that private response has provided a higher quality of service in terms of both promptness of response and in apprehending of burglars than have the police (Hakim and Blackstone, 1997: 218-219). A competitive or monopolistically competitive market with various price/quality packages of services replaces a public monopoly. Further, cross-subsidization between alarm activators and others ceases.

One may question why nationwide is there limited private response to alarms. When police typically provide three responses at no charge and sometimes even additional responses at fees that are often nominal and below cost, private response companies cannot enter and attract customers. However, when police charge at their cost for all responses, private response service could develop.[7]

Some interesting implementation questions remain. Private response can take two forms: police could contract out the service to a private company that will serve the entire or part of the jurisdiction as in the cable TV case. Alternatively, entry to the response business could be open to all interested parties, including of course guard services. We maintain that the second alternative is preferred. The first alternative maintains a monopoly service even if the contract is designated for only a few years. The provider will be a monopolist for the duration of the contract, and government will bear the cost of regulating the provider to ensure that the terms of the contract

[7] Interestingly, some commercial establishments are required by their insurance companies to adhere to UL standards, where private response is required.

are followed. Competition is also likely to provide a richer choice of service offerings tailored to the particular demands of relatively small groups; this product variety which arises in monopolistic competition is likely to attain a higher level of social welfare than the first alternative of a monopoly provider. Also, even if a number of providers compete for the contract under the first alternative, the lowest bidder's price is likely to be higher than what prevails under market conditions.

Competition could also arise from police in adjacent or nearby jurisdictions. Police departments could contract to provide response. Under current practices inter-jurisdictional contract for all police services occurs mainly among rural and suburban communities. In the realm of "managed competition" discussed below, the public police should be allowed to compete with private providers of response to alarm activations. This service could allow some departments to exploit economies of scale and possibly of scope and thereby lower the cost of providing response, including to their own constituents. Further, many jurisdictions were created when transportation and communication were less adequate. Permitting police departments to offer private response in nearby areas could be quite desirable. These would be legal and liability issues that would have to be resolved, but the benefits from increased competition could outweigh the legal complexities.

Another issue is whether police should stop responding to burglar alarms under all conditions? Suppose that in a sparsely populated area no private response emerges. Or, suppose that a private monopoly develops. Should Smith's efficient private market principle be compromised? In other words, should alarm response be public or should the private monopoly be regulated? Richard Posner (1971) argued in related regulation issues that private unregulated solutions are preferred to a regulated monopoly. The latter normally enjoys protection against entry. It also often practices cross subsidization that helps create a constituency, the favored group who receives the service below cost, with a strong interest in maintaining the monopoly even after it is not justified. Accordingly, in keeping with Posner, if a single private response company evolves because of limited market size then the most appropriate public policy is probably to do nothing in terms of regulation. Another alternative is to allow police to provide competitive alarm response but under strict conditions.

6. The public option

Although we advocate private response to all activations and then police dispatch to actual or attempted burglaries, we recognize that some communities may want to preserve public police response.[8] In particular, in a sparsely populated region where no private response emerges, then in case of a *bona fide* dispatch, no response would follow. Therefore, the public good portion of alarm response will not be provided; clearly, public security would decline. The police should be allowed to offer response service but charge their actual cost, or the monetary value of the services sacrificed when police resources are used to respond to alarm activations. Economists refer to this as the long-run marginal cost that includes any extra capital and labor required for response. Clearly, the delivery of service by the public police monopoly might not be efficient. Monopolies often exhibit what economists call X-inefficiency, namely, simple business inefficiency that results from insufficient competition, which allows excess costs and slack.

Unfortunately, in small markets, consumers might have to endure the lack of competition. Still pricing at long-run marginal cost would mean that cross subsidization should and would be avoided. Further, public finance theory suggests that when beneficiaries can be clearly identified and when no externalities exist as in the case of response to false alarms, user charges are desirable instead of funding from the general ledger.

More generally, Stephen Goldsmith, the former Mayor of Indianapolis, Indiana, introduced the concept of "managed competition", which allows government employees to bid against private firms for service provision. Indeed, police in many rural and suburban communities want to retain the service. If police wish to retain the response service as a non-monopoly, they need to price at their long-run marginal cost, and allow others to provide the service under competitive conditions. This means that all false activations are charged, no escalating fees, and no ceasing of response for repeat activators. The function of response to false activations should be established as a separate profit center and its accounting should be divorced from the public functions of police. The police probably enjoy scope economies in the sense

[8] There is another argument why government should be involved in the emergency services. Private provision of service is designed for existing demand. Government, however needs to maintain a higher level of emergency vehicles and personnel than is needed commercially in case of such disasters as earthquakes, terrorist attacks, or an electricity brownout or blackout. In such cases, the general population requires more service than private emergency companies can offer. Public emergency services must be prepared for low probability peak demand while private companies capacity is maintained for merely existing demand that can be profitably provided. On the other hand, one may argue that State or even the Federal government already does or should provide the excess capacity designed for emergency situations. The Federal government allows in catastrophic cases the use of National Guard or even the Army.

that providing alarm response could lower the cost of other services including alarm response. As a result, police should be allowed to compete and consumers will gain.

7. Efficient practices

The marketplace solution has been partially applied in a few communities. Las Vegas, Nevada utilizes a system that is close to our ideal model. The Chief of Police in 1991, at his own discretion and without a change in the ordinance, adopted the non-response policy. Before the change in policy, the annual police cost of response to 8,000 false alarms was $600,000. Each response took 45 minutes and involved two officers. The cost of just the officers' time per response was estimated at $75. As is usual, only one to two percent of calls were valid alarms. The change in response policy meant that police respond to alarms only when dispatched by an agent at the scene. Actually, police response became faster since the officers know that they are going to a real event, and the large number of false activations to which other private agents now respond reduces the pressure on patrol officers. The police are now prepared to confront a criminal, are no longer frustrated by rushing to non-events, and now deliver the service they are mandated and trained to do.

The initial responders are usually guards from a private response company. The guards check the premise. In case a burglary is in progress or has occurred, they will remain outside, dispatch the police, and watch the entrances until police arrive. The guards will enter the premise only if lives are in danger. Alarm systems are not registered and data are not kept on false activations. After considering the rapid growth of Las Vegas, the annual budgetary savings exceed $600,000. Further, the burglary rate diminished from 1600 per 100,000 population in 1990 to 1187 in 1998. Hence, security and police deterrence were not compromised. Police maintain the public function they are obligated to do, namely, pursue burglars, and private response handles the private good of it.

In 1999 Salt Lake City had a significant false alarm problem. Its police responded to 8,213 false alarms at a total cost of $492,780. Ninety- nine percent of all alarm calls were false. The response time was at least forty minutes because response was accorded a low priority. Near the end of the year 2000 an ordinance was passed that adopted the Las Vegas practice. Within a few months, seven companies were offering private response for

fees that were substantially less than the $60 average cost for the police. The price per response ranges from $15 to $35. One company offers a monthly contract for $30 that includes unlimited responses. Another company included response as part of a patrol contract. Further, the response time ranged from 2 to 20 minutes with most under 10 minutes. One company guaranteed free response if its officers' do not arrive at the scene within 20 minutes.

It is noteworthy that false alarms during December 2000 were only 71 compared to 773 for the same period in 1999. Further, false alarm responses in the December 1, 2000 through May 31, 2001 period were only 496 compared to 5151 for the same period a year earlier under the previous ordinance. Indeed, efficient markets developed with many price/quality choices for consumers once police shed the service. Also, Salt Lake City taxpayers saved $280,000 in personnel expenses over the six-month period and non-alarm activators no longer subsidize false activators. Police now had an additional 5102 hours for general patrol or response to valid calls.

The discussion so far suggests that the response to alarms could and should be shifted to the private sector where security companies will compete on service delivery. Clearly, the issue of registration fees is moot in the private option. Police departments and the alarm industry devote many resources to improve the currency of the database of alarm ownership. We question whether such data maintenance is at all necessary even in the case of the public option. The only relevant information for the police concerns who falsely activated their systems and only for a given calendar year so fines can be collected. This is similar to car registration. In any typical city there are cars from numerous cities in the state, from other states, and even from other countries. Police do not maintain a database of all vehicles using the city's road network. The only relevant information for the police concerns the violators of traffic and parking regulations. Similarly, all alarm systems need not be registered. The elimination of registration saves the cost of constantly updating the database. For example, the police department in Seattle, Washington maintains just the names and addresses of alarm violators for a one-year period with the addresses provided by the central stations requesting the response. The responding officer directly hands citations and then the data are recorded. By year's end most of the data are deleted.

8. Conclusions

This paper introduced a new type of public good that incorporates both private and public attributes and suggests a form of public-private partnership for socially efficient provision. This new form of public good applies to most emergency services.

The case study involves police response to burglar alarms that comprises ten to twenty percent of all emergency patrol responses. Unfortunately, 94 to 99 percent of all alarm responses turn out to be a non-event. Only when the service is provided does its nature, whether it is a public or private good, become clear. This characteristic of being unknown *ex ante* is common for most emergency services.

Local jurisdictions differ in their methods of coping with the problem; they use cost recovery, punitive, technological, and educational methods. Unfortunately, most methods fail, have a temporary impact, or involve high transaction costs and unjustified cross subsidization. From an economic viewpoint, the solutions are either inefficient or inequitable or both. The reason for the failure is that consumers, dealers, and central stations lack the motive to eliminate false activations. Only the police have a motive to eliminate the problem. Further, the service has been provided under non-market and public monopolistic conditions. Only Las Vegas and Salt Lake City have adopted policies that involve competition and a form of a Public-Private Partnership that has had a lasting effect on reducing false activations without sacrificing the level of security.

Adam Smith's theory once again proves socially efficient and equitable. Private firms should respond to all activations. In case a burglary is under way or has occurred, the police are dispatched. Police then fulfill their public responsibility, are relieved from response to all false activations, and therefore can promptly respond to valid alarms. Private companies will compete for customers, consumers will be empowered to choose a service that best fit their preferences, prices will be established close to cost, service will be enhanced, and cross-subsidization will be eliminated.

Police can continue responding if the following strict conditions prevail: no artificial barriers prevent entry by private response firms or by other police departments, police price at their real marginal cost, and the alarm service is established as an independent profit center. Then, private companies or other police departments will enter if they can provide the service at lower cost. Further, the reduced pressure on the 911 system will allow police to respond faster to real emergencies of all types. Alarm owners

will pay for all false alarms but will not pay for real activations. Indeed, if the positive externalities of apprehending burglars exceed the long-run marginal cost of response for the police, one may argue that alarm owners who experience an activation that leads to the conviction of a burglar should be subsidized by that difference. The same principles and methods can be applied to other government emergency services like ambulance, fire, and Coast Guard.

Introducing competition into burglar alarm response is equivalent to deregulation, a policy that has worked in many other markets. There is every reason to apply it to public emergency services and expect an overall increase in social welfare.

This paper illustrates the problem of false alarms and the various solutions attempted to solve the problem. Our recommended solution is competition and a public-private partnership. In any event, the time has come to conduct a comprehensive study to evaluate the alternatives that have actually been applied and those suggested by academicians and professionals to determine the solution that indeed maximizes net social benefits.

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