Explaining and Sustaining the Crime Drop:

The Effectiveness of Vehicle Security Devices

Introduction

The most important criminological phenomena of recent times are the major drops in crime experienced in many industrialised countries over the last two decades. Between 1995 and 2007 in England and Wales, violent crime fell 49 percent, domestic burglary 58 percent, other household theft 48 percent, bicycle theft 20 percent, and other theft of personal property 47 percent according to the British Crime Survey (Hoare, 2009; 21). While the trends have stabilised at the time of writing, these are the most major declines in such crimes ever experienced.

The UK experience parallels that of many, perhaps most, industrialised countries. The crime drops occurred first in the United States where serious violent crime including homicide fell by 40 percent (LaFree, 1999; Blumstein and Wallman 2000, 2006). With variation by country and crime type there were significant declines across the 15 European countries for which reliable comparison could be made using the International Crime Victims Survey (van Dijk et al. 2007, van Dijk, 2006a, 2006b). Significant falls in crime have been identified in other countries including Australia, Canada, Japan and elsewhere (see e.g. Zimring, 2007; Rosenfeld, 2009; Rosenfeld and Messner, forthcoming; Tseloni et al., forthcoming). Amidst the more general falls in crime, declines in vehicle theft were particularly pronounced. In the United States, both the national police recorded crime data of the Uniform Crime Reports and the National Crime Victims Survey data show that from 1991 to 2008 vehicle theft fell around 70 percent. Between 1995 and 2008, vehicle-related theft in England and Wales fell steadily and by two-thirds (65 percent: Walker et al., 2009; 3).

The most prominent explanations for the crime drops offered to date are changes in: demographics; sentencing and imprisonment practices; the size and practice of policing; gun control and concealed weapons laws; teenage pregnancy and abortion; lead pollution; crack markets; and economic strength. Yet despite a range of imaginative research and innovative analyses, most of these 'early' hypotheses appear to have little explanatory value. Some of the explanations that initially appeared the strongest contenders offer explanations that appear particular to the US context. These were areas where US experiences differed significantly from other countries including those in relation to sentencing and imprisonment, policing, gun control, abortion, and the crack cocaine market (see Blumstein and Rosenfeld, 2008; Farrell et al. in press, for recent reviews).

The theoretical orientation of this paper is drawn from the criminologies of everyday life. These interpret crime trends in terms of the changing patterns of opportunity. Patterns of opportunity are a function of the supply, distribution and movement of suitable targets, of guardians who might protect those targets, and of those most likely to commit crime. Cohen and Felson use this basic, and apparently rather simple, idea to explain the rise in crime in the United States following the Second World War (Cohen and Felson 1979). The increased supply of suitable targets for crime (for example easily removed cars and electronic goods), the decreased supply of some forms of guardianship (for example with increased participation in the labour market and hence reduced levels of day-time home occupancy), and the increased availability and movement of likely offenders (for example young men freed from domestic chores) created a rapid rise in crime. None of the developments producing the rise in crime was undesirable in itself. Increased criminal opportunities were an inadvertent by-product of socio-economic progress. The actual increase in crime spawned efforts to reduce it. Methods that focused on opportunity reduction included efforts first, to reduce the suitability of targets that would otherwise be attractive to likely offenders and second, to improve guardianship where the supply of suitable targets was likely to be met by a supply of likely offenders. One possible explanation for the widespread crime drop is, thus, that improvements in security have reduced opportunity. Just as routine activity theory explained the rise in levels of volume crime (notably vehicle crime and burglary) after the Second World War in terms of widening crime opportunities, so too perhaps the recent falls in those crimes can be explained in terms of shrinking crime opportunities effected by increases in security.

What we refer to as the 'security hypothesis' has been mooted by Clarke and Newman (2006) and van Dijk (2006b). Building on this, Farrell et al. (2008, forthcoming) proposed that change in the quality and quantity of security was a key driver of the crime drop by reducing the opportunities for it. Their work sought to explain trends in England and Wales, and in Australia and focused on vehicle theft and the role of security. In keeping with the work of Brown and Thomas, 2003; Brown, 2004; Webb, 2005; Laycock, 2004) relating to England and Wales, and that of Potter and Thomas (2001) and Kriven and Ziersch (2007) relating to Australia, the study concluded that better and more widespread vehicle security underpinned the crime drops.

The present study complements that of Farrell et al. (2008, forthcoming). It attempts more precisely to identify the effects of different security devices and their combination. That is, it explores in greater detail the relative effectiveness of different car security devices. Furthering the understanding of the contributions from different devices rather from them as a whole, is a means of drilling down into the details of the causes of the most significant drops in car theft ever experienced. By looking in detail at whether the form of opportunity reduction promised by a particular security device is matched by detailed patterns of crime, greater confidence can be had that the device itself is responsible for the reduced risk of crime: different security devices work in different ways to reduce opportunities for different forms of crime, as will become clearer as the paper unfolds. Moreover, from a rather practical viewpoint identifying the most effective single and/or in-combination car security measures may direct the industry towards additional 'crime-proofing' of products and consumers towards more informed decisions. In addition to the substantive contribution of this work a simple methodology is proposed here to measure the effectiveness of car security devices relative to the absence of security, presented as the Security Protection Factor (SPF). This can be transferred to other evaluation contexts. The next section gives a brief overview of the history of vehicle security to provide a context for the analysis that follows.

Vehicle security

Vehicle security is almost as old as the automobile itself. Newman (2004) provides a fascinating account of the parallel evolution of car security and car safety. Many seemingly everyday features such as keys and license plates arose as early responses to theft. Keys were an early immobiliser as they isolated the ignition system. License plates reduced anonymity and allowed one stolen black Ford to be distinguished from the next. Following the rapid rise in car ownership and theft in the 1950s and 60s, mechanical immobilisers (steering wheel and gear locks) showed some potential to reduce crime (Mayhew et al, 1976; Mayhew, 1992; Webb, 1994). However, many mechanical immobilisers could be overcome: One test found many could be overcome in seconds, and half of them in three minutes and 20 seconds (BBC, 2000). Electronic immobilisers have evolved as the preferred response. Good quality electronic immobilisers tend to be build-in rather than retro-fitted and work by disconnecting one or more of the fuel, starter and ignition system (see Tilley et al., 2009). Likewise, door locks have evolved in form and placement. Individual windowsill-top push-button door knobs have been displaced by more discretely located central-deadlocking with remote or proximity-activation by increasingly encrypted RFID devices. Systems relating to cars are now better regulated: The Vehicles (Crime) Act 2001 introduced the registration of motor salvage dealers and number plate suppliers and the Vehicle Identity Check scheme, all aimed at targeting the re-selling of stolen vehicles.[1] Licence-plate systems are becoming more sophisticated to reduce false registration of stolen vehicles (Webb et al. 2004). Southall and Ekblom (1985) dreamed of the crime-free car a quarter of a century ago, and it seems that many of the measures they recommended have become routinely incorporated during manufacturing. In addition, although the present focus is devices fitted in vehicles, environmental influences upon car crime have also proved amenable to prevention efforts. Work and leisure routines make car parks key nodes but risks can be reduced by quality surveillance, access control and other measures (Poyner, 1992; Webb et al. 1992; Clarke and Mayhew, 1998; Mayhew and Braun, 2004; see http://www.saferparking.com/). Car crime at residential nodes can be reduced by better layout that facilitates surveillance by owners, particularly parking on driveways and in garages (see e.g. Clarke and Harris, 1992).

Market imperfections mean little information on risk and protection was previously available to consumers, so there was little incentive for manufacturers to develop security. Hence car theft indices were developed to 'name and shame' manufacturers and alert customers to the most stolen makes and models, those in the UK (Houghton, 1992; Laycock, 2004) following those in the US (Hazelbaker, 1997). Likewise, detailed information derived from security tests by Thatcham (the Motor Insurance Repair Research Centre) are now publicly available, and information from sources such as *Motoring Which* are increasingly valuable (see Pease and Shaw, forthcoming).[2] Over time, built-in and automated security has gradually changed the default from insecure to secure among many new vehicles. Time-delayed auto-locking means the forgetfulness or apathy of car owners is now less likely to generate easy criminal opportunities. This means, as one colleague used to put it, that the careless are not necessarily the carless. At the same time, remaining thieves are faced with an increasingly difficult task requiring extra time, skills and know-how, tools and other resources, and risk.

Data

This study employs the British Crime Survey (BCS) data which was retrieved from the UK Data Archive at the University of Essex. The BCS is a nationally representative survey of adults 16 years or older living in private accommodation in England and Wales (Bolling et al. 2008). It has been conducted since 1982, and annually with continuous sampling since 2001. Data from the six contiguous annual surveys to 2007 are grouped together here to increase the number of responses relating to the many combinations of security devices. Data from both the Crime Prevention and Witness Intimidation Module C, and from the Victim Module of the survey are used. In Module C, a randomly selected sub-sample (one fourth) is asked about the security measures relating to the main household car. Based on these answers we estimate the prevalence of car security devices in the population of cars which is also referred to herein as the fleet. In the Victim Module, victims of car crime are asked about the security measures relating to their victimised car, the prevalence of which we then compared to that of the fleet to generate our initial outcome measure. We note at the outset that, in the BCS, the classification of 'attempt' does not distinguish between attempted theft of car and attempted theft from car due to the ambiguity of determining the aim of the offender.

The methodological limitations warrant acknowledged. First, only those security features recorded in the BCS can be examined. Second, the sample of main household cars on which security information is collected is unlikely to be perfectly representative of the population from which victimised cars are drawn because 41.2% of households (in our merged 2001 to 2007 BCS file) had more than one car. We anticipate this may over-estimate security effectiveness slightly but would have little effect on the between-device differences which are our main focus.[3] Third, the car security devices of the most vulnerable one percent of the population are unknown. This is because detailed information is only collected on the first three crimes per victim, and so it is missing for about 1 percent of the sample who experienced more than three. The BCS survey strategy for victim module completion prioritises personal over property victimisations. This means that when a respondent reports more than six cases of crime (six being the maximum allowed), that the car crimes are more likely to be excluded (Bolling et al. 2008). Hence in our merged file, 9.8% of thefts of car, 7.3% of theft from cars, and 5.2% of attempts lacked information on security devices.

The following analysis employs the data without weights. The incident weight adjusts the sample-based crime rates to represent the population in England and Wales. In this analysis however we do not have an estimate of the security features in the population of cars (see second limitation above) and therefore it would have been pointless to adjust the number of victimised cars.

The BCS requested information on six main types of car security. These were central locking, electronic immobilisers, car alarms, tracking devices, mechanical immobilisers, and window security etching. Information on whether devices were built-in or retro-fitted was not requested in the BCS except for cars bought in the last five years. Likewise, information on the technical specifics of individual devices was not available. It also seems reasonable to expect that the quality of new devices has improved over time (particularly electronic immobilisers) and have become more likely to be built-in rather than retro-fitted. However, these issues are not addressed in the present study but could perhaps form part of future research. Such information might be available or inferred from data on manufacturing or parts-sales, but identifying and collating such information was outside the scope of the present study.

Each of the six types of security device examined could be used alone or in combination with others, giving 64 possible configurations (including 'no security').[4] However, preliminary analysis suggested window etching conferred little additional security and so it was not examined further, a finding that squares with that of Tilley et al. (2009). The omission of window etching reduced the possible configurations to 32. In reality, some combinations were more popular than others. Cars with electronic immobilisers always had one or other form of security. There were few cars with tracking devices. These patterns probably reflect the more recent implementation of such devices into the manufacturing stages of cars that already had other devices (alarms and/or central locking). There were 31 configurations in the survey responses. However, there were 13 categories which we categorised as minor because they each had only a small number of cases (always less than 50) and accounted for only 150 cases in total. Findings relating to the remaining 18 categories accounted for 22,616 cases, or 99.3 percent of the total, and are reported here.

Analysis

The prevalence of security in the vehicle fleet relative to that for victimised cars constituted the initial outcome measure. In essence, the fleet measures the expected level of security which, *ceteris paribus*, would be found among stolen cars. This can be compared to the observed level of security among victimised cars. The proportions of each were used to derive odds ratios. The odds ratio for each security combination could then be compared to that for 'no security' to develop a score for the degree of protection conferred.

Table 1 shows counts of the number of survey responses for the 18 most popular security configurations. A particular type of security is denoted by its capital first letter, so that A is Alarms, C is Central Locking, E is Electronic immobiliser, M is Mechanical immobiliser, and T is a Tracking device. Multiple capital letters denote a configuration of multiple devices, so that CE denotes cars with both central-locking and an electronic immobiliser. The first numeric column of Table 1 relates to the fleet. Hence in the top left numeric cell, there were 249 households where the main car had the four security types constituting ACET. The second numeric column shows the number of stolen cars with that security configuration. So, in the top row there were only three stolen cars which had the ACET security configuration. The third and fourth columns show the number of incidents relating to theft from cars and attempted theft.

For each security configuration, comparing the proportion of cars victimised relative to the proportion of cars in the fleet, produces an odds ratio. Hence 3 of 1364 stolen cars had ACET compared to 249 of 22616 for the total population of cars which had this security combination. The odds ratio is calculated as (3/1364) / (249/22616) = 0.2. The set of odds ratios are shown in the last three columns of Table 1 for each crime type and security configuration. The odds ratios were complemented by a p-test for difference in proportions. While the odds ratio shows the difference in the proportions, the p-test says whether or not the difference was statistically significant, and the three levels of significance indicate to what extent. The bulk of the findings did show a statistically significant difference between security levels in victimised cars and the fleet.

INSERT TABLES 1 AND 2 ABOUT HERE

The security protection factor (SPF) shown in the first three columns of Table 2 is derived from the odds ratios. The odds ratio for each individual security combination was compared to that for ‘no security’. Hence the odds ratio of 0.2 for ACET was a multiple of 25.4 that of 5.08 for ‘no security, that is, 5.08/0.2 = 25.4, our highest SPF. Tables 1 and 2 are ranked by the SPF for theft of car. Independent SPFs could not be calculated for tracking devices, reflecting their rarity plus the fact that when they were used it was always in combination with another type of security device.

In the final three columns of Table 2, a net interaction effect (NIE) is shown. This is the difference between the expected and observed SPFs for security combinations. The expected SPF is the sum of the independent SPFs of security devices when used alone. For example, the independent SPFs for theft of car, at the bottom left of Table 2 are: A = 1.2, C=2.7, M=2.8, and E=4.0. Hence the expected car theft SPF for the AE configuration is the sum of 1.2 for A plus 4.0 for E, a total of 5.2. This is compared to the observed SPF of 5.6 for AE for theft of car, which is greater by 0.4. Hence 0.4 is its net interaction effect. The net interaction effect gauges whether the effect of combining security devices is the same, less, or more, than the sum of the independent effects of those devices. For the two security configurations involving tracking devices where an independent SPF was not available (ACET and ACEMT), the NIE is based on the other devices in the configuration as this seems preferable to excluding those configurations.

Results

Different security devices would be expected to impact differentially by crime type. Immobilizers would be expected to reduce risk of theft of cars because they make them more difficult to drive away, with electronic devices being more effective than mechanical ones. However, immobilisers would not be expected to generate much additional prevention against theft from cars because they do not make it more difficult to break-in. In contrast, alarms would be expected mainly to reduce theft from cars, although they might also deter some of the more opportunistic thieves. Central dead-locks (central locking) would be expected to reduce the risk of both theft of and theft from cars because they make the car more difficult to enter. The results tend to support these broad expectations.

For theft of car, central locking and electronic immobilisers featured in each of the top four security configurations and in, respectively, seven and six of the top seven configurations. There were no configurations involving both central locking and electronic immobilisers that ranked lower than seventh. Alarms, central locking and either or both immobilisers feature in the three security combinations with the highest significant SPFs. For theft from cars, alarms and central locking featured in each of the six top security configurations and in no other configurations. Alarms and central locking also featured in the top five security configurations for attempted car theft.

Figure 1 presents the SPFs from Table 2 and facilitates easy visual identification of the findings that (1) crime prevention generally increases with the number of security devices, (2) impact upon theft of car is greatest, (3) impact upon attempts are generally least, and (4) the increase in protection is exponential in relation to theft of car. It also shows that in the one instance where the SPF for theft from cars is greater, it relates to alarms.

INSERT FIGURE 1 ABOUT HERE

Single security devices offered some protection but have relatively low SPFs. Alarms on their own confer 20 percent greater protection (SPF = 0.2) against theft of car and 50 percent greater protection against theft from car relative to no security. The use of only central locking (C) or only a mechanical immobiliser (M) approximately doubles protection from theft of cars. The individual measure which on its own confers quadruple the level of protection against car theft is an electronic immobiliser (E), but an electronic immobiliser's effects against theft from cars and attempts are, as expected, far less marked than those of central locking.

Pairs of security devices generally produce significantly greater protection and in the anticipated direction. Against car theft, pairs of devices are typically between four and twelve times better than nothing. Pairs generally confer greater protection against theft of cars relative to theft from cars or attempted thefts. This is shown by the net interaction effect values where four of the five pairs are positive for theft of car but only one for theft from car and none of those for attempts. This measure suggests security pairs generally have an effect that is greater than additive against theft of car but not for the other crime types. Central locking and electronic immobilisers are the most effective pairing against theft of car (CE has SPF = 11.8 and NIE = 5.1). It is notable that the added security from most pairs is less than additive for theft from cars and attempts (shown by their negative NIEs).

Security configuration triplets increase the overall level of security offered. Triplets are most effective against theft of car where they are always at least eight times better than nothing (SPF= 8.4 for AEM), and as much as 25 times greater. Although the SPF 25 for ACET and CEM is arguably the headline finding, it should be treated with caution because the odds ratio for CEM was not statistically significant and there is some uncertainty over the SPF for ACET due to the inclusion of the tracking device. However, ACE and ACEM have SPFs of 15 and 19, which appear to be reasonable minima for the ACE combination against car theft. These configurations have NIEs that indicate bonus security effects, perhaps due to the interaction of the devices, that are significantly beyond additive.

Conclusion

The major drops in crime that were experienced in the UK and elsewhere from the 1990s were arguably the most important criminological phenomena of recent times. Many types of crime in England and Wales were halved. Car theft fell by two-thirds and a range of studies suggests this is attributable to more and better vehicle security. The present study sought to add to this body of work by teasing out the relative contribution of individual security devices and combinations of devices. Central locking plus electronic immobilisers, particularly when used in combination and with an alarm, tend to confer greatest security. Cars with such devices are far less likely to be stolen. Overall, the study lends additional weight to the 'security hypothesis' explanation of the crime drops because it provides more specific details on particular security devices and their effectiveness. Based on this, the study suggests there is a need to explore the security hypothesis in relation to other crime types. Burglary may be the next logical step, though it is likely that identification of the causes of the drop in burglary may be less straightforward than those relating to car theft.

The present study suggests additional avenues for future research on vehicle theft. There is a need to isolate any possible confounding effects, particularly any due to vehicle age and vehicle 'lifestyle' (such as its usual parking location). Vehicle age is likely to be positively correlated with the quality and quantity of security, that is, newer vehicles will tend to have more and better devices. The inclusion of vehicle age in the questionnaire for the BCS car security module would facilitate this analysis. The study also has implications for the analysis of combinations of crime prevention tactics more generally. Combinations of tactics are often used against household and commercial crime. However, their individual and interaction effects are rarely distinguished. The possibility of teasing out such interaction effects is an enticing one that warrants further research.

The findings lend support to efforts to build-in security at the point of manufacture. They suggest that new cars, as many already are, should be built with a minimal security configuration of central-deadlocking, an electronic immobiliser, and an alarm system. Each system should meet minimum standards, as they are already required to do in the EU, Australia and many other countries. If viewed as an evaluation, the present study indicates there are positive crime prevention outcomes from policy measures that promote designing-out crime. Hence the findings offer a lesson for policy-makers and champions of industry in manufacturing and business with criminogenic products and services. Government should seek to nudge manufacturers and business towards security as the default position. Frequently stolen electronic devices such as MP3s, smartphones, PDAs, laptops, SatNavs could all probably be built so that they could be deactivated or tracked if stolen, so that theft is no longer an attractive option. Residential and commercial buildings and urban transport and road systems should be designed in ways that overtly seek to minimise criminal opportunities. The preponderance of theory and evidence suggests that encouraging corporate social responsibility via designing-out crime externalities could be a fruitful role for government.

References

BBC, 2000. 'Car immobilisers fail test' BBC News online, 1 May 2000, at http://news.bbc.co.uk/1/hi/uk/732669.stm

Blumstein, A. and J. Wallman. 2000. *The Crime Drop in America*. Cambridge: Cambridge University Press.

Blumstein, Alfred and Joel Wallman. 2006. *The Crime Drop in America*. Revised Edition. Cambridge: Cambridge University Press.

Blumstein, A. and R. Rosenfeld. 2008. "Factors Contributing to U.S. Crime Trends." Pp 13-43 in *Understanding Crime Trends: Workshop Report*. National Research Council Committee on Understanding Crime Trends, Committee on Law and Justice, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

Bolling, K., Grant, C. and Donovan, J.-L. (2008). '2007-08 British Crime Survey (England and Wales) Technical Report. BMRB.

Brown, R. (2004). 'The effectiveness of electronic immobilisation: Changing patterns of temporary and permanent vehicle theft' in M. G. Maxfield and R.V. Clarke (Eds.) *Understanding and Preventing Car Theft*, volume 17 of *Crime Prevention Studies*. Monsey, NY: Criminal Justice Press. (pp. 101-119).

Brown, R. and Thomas, N. (2003). 'Aging Vehicles: Evidence of the Effectiveness of New Car Security from the Home Office Car Theft Index.' *Security Journal* 16(3):45-54.

Clarke, R. and Harris, P. (1992) 'Auto Theft and its Prevention.' In M. Tonry (ed.) *Crime and Justice: A Review of Research*, Vol. 16 Chicago: University of Chicago Press (pp. 1-54).

Clarke, R.V. and Mayhew, P. (1998). ‘Preventing Crime in Parking Lots: What We Know and What We need to Know.’ In M. Felson and R. Peiser (eds.) *Reducing Crime Through Real Estate Development and Management*. Washington DC: Urban Land Institute.

Clarke, R. V. and G. Newman. 2006. *Outsmarting the Terrorists*. Westport CT: Praeger.

Cohen, L. E. and M. Felson. 1979. “Social Change and Crime Rate Trends: A Routine Activity Approach.” *American Sociological Review* 44:588-608.

Farrell, G., Tilley, N., Tseloni, A. and Mailley, J. (2008) ‘The Crime Drop and the Security Hypothesis’ *British Society of Criminology Newsletter*, No. 62: 17-21.

Farrell, G., Tilley, N., Tseloni, A. and Mailley, J. (forthcoming) The Crime Drop and the Security Hypothesis. *Journal of Research in Crime and Delinquency*.

Farrell, G., Tilley, N., Tseloni, A. and Mailley, J. (in press) Explaining and sustaining the crime drop in industrialised countries. *Crime Prevention and Community Safety: An International Journal*.

Hazelbaker, K . (1997) Insurance Industry Analyses and the Prevention of Motor Vehicle Theft . In Felson, M. and Clarke, R.V. (eds) *Business and Crime Prevention*. Monsey, NY: Willow Tree Press .

Hoare, J. 2009. “Extent and Trends.” Pp 13-42 in *Crime in England and Wales 2008/09, volume 1: Findings from the British Crime Survey and police recorded crime*, *Home Office Statistical Bulletin 11/09,* Vol 1, edited by A. Walker, J. Flatley, C. Kershaw and D. Moon. London: Home Office.

Houghton, G. 1992. *Car Theft in England and Wales: The Home Office Car Theft Index*. Crime Prevention Unit Paper 33. London: Home Office.

Kriven, S. and Ziersch, E. 2007. 'New car security and shifting vehicle theft patterns in Australia', *Security Journal*, 20(2) 111-122.

LaFree, G.. 1999. "Declining Violent Crime Rates in the 1990s: Predicting Crime Booms and Busts." *Annual Review of Sociology* 25:145-68.

Laycock, G. 2004. 'The UK Car Theft Index: An Example of Government Leverage' in M. G. Maxfield and R.V. Clarke (Eds.) *Understanding and Preventing Car Theft*, volume 17 of *Crime Prevention Studies*. Monsey, NY: Criminal Justice Press (pp. 25-44).

Mayhew, P. 1992. 'Steering column locks and car theft' in R.V. Clarke (Ed.) *Situational Crime Prevention: Successful Case Studies*, 1st edition. Albany, NY: Harrow and Heston. (pp. 52-65).

Mayhew, P. and Braun, G. 2004. 'Parking Lot Security' in M. G. Maxfield and R.V. Clarke (Eds.) *Understanding and Preventing Car Theft*, volume 17 of *Crime Prevention Studies*. Monsey, NY: Criminal Justice Press. (pp. 121-145).

Mayhew, P., R. V. G. Clarke, A. Sturman and J. M. Hough. 1976. *Crime as Opportunity*. Home Office Research Study 34. London: HMSO.

Newman, Graeme. 2004. "Car Safety and Car Security: An Historical Comparison." Pp 217-248 in *Understanding and Preventing Car Theft*, *Crime Prevention Studies,* Vol 17, edited by M. G. Maxfield and R.V. Clarke. Monsey, NY: Criminal Justice Press.

Pease, K. and D. Shaw. forthcoming. 'Car security and the decision to recommend purchase' *Crime Prevention and Community Safety: An International Journal*.

Potter, R. and Thomas, P. 2001. *Engine Immobilizers: How Effective are They?,* National Motor Vehicle Theft Reduction Council. Australia, Poyner, B. 1992. 'Situational Crime Prevention in Two Parking Facilities'. In R. V. Clarke (ed) *Situational Crime Prevention: Successful Case Studies*. NY: Harow and Heston.

Rosenfeld, R. 2009. "Crime is the Problem: Homicide, Acquisitive Crime, and Economic Conditions." *Journal of Quantitative Criminology*, 25:287-306.

Rosenfeld, R. and S. F. Messner. Forthcoming. "The Crime Drop in Comparative Perspective: The Impact of the Economy and Imprisonment on American and European Burglary Rates." *British Journal of Sociology*.

Southall, D. and P. J. Ekblom. 1985. *Designing for* Car *Security: Towards a Crime-Free Car*, Crime Prevention Unit Paper 4. London: Home Office.

Tilley, N., G. Farrell, A. Tseloni and J. Mailley. 2009. 'Curbing vehicle theft: Experience beyond the United States' Task M of Report to the National Highway Traffic Safety Administration by Maryn Consulting and Rutgers University. New Jersey: Maryn Consulting.

Tseloni, A., J. Mailley, G. Farrell and N. Tilley. Forthcoming. "The International Crime Drop: Trends and Variations" *European Journal of Criminology*.

Van Dijk, J. J.M. 2006a. *International Comparisons of Crime: The ICVS and More*. Presented at the British Crime Survey 25th Anniversary Conference at Cumberland Lodge. England, 16-17 October, 2006.

Van Dijk, J. J.M. 2006b. "What goes up, comes down: Explaining the Falling Crime Rates." *Criminology in Europe, Newsletter of the European Society of Criminology*, 5:, 3 and 17-18.

Van Dijk, J. J.M., R. Manchin, J. van Kesteren, Sami Nevala and Gergely Hideg 2007. *The Burden of Crime in the EU*. Research Report: A Comparative Analysis of the European Survey of Crime and Safety (EU ICS) 2005.

Walker, A., J. Flatley, C. Kershaw and D. Moon. 2009. Crime in England and Wales 2008/9. Home Office Statistical Bulletin 11/09 volume 1. London: Home Office.

Webb, B. 1994. 'Steering column locks and motor vehicle theft: evaluations from three countries.' In R. Clarke (ed.) *Crime Prevention Studies*. Volume 2. Monsey NY: Criminal Justice Press (pp. 71-89).

Webb, B.. 2005, "Preventing Vehicle Crime." Pp.458-85 in *Handbook of Crime Prevention and Community Safety*, edited by N. Tilley. Cullompton: Devon: Willan.

Webb, B., B. Brown and K. Bennett. 1992. *Preventing Car Crime in Car Parks*. Crime Prevention Unit paper 32. London: Home Office.

Webb. B., M. Smith and G. Laycock. 2004. 'Designing-out crime through vehicle licensing and registration systems' in M. G. Maxfield and R.V. Clarke (Eds.) *Understanding and Preventing Car Theft*, volume 17 of *Crime Prevention Studies*. Monsey, NY: Criminal Justice Press (pp. 67-84).

Zimring, F. E. 2007. *The Great American Crime Decline*, New York, NY: Oxford University Press.

Table 1: Sample Sizes and Odds Ratios by Crime Type and Security Configuration

Security configuration	Number of Respondents				Odds ratio		
	Population	Theft of	Theft from	Attempts	Theft of	Theft from	Attempts
ACET	249	3	28	16	0.20♦	0.45♠	0.56♥
CEM	1151	14	335	109	0.20	1.16♥	0.83♦
ACEM	3363	54	438	241	0.27♠	0.52♠	0.63♠
ACE	5923	119	797	405	0.33♠	0.54♠	0.60♠
ACM	1087	26	126	81	0.40♠	0.46♠	0.65♠
CE	2074	54	541	219	0.43	1.04	0.92
ACEMT	168	5	23	11	0.49	0.55♠	0.57♦
AEM	164	6	41	44	0.61♠	1.00	2.35♠
EM	302	12	133	56	0.66♠	1.75♠	1.62♠
AE	182	10	57	54	0.91♠	1.25	2.59♠
CM	874	50	250	100	0.95	1.14♦	1.00
AC	1955	120	369	179	1.02♥	0.75♠	0.80♠
E	400	31	173	79	1.29♠	1.72♠	1.73♠
AM	145	12	47	28	1.37♥	1.29	1.69♠
M	723	80	287	180	1.83♠	1.58♠	2.18♠
C	2086	239	782	266	1.90	1.49♠	1.12♦
A	240	60	117	68	4.15♠	1.94♠	2.48♠
No Security	1530	469	1133	450	5.08♠	2.95♠	2.57♠
Total	*22616*	*1364*	*5677*	*2586*			
Other	150	5	38	16			
Don't Know	19	5	8	0			

Key: A = Alarm; C = Central Locking; E = Electronic Immobiliser; M = Mechanical Immobiliser; T = Tracking Device.

Notes:

(1) 'Other' = 13 minor security configurations (see text for explanation).

(2) Symbols refer to statistically significant difference in proportions (p-test):
♠ p-value ≤ 0.01; ♥ 0.01< p-value ≤ 0.05; ♦ 0.05< p-value ≤ 0.10.

Table 2: Security Protection Factor and Net Interaction Effect

	Security Protection Factor			Net Interaction Effect		
Security configuration	Theft of	Theft from	Attempts	Theft of	Theft from	Attempts
ACET		6.6	4.6	17.6	1.4	-0.3
CEM	25.2	2.5	3.1	15.8	-3.0	-1.9
ACEM	19.1	5.7	4.1	8.5	-1.4	-1.9
ACE	15.3	5.5	4.3	7.4	0.3	-0.5
ACM	12.8	6.4	3.9	6.1	1.0	-0.6
CE	11.8	2.8	2.8	5.1	-0.8	-1.0
ACEMT	10.3	5.4	4.5	-0.3	-1.7	-1.5
AEM	8.4	3.0	1.1	0.4	-2.1	-2.6
EM	7.7	1.7	1.6	1.0	-1.9	-1.1
AE	5.6	2.4	1.0	0.4	-0.9	-1.5
CM	5.4	2.6	2.6	-0.1	-1.3	-0.9
AC	5.0	3.9	3.2	1.1	0.4	-0.1
E	4.0	1.7	1.5	-	-	-
AM	3.7	2.3	1.5	-0.3	-1.1	-0.7
M	2.8	1.9	1.2	-	-	-
C	2.7	2.0	2.3	-	-	-
A	1.2	1.5	1.0	-	-	-
No Security	1.0	1.0	1.0	n/a	n/a	n/a

Key: A = Alarm; C = Central Locking; E = Electronic Immobiliser; M = Mechanical Immobiliser; T = Tracking Device

Notes: Results are based on the odds ratios of Table 1 and so that table's statistical significance levels still apply.

n/a = not applicable.

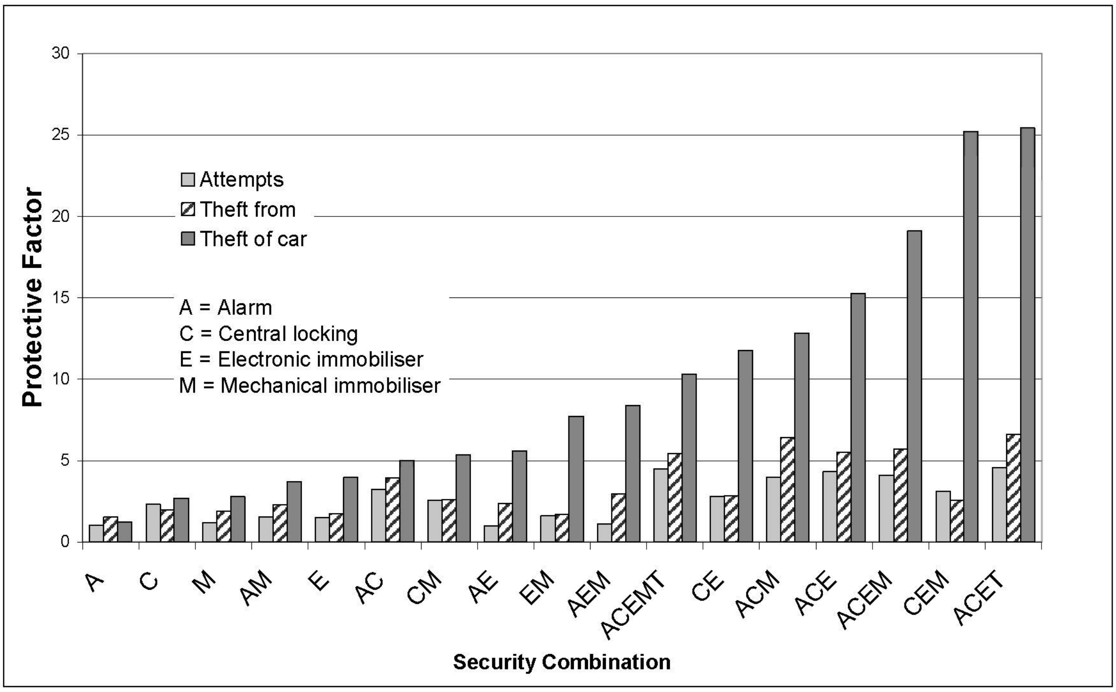

Figure 1: Security Protection Factor

Notes

[1] http://www.homeoffice.gov.uk/crime-victims/reducing-crime/vehicle-crime/

[2] http://www.thatcham.org

[3] For example, if main cars had as much as 10 percent more effective security than non-main cars, then our measure of security effectiveness would be an over-estimate by around 4 percent (slightly more because 6 percent of households own three or more cars according to the 2001 census findings at http://www.statistics.gov.uk/census2001/profiles/commentaries/housing.asp accessed 25 November 2009). But we anticipate that between-devices differences in security effectiveness would remain only marginally affected if at all.

[4] Six types of device with two possibilities (present or not) = $2^6 = 64$.