Product Life Cycles and Crime: Automated Teller Machines and Robbery

Rob T. Guerette and Ronald V. Clarke[1]

Products attractive to thieves, such as cars and VCRs, are said to go through a life cycle of vulnerability such that risks are highest when the products are heavily in demand among consumers but before security measures have been retrofitted. This paper suggests that the life-cycle hypothesis might also apply to new modes of service delivery such as automated teller machines (ATMs). Following a brief history of ATMs in the United States, case studies are presented of the effectiveness of legislation establishing security standards for ATM facilities in New York City and Los Angeles. Substantial decreases in ATM robberies were found without any evidence of displacement. Implications for government and industry are discussed.

Key Words: Automated teller machines; ATM robberies; crime harvests; hot products; situational crime prevention

Introduction

An important idea in the literature on criminogenic products is that 'hot products'—those that are attractive to thieves[2]—go through a life cycle of vulnerability. At first, these products attract little theft because they are unfamiliar and relatively unavailable. As their popularity among consumers grows, thieves become attracted to them for personal use or for resale. Subsequently, they become widely available and relatively inexpensive, and their attractiveness for theft declines. Gould and his colleagues first put forward this idea to explain trends in car theft in industrialized societies.[3] More recently, Felson has identified four successive phases in the life cycle of vulnerability: innovation, growth, mass market, and saturation.[4]

One variant of the life-cycle hypothesis emphasizes the role played by prevention in reducing product vulnerability in the later stages of the cycle. Thus, Home Office researchers in the UK have argued that 'crime harvests'[5] resulting from the sometimes hasty introduction of criminogenic products are diminished by retrofitting crime prevention measures.[6] While this idea has been discussed primarily in the context of consumer products, such as TVs, VCRs and mobile phones, it may also apply to some modes of service and product delivery—such as the automated teller machine (ATM), the focus of the present paper.[7] In this case, the problem was robbery, not of the ATMs, but of customers making use of them. While ATMs were first introduced in the United States in the 1970s, it was not until the mid-1980s that robberies of ATM users became a significant problem. And it was not until the beginning of the 1990s that widespread retrofitting of preventive measures was undertaken. This fits the pattern of *new target* ⟶ *crime harvest* ⟶ *retrofit solution*; in this paper we describe that pattern in detail, and then present two case studies evaluating the effectiveness of measures implemented in two US cities—Los Angeles and New York—in preventing ATM robberies.

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The product life cycle of ATMs

In the 1970s, the banking industry in the United States turned to the use of ATMs to reduce costs[8] and to expand service to customers through enabling 24-hour access to cash. Since their introduction, ATMs have been developed to serve a much wider variety of functions besides dispensing cash. They can be used to deposit money, transfer funds between accounts, obtain balance or transaction information, and apply for credit cards. More recently, they have even been proposed as a method of distributing welfare funds.[9]

At the same time, ATMs have found homes not only in banks, but also in shopping malls, airports, stadiums, police stations, convenience stores, gas stations, parking lots, apartment buildings, school campuses, movie theatres, bars, casinos and other places where people gather. Considerable variety now exists in the types of ATM available for customer use. Many are placed on the outside wall of a building, often a bank. Some are self-contained units standing free in a corner or along a corridor in a mall, a hotel or some other large facility. In many cases, they have been given their own rooms, such as in the entryways to bank lobbies. Still others are positioned as drive-up units allowing customers to pull up alongside without getting out of their vehicle.

The first ATM was brought into use in the United States in 1971, in Valdosta, Georgia (see Figure 1), and by 1974 some 3000 such machines were in operation. Consistent with Felson's 'innovation' stage, there was little evidence of security concerns at this time. The machines tended to be located in more affluent neighborhoods, and relatively few people used them. Consequently, only a few criminals had learned to take advantage of the opportunities for robbery that they provided.

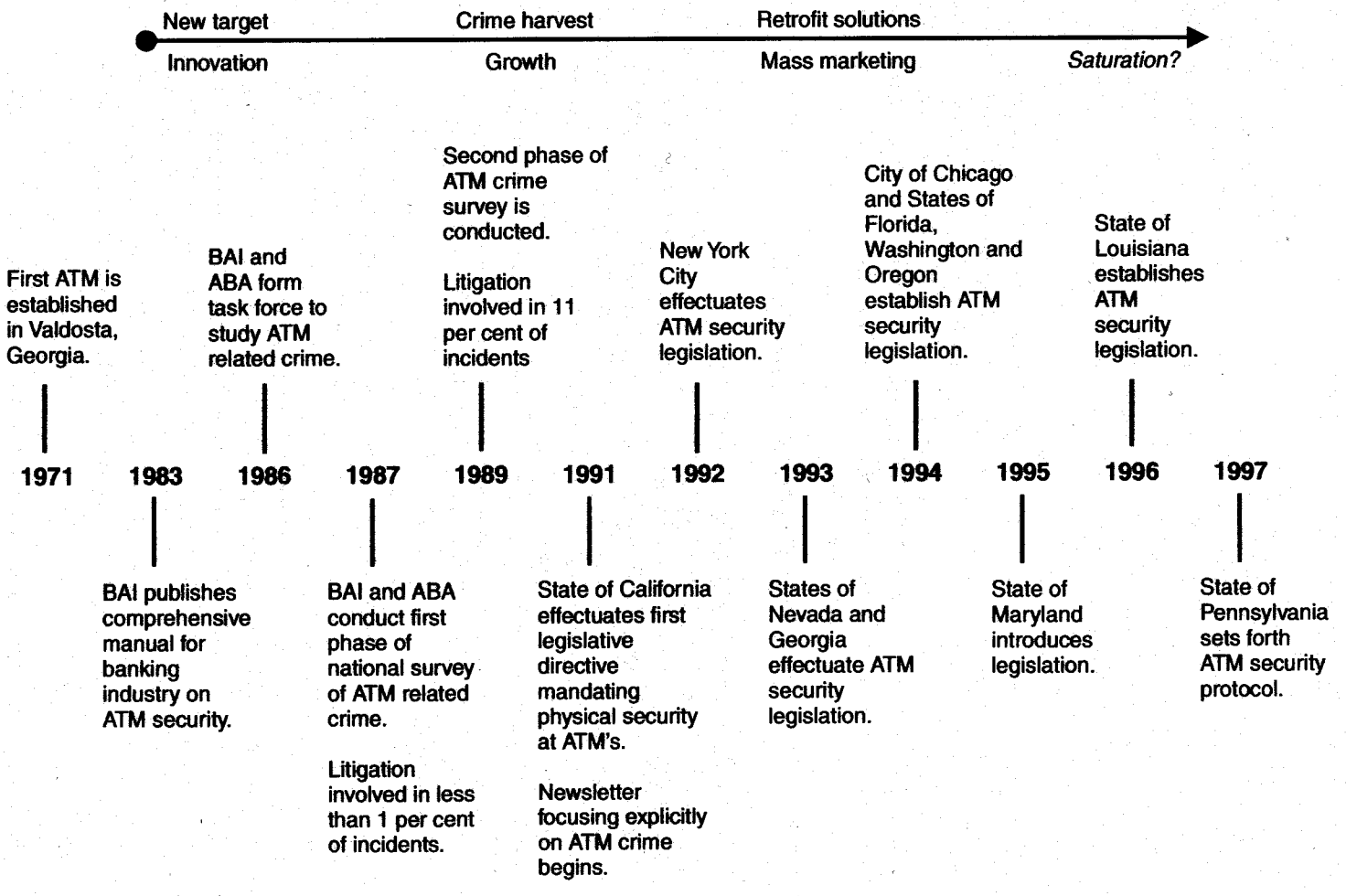
In the late 1970s, ATMs moved into Felson's 'growth' and 'mass marketing' stages, and by 1982 there were approximately 35,000 teller machines in operation.[10] By then, robberies had begun to increase, and the banking industry had begun to recognize the need for improved security at ATMs.[11] By 1983, a leading banking association acknowledged the need for a technical manual on ATM security, and published a guidebook for the banking industry on the prevention of ATM crime.[12] Stemming from the increase in robberies, civil litigation holding banks liable for insufficient security also began to increase.

In 1986, the Bank Administration Institute (BAI) and the American Bankers Association (ABA) assembled a task force with the explicit purpose of studying the nature and prevalence of crime at ATMs. The task force released findings from surveys of ATM crime conducted in 1987 and 1989 indicating a low rate of victimization—one in every 3.5 million transactions. However, the rate of civil litigation resulting from such attacks increased rapidly, from just one per cent of incidents in 1987 to 11 per cent by 1989.[13] By the early 1990s, trial lawyers identified ATM attacks as one of five major growth areas for litigation in the United States.[14] In 1991, a monthly bulletin, the *ATM Crime & Security Newsletter*, was established to cover crime at ATMs; a consistent portion of its coverage was devoted to a review of litigation cases.[15]

Despite the growing number of robberies and the increase in litigation, banks made few determined efforts to implement uniform security measures at their ATM facilities. Rather, it was state and city governments, specifically in California and New York, which took the lead in seeking to improve ATM security in the early 1990s. Over the remainder of the decade several other states and local jurisdictions throughout the United States followed the same course by establishing their own ATM security requirements (see Figure 1).

While the prevalence of crime has remained low in relation to the number of transactions, the sheer number of transactions, and the opportunities for robbery and other crime that they present, has meant that ATM crime is no longer rare. The incidents also tend to attract media attention,

Figure 1. Chronology of ATM developments in the United States



especially when victims are prominent (see below). In addition, media commentry on the crimes has been tinged with criticisms of the banks, which are charged with investing heavily in ATM facilities to increase profits while failing to invest the necessary resources to ensure customer safety. For these various reasons, dealing with ATM crimes has remained high on the public agenda.

There is little indication yet that ATMs have moved into the 'saturation' stage. The growth in the number of ATMs shows no sign of slowing. According to American Bankers Association figures,[16] by 1991 an annual total of 6.4 billion transactions were processed at 83,000 ATM terminals. In 1995, the number grew to over 9.5 billion transactions at almost 123,000 terminals. By 2000 there were 273,000 terminals hosting over 13 billion transactions, and the number of ATM sites is expected to continue to grow by 15 per cent through the year 2003.[17] There are also plans to introduce an entire new generation of ATM networks having online Internet capabilities, offering a whole new array of service possibilities.[18]

Even if ATMs were to reach saturation, it seems unlikely that this alone would lead to a decline in ATM robberies and other crimes. The criminal demand for cash, unlike that for TVs or VCRs, is never likely to diminish—at least not until we become a 'cashless' society. However, it is possible that retrofitting of security to ATM facilities could help put an end to the crime harvest they have produced. In the next section of the paper, we examine the effectiveness of mandated security measures at ATM facilities in New York and Los Angeles.

ATM security in New York City

The shooting of a Manhattan Assistant District Attorney at an ATM in Brooklyn and the murder of a police officer who was attempting to intervene in a midtown Manhattan ATM robbery led to a inquiry into the security of ATMs in New York. At the request of the City Council, the Office of Legislative Oversight and Investigation conducted a facilities survey of ATMs throughout the city's five boroughs.[19] ATMs at 231 sites were surveyed, which, at the time, represented one-third of all ATMs operating during daytime-only hours. The report found that security varied widely among sites. Of the interior ATMs surveyed, 37 per cent posted signs with safety information; 33 per cent maintained a security camera; 26 per cent had broken or faulty door locks; 10 per cent had security personnel; and six per cent provided elevated mirrors allowing customers a view behind them. Access to ATM facilities was open to anyone with a card containing a magnetic strip, not just to those with an ATM bankcard.

According to the *EFT Report*, New York bankers were stunned to learn of these findings at the first public hearing on the matter.[20] By the second hearing, banking leaders assembled representation to oppose the bill on ATM security but were reported to have succeeded only in 'further polarized relations between bankers and the council'. In particular, bankers submitted that it was too expensive to limit access to inside ATM facilities only to those with a bankcard. Infuriated with this response, Council members further strengthened the requirements of the bill on two separate occasions. The bankers' representatives threatened to challenge the Council's authority to impose regulation on the banking industry given that the industry was already operating under federal regulations. This was said by one Council member to have been the 'final straw', and incensed Council members proceeded to enact the most costly ATM security package yet mandated.[21]

The result was an administrative code, listed as Local Law 70 of 1992, that required all banks maintaining an ATM facility in New York City to provide a series of security measures, summarized in Table 1. The law took effect 180 days after its enactment, and established fines ranging from $500 to $2000 for any bank found in violation of any of the security provisions.[22]

Table 1. Summary of ATM security provisions in New York City and Los Angeles

Security measures	New York City	Los Angeles
Enclosed ATM vestibule with secured entry door	✔	
Increased lighting	✔	✔
Transparent windows in facility enclosure	✔	
Elevated mirrors for users	✔	✔✔
Reduced vegetation near machine		✔
Surveillance cameras	✔	✔✔
Safety reminders to users	✔	✔
Security provisions notice to potential offenders	✔	✔
Crime assessment prior to ATM installation		✔
Security guard personnel	✔*	
Reduced ATM operational hours based on temporal crime patterns in area		✔✔

✔ Required by legislation.

✔✔ Not required under legislation, but commonly implemented at bank's volition.

* Required only during non-banking hours for ATMs located inside bank buildings open for customer use.

Full compliance with the security provisions was not reached until 1993, but as shown in Table 2 the number of ATM robberies began to decline in New York City from 1991 (the year in which public attention became focused on the problem).[23] Overall, the decline in ATM robberies was 78 per cent, from 380 to 82. According to a simple regression of robberies on time this drop was highly significant ($t = -9.624$, $df = 8$, $p < 0.001$).

Table 2. ATM and all robberies in New York City, 1991–99 (indexed to 100)

Year	ATM robberies	All NY robberies	ATM robberies per ATM facility*	ATM robberies per transaction**
1991	380 (100)	98,512 (100)	458 (100)	59 (100)
1992	278 (73)	91,239 (93)	299 (65)	39 (66)
1993	304 (80)	86,001 (87)	295 (64)	38 (64)
1994	252 (66)	72,540 (74)	223 (49)	29 (49)
1995	193 (51)	59,280 (60)	157 (34)	20 (34)
1996	217 (57)	49,670 (50)	150 (33)	22 (37)
1997	136 (36)	44,707 (45)	82 (18)	13 (22)
1998	127 (33)	39,357 (40)	68 (15)	12 (20)
1999	82 (22)	36,099 (37)	36 (8)	7 (12)

Source: New York City Police Department.

* Per 100,000 estimated ATM facilities. Based on national estimates.

** Per one billion estimated ATM transactions. Based on national estimates.

Interpretation of this result is complicated by two opposing factors. The first is the general decline in crime occurring in New York City at that time,[24] which should have resulted in a reduction in ATM robberies, and the second is the large increase in ATM facilities over the period, which would have increased the opportunities for robbery and thus the numbers of robberies.

Concerning the general drop in crime, Table 2 shows that the overall numbers of robberies in New York City also declined markedly (by about 63 per cent) between 1991 and 2000 ($t = -14.796$, $df = 8$, $p < 0.001$). This decrease is not significantly different from the decline in robberies at ATM facilities ($z = -0.158$),[25] but when account is taken of the increase in ATM facilities over the same period (see Table 2)[26] the difference in the declines just reaches significance ($z = -1.447$, $p = 0.10$, one tailed test).[27] These data suggest that the preventive measures introduced under Local Law 70 did achieve some reduction in ATM robberies.

ATM security in Los Angeles

In 1991 the State of California enacted law AB244, which laid down security standards for all ATM owners and operators within the state (see Table 1 for a summary). In addition, the law required bank security personnel to make good-faith efforts to remedy security weaknesses after an incident had occurred at an existing ATM site. For example, the teller machine may be moved from behind the building to the front where it receives more surveillance or may be moved from outside to inside an entryway. Law AB244 required any new ATM facility coming into operation after 1st July 1991 to meet these requirements. For ATM facilities that were already in existence, compliance was required by no later than 1st July 1993.

Most banks have gone beyond the requirements of the law and have implemented other measures.[28] In addition to the measures listed in Table 1, they have also sought to increase customer awareness of security precautions by distributing safety information in statement stuffers, by posting precautions at ATM sites, and by providing brochures beyond the requirements of AB244. They have also established reward hotlines for tips leading to the arrest of suspects involved in an ATM-related crime.

To evaluate the effectiveness of bill AB244, data from the City of Los Angeles on ATM crimes were obtained for 1992 ($N = 211$) through the end of 2000 ($N = 67$). These figures include incidents of rape, attempted and completed robbery, attempted and completed burglary, petty and grand theft, motor vehicle theft and incidents of domestic violence. The most frequent crimes reported at ATM facilities were robberies and attempted robberies ($N = 646$), which comprised nearly half of all incidents during this time period. Table 3 shows trend data for all ATM crimes and ATM robberies. Both indices show sharp declines after the compliance deadline of 1993. By 2000 there was a 68 per cent decrease in all crimes compared to 1992 ($t = -2.659$, $df = 8$, $p < 0.05$), while attempted and completed robberies dropped by 88 per cent during this same period ($t = -6.484$, $df = 8$, $p < 0.001$).

Once again, interpretation of these trends is complicated by the same factors encountered in New York City: crime was decreasing throughout the period, while at the same time ATM use was increasing. Concerning the former, Table 3 provides data for all robberies during this same nine-year period. In 2000, all city robberies had declined by 68 per cent compared to their level in 1992 ($t = -17.991$, $df = 8$, $p < 0.001$). This decline is not significantly different from the decline in robberies at ATM machines during the same period ($z = -1.164$, not significant), but when account is taken of the increase in ATM facilities (see Table 3), the difference in the declines just reaches significance ($z = -1.346$, $p = 0.10$, one tailed test).[29] As for New York City, these data suggest that the improved ATM security was effective in reducing robberies at these machines.

Table 3. ATM crimes and robberies in Los Angeles, 1992–2000 (indexed to 100)

Year	All ATM Crime	ATM robberies*	All LA robberies	ATM robberies* per ATM facility**	ATM robberies* per transaction***
1992	211 (100)	152 (100)	39,451 (100)	163 (100)	21(100)
1993	233 (110)	154 (101)	39,222 (97)	150 (92)	19 (90)
1994	163 (77)	72 (47)	38,183 (78)	64 (39)	8 (38)
1995	126 (60)	73 (48)	30,622 (73)	59 (36)	8 (38)
1996	274 (130)****	77 (51)	28,807 (64)	53 (33)	8 (38)
1997	93 (44)	41 (27)	25,010 (52)	25 (15)	4 (19)
1998	116 (55)	39 (26)	20,327 (40)	21 (13)	4 (19)
1999	97 (46)	20 (13)	15,623 (36)	9 (6)	2 (10)
2000	67 (32)	18 (12)	14,185 (32)	7 (4)	1 (5)

Source: Public Affairs Unit and Crime Statistics, Los Angeles Police Department.

* Figures include actual and attempted robberies.

** Per 100,000 estimated ATM facilities. Based on national estimates.

*** Per one billion estimated ATM transactions. Based on national estimates.

**** The spike in all ATM-related crime occurring in 1996 was due to an organized ring of ATM burglars who would gain access to money by tying cables to ATMs and pulling them off the wall. In 1996 there were 119 burglaries compared to two the previous year and only eight in 1997.

Displacement

Any successful introduction of situational crime prevention, as in the case of the ATM security provisions, raises the possibility that the crime reductions obtained will be dissipated through displacement. However, as shown above, overall robbery rates declined during the nine-year period in both New York and Los Angeles. While ATM robberies comprise only a small proportion of all robberies, this suggests that the implementation of ATM security measures did not result in displacement to other kinds of robberies.

Perhaps a more appropriate test of displacement in the present case would be to focus only on bank robberies. These often involve lone offenders, many of whom are drug addicts. The robberies are not especially well planned and may net rather modest amounts of cash for offenders. In these respects, they may be little different from ATM robberies and might therefore provide a likely avenue for displacement.

Data for bank robberies were available for Los Angeles, but not for New York. Table 4 presents the yearly percentage changes occurring in the number of bank robberies and ATM robberies in Los Angeles. For the years 1992 through 2000, the two forms of robbery either increased or decreased in parallel, with the exception of 1993 when ATM robberies increased (by 1.4 per cent) and bank robberies decreased (by 32 per cent). In other words, trends for both kinds of robberies did not differ significantly ($z = 0.743$), nor did this picture change when ATM robbery

rates were expressed per facilities or transactions and bank robbery rates were expressed per number of branches.[30] This lack of evidence of displacement in the present study is consistent with many other evaluations of situational prevention measures.[31]

Table 4. Yearly percentage change in ATM and bank robberies in Los Angeles, 1992–2000

Year	ATM robberies (% change)	Bank robberies (% change)
1992	152 (52.0)	1075 (12.0)
1993	154 (1.4)	732 (-32.0)
1994	72 (-54.0)	443 (-39.0)
1995	73 (1.4)	442 (0)
1996	77 (5.5)	451 (2.0)
1997	41 (-47.0)	303 (-33.0)
1998	39 (-5.0)	182 (-40.0)
1999	20 (-49.0)	156 (-14.0)
2000	18 (-10.0)	150 (-4.0)

Source: Public Affairs Unit and Crime Statistics, Los Angeles Police Department.

Conclusions

When crime rates are declining, it is difficult to know whether specific crime prevention measures are working, since any observed reductions in crime might be due to the general fall rather than to the measures taken. In this case, the reductions in ATM robberies in both New York and Los Angeles were significantly greater than the overall falls in robbery in each city, at least when account is taken of the considerable increase in opportunities for ATM robberies provided by the increase of ATM facilities during the period under study. Despite various limitations of data and small inconsistencies in the findings,[32] these facts taken together suggest that the situational measures mandated in both cities were effective in reducing ATM robberies.

The present study is therefore one more example of the successful application of situational crime prevention[33] and, moreover, provides additional evidence of what has been described as the 'anticipatory benefits' sometimes resulting from the introduction of such measures:[34] a decline in ATM robberies was evident in New York City even before the measures mandated by Local Law 70 of 1992 were brought into effect. This could have been the result of the acrimony surrounding their introduction by the City Council, which attracted considerable local media coverage. Local robbers might have been aware that security was being tightened without being aware of precisely the measures being taken or when they were to take effect. In Los Angeles, on the other hand, there was no evidence of any anticipatory benefits of the regulations introduced, but these attracted much less media attention because they were relatively uncontroversial and were introduced by the state rather than by local politicians. Robbers in Los Angeles might therefore have been less aware that security was being tightened at ATM machines.

The study also confirms that the product life-cycle hypothesis may be as relevant to service delivery products as to consumer products. The 'crime harvest' resulting from the introduction of ATMs was diminished by retrofitting of preventive measures. The implications for avoiding crime harvests through anticipating and designing out crime vulnerabilities therefore apply equally to new service delivery products as to 'hot products'—those consumer items attractive to thieves. Incorporating security in the initial product design might avoid many crimes, and might be cheaper than later retrofitting, particularly when product liability settlements are figured into the calculations. For certain service delivery products, such as ATMs and bankcards, where cash is the thief's reward, it may be particularly important to take pre-emptive measures. Unlike consumer products, these products are never likely to reach the 'saturation' stage, when they become so widely available as to lose their attractions in the criminal market place.

On the other hand, it could be argued that changes in technology often result in the obsolescence of service delivery products, thus bringing about a natural end to the crime harvests they facilitate. A case in point might be analog wireless phones. These were much easier to clone than the digital models that soon replaced them.[35] If this obsolescence occurs with any frequency and regularity, it could be a waste of resources to invest in prevention, particularly for service products with a short life cycle. Even in the case of ATMs, it might be argued that investing in crime prevention would be uneconomic. Judged by the low rates of robbery per transaction, the crime harvest has not been bountiful, and the machines might soon be superseded by electronic point-of-sale (EPOS) terminals at grocery and other stores, which permit customers to withdraw cash. However, there is no indication that ATMs will fall out of use in the near future, even though EPOS cash withdrawals are growing fast. In fact, the case for postponing preventive action because of possible obsolescence is really a case for introducing prevention from the beginning. The costs of the measures can then be written-off over the whole of the product's useful life, not just in its final stages.

Finally, the present study holds some lessons for governments seeking to reduce crime harvests and for the affected industries. Recognition of the fact that industry leaders will resist taking crime prevention measures for the good of society when these measures will also reduce their profits should prepare government negotiators for a long and difficult process. They may need to make quite sophisticated use of data to build their case. They may need to build public support through judicious use of the media. Finally, they must anticipate that their legislative authority may have to be employed in order to reach their ends.

For industry, recognition of governmental authority and the need to develop good working relations with government officials might achieve compromise over the nature and extent of security regulation. In the case of New York City it seems that the Council's imposition of stringent security requirements at ATMs was as much a response to banking industry opposition as the extent of ATM victimization. Cognizant of this danger, industry representatives may further reduce monetary expense through finding middle ground in terms of security interventions that serve both the interest of government in protecting citizens and of industry in maximizing profit.

Notes

1 Rob Guerette is a doctoral candidate at the School of Criminal Justice, Rutgers, The State University of New Jersey; email: guerette@pegasus.rutgers.edu. Ronald Clarke is University Professor at Rutgers and Visiting Professor at the Jill Dando Crime Science Institute, University College London. The authors would like to thank the Information Technology Division and Shaquana Hall of the Public Affairs Unit, Los Angeles Police Department, and Sergeant Rocanelli of the Office of Management & Planning, New York City Police Department, for their help in providing crime data. They are also grateful to an anonymous reviewer and to Dr Travis Pratt of the Rutgers School of Criminal Justice, for statistical advice.

2 Clarke, R.V. (1999) *Hot Products: Understanding, Anticipating and Reducing Demand for Stolen Goods.* Policing and Reducing Crime Unit, Police Research Series Paper No. 112. London: Home Office.

3 Gould, L.C. (1969) The Changing Structure of Property Crime in an Affluent Society. *Social Forces.* Vol. 48, No. 1, pp 50–9; Mansfield, R., Gould, L.C. and Namenwirth, J.Z. (1974) A Socioeconomic Model for the Prediction of Societal Rates of Property Theft. *Social Forces.* Vol. 52, No. 4, pp 462–72.

4 Felson, M. (1997) Technology, Business, and Crime. In Felson, M. and Clarke, R.V. (eds) *Business and Crime Prevention.* Monsey, NY: Criminal Justice Press; Felson, M. (1998) *Crime and Everyday Life.* 2nd edn. Thousand Oaks, CA: Pine Forge Press. In Felson's view, the innovation stage comprises the initial introduction of a product whereby only a few people are owners. Due to novelty, the product may be more difficult to use and its unfamiliarity reduces its attractiveness in the secondary marketplace. As such, it is not likely to be stolen. It is not until the growth and mass-market phase that people become more accustomed to the product, and it is during this time that thefts become more prevalent. In the saturation phase the product is said to have become so widely available and inexpensive that there exists little reward for offenders, and thefts decline.

5 Ekblom, P. (1997) Gearing up Against Crime: A Dynamic Framework to Help Designers Keep up with the Adaptive Criminal in a Changing World. *International Journal of Risk, Security and Crime Prevention.* Vol. 2, No. 4, pp 249–65; Pease, K. (1997) Predicting the Future: The Roles of Routine Activity and Rational Choice Theory. In Newman, G., Clarke, R.V. and Shoham, S.G. (eds) *Rational Choice and Situational Crime Prevention: Theoretical Foundations.* Aldershot: Dartmouth.

6 Examples of this include anti-vehicle theft developments such as steering column locks and parts marking, magnetic strips for reducing credit card fraud, 'smart-guns', anti-cloning and fraud measures for cell phones, pay phone enhancements to reduce vandalism and theft, and tamper-proof seals on medicine and consumable products, to name a few.

7 'Bank and cash' machines, as they are sometimes called.

8 The American Bankers Association estimates that a human teller transaction costs the bank $1.07 per transaction, while a similar ATM transaction costs only 27 cents. Morisi, T.L. (1996) Commercial Banking Transformed by Computer Technology. *Monthly Labor Review.* Vol. 119, No. 8, pp 30–7.

9 New York State government officials recently proposed a 'cashless' system of welfare disbursements to the state's poorest families, in the form of a new card that permits ATM access. The proposal was later withdrawn over concern that an insufficient number of stores would accept the card, and other options are being explored. See Sengupta, S. (2001) State Rethinks Deal to Provide Extended Welfare via A.T.M. *The New York Times*, Metro Section, 14th July, p B1.

10 Bank Administration Institute (1983) *ATM Security.* Security Commission. Rolling Meadows, IL: BAI.

11 Ibid, p 9.

12 Ibid, p 9.

13 California Bankers Association (1987, 1989) *ATM Crime Survey Report.* San Francisco, CA: CBA.

14 Schreiber, F.B. (1994) The Future of ATM Security. *Security Management.* Vol. 38, March supplement, pp 18A–21A.

15 Schreiber, F.B. (1991) *ATM Crime & Security Newsletter.* Vol. 1, No. 1, p 1.

16 American Bankers Association (2001) *ATM Fact Sheet.* At *www.aba.com/Press+Room/ATMfacts2001.htm.*

17 Mercurio, M. (1999) Amplified ATMs. *Bank Marketing.* Vol. 31, pp 18–24.

18 *Community Banker* (2001) Web Enables ATMs to Create New Options. Vol. 10, No. 8, p 44; Dernovsek, D. (2000) ATMs: More than the Box Has Changed. *Credit Union Executive Journal.* Vol. 40, No. 4, pp 6–10; Newell, A. (2001) ATMs: The New Role Models. *Bank Technology News.*

Thomson Financial, September. At *www.electronicbanker.com/btn/articles*; Porter, J. (1996) ATMs: They're Not Just for Cash Anymore. *Bank Marketing.* Vol. 28, No. 8, p 11; Reid, K. (2001) A New Era for ATMs. *National Petroleum News.* Vol. 93, No. 6, pp 30–4.

19 Legislative Oversight and Investigation Unit (1991) *Report on ATM Security.* Submitted to the Council of the City of New York Committee on Public Safety, 9th December.

20 Schreiber, F.B. (1992) New York's ATM Security Law: What Went Wrong, Where to From Here? *EFT Report: Newsletter of Electronic Funds Transfer.* Vol. 15, No. 18, p 4.

21 Schreiber (1994), op cit, p 12, reports that the average amount spent by Chase Manhattan Bank and Chemical Bank on upgrading security features required under Local Law 70 ranged from $17,000 to $20,000 per ATM site, for a total cost to each bank of $2 million and $3.5 million respectively.

22 New York City Council (1992) Local Law 70 of 1992.

23 Data were available only for robberies, not all crimes, occurring at ATM facilities in New York City. However, as found in Los Angeles, robberies make up most of the crimes committed at ATM facilities, and arguably offer the most reliable measure of ATM crime. Data collection procedures changed during the time period reviewed. The 1990–97 data were maintained by the Detective Bureau Computer Assisted Robbery System (CARS), while the Investigative Liaison Unit and the Data Integrity Unit supplied data for 1998–99. Finally, it should be noted that it is sometimes difficult to decide if an ATM has facilitated a reported robbery. For example, police officers responding to a report may have difficulty in ascertaining if an offender had simply targeted the victim under the assumption he/she carried money, or had tracked the unknowing prey several blocks from an ATM site after observing the victim withdraw cash from the dispenser. Consequently, it is likely that robberies involving an ATM are not always recorded as such, or that incidents reported as involving an ATM did not in fact do so. In spite of this difficulty, the trends indicated most likely portray an acceptable representation of ATM crimes given the gradual and steady transitions over the course of analysis.

24 Fagan, J., Zimring, F.E. and Kim, J. (1998) Declining Homicide in New York City: A Tale of Two Trends. *Journal of Criminal Law and Criminology.* Vol. 88, No. 4, pp 1277–323; Silverman, E. (1999) *NYPD Battles Crime: Innovative Strategies in Policing.* Boston, MA: Northeastern University Press.

25 The formula is: $z = b_1 - b_2 / / (se_1^1 + se_2^2)$. See Brame, R., Paternoster, R., Mazerolle, P. and Piquero, A. (1998) Testing for the Equality of Maximum-Likelihood Regression Coefficients Between Two Independent Equations. *Journal of Quantitative Criminology.* Vol. 14, No. 3, pp 245–61; Clogg, C.C., Petkova, E. and Haritou, A. (1995) Statistical Models for Comparing Regression Coefficients Between Models. *American Journal of Sociology.* Vol. 100, No. 5, pp 1261–93; Paternoster, R., Brame, R., Mazerolle, P. and Piquero, A. (1998) Using the Correct Statistical Test for the Equality of Regression Coefficients. *Criminology.* Vol. 36, No. 4, pp 859–66. Use of the 0.10 critical value is appropriate with such a small sample.

26 Figures for New York City were not available for the number of ATM machines and ATM transactions, but national estimates were available from the American Bankers Association for 1991 (83,000 facilities, 6.4 billion transactions), 1995 (123,000 facilities, 9.5 billion transactions), 1998 (187,000 facilities, 11 billion transactions) and 2000 (273,000 facilities, 13 billion transactions). Interpolation of these figures yielded the annual data used in Table 2. There is little reason to believe that the increase in ATM transactions would have been any less in New York City than elsewhere, as the city was enjoying a remarkable period of economic prosperity and population growth.

27 The difference in the declines between all New York City robberies and ATM robberies per transactions did not reach significance ($z = -0.871$).

28 California Bankers Association (1995) *ATM Crime Survey Report.* San Francisco, CA: CBA.

29 The difference in the declines between all Los Angeles robberies and ATM robberies per transactions did not reach significance ($z = -1.071$).

30 Numbers of bank branches (excluding savings and loans offices) for Los Angeles County for 1994 to 2000 (1093, 1080, 1091, 1018, 1027, 1016 and 1014 respectively) were obtained from the website of the Federal Deposit Insurance Corporation (FDIC) and Office of Thrift Supervision (at *www3.fdic.gov/sod/*), and for 1992 to 1993 (1315 and 1115 respectively) from the FDIC Division of Research.

31 For studies of displacement and bank robbery see Grandjean, C. (1990) Bank Robberies and Physical Security in Switzerland: A Case Study of the Escalation and Displacement Phenomena. *Security Journal.* Vol. 1, No. 3, pp 155–9; Clarke, R.V. Field, S. and McGrath, G. (1991) Target Hardening of Banks in Australia and Displacement of Robberies. *Security Journal.* Vol. 2, No. 2, pp 84–90. For more general reviews of findings on displacement reviews see Clarke, R.V. (1997) *Situational Crime Prevention: Successful Case Studies.* Monsey, NY: Criminal Justice Press; Hesseling, R. (1994) Displacement: A Review of the Empirical Literature. In Clarke, R.V. (ed.) *Crime Prevention Studies*, Vol. 3. Monsey, NY: Criminal Justice Press.

32 Only national estimates of the numbers of ATM facilities and transactions were available, not for New York and Los Angeles separately. Tests of significance are less robust with few data points, as was the case in this study; declines in ATM robbery rates per transactions did not differ from declines in overall robbery rates in either city.

33 Clarke (1997), op cit.

34 Smith, M., Clarke R.V. and Pease, K. (2002) Anticipatory Benefits in Crime Prevention. In Tilley, N. (ed.) *Crime Prevention Studies*, Vol. 13. Monsey, NY: Criminal Justice Press.

35 Clarke, R.V., Kemper, R. and Wyckoff, L. (2001) Controlling Cell Phone Fraud in the US: Lessons for the UK 'Foresight' Prevention Initiative. *Security Journal.* Vol. 14, No. 1, pp 7–22.