P.J. van Koppen & R.W.J. Jansen (1999) The time to rob: Variations in time of number of commercial robberies. *Journal of Research in Crime and Delinquency, 36*, 7-29

THE TIME TO ROB: VARIATIONS IN TIME OF NUMBER OF COMMERCIAL ROBBERIES

PETER J. VAN KOPPEN
ROBERT W. J. JANSEN

This article reports a study on daily, weekly, and seasonal variations of the number of commercial robberies perpetrated in the Netherlands during the period 1988 to 1994. Results show that daily and weekly peaks depend on the kind of premises targeted. These peaks are explained by robbers' expectations of the amount of money available at the robbery target. The number of robberies in winter is distinctly higher than in summer, explained by the increased number of dark hours during the day. The explanation of changes in the number of robberies during the day, the week, and the year is straightforward: availability of suitable targets and adequate guardianship. The study shows that there is no reason to seek more complicated and less elegant explanations for daily, weekly, and seasonal variations, like cash flow in commercial targets, the cost of living during the winter, bad weather, or changes in the unemployment rate.

Crimes are unevenly distributed over the year, the week, and the day. July and August seem to be the months for homicide (Cheatwood 1988, 1995), rape happens after sundown (Cohn 1993), and the weekend produces more violent crime (LeBeau 1994), to give but a few examples. Some criminological theories try to explain variations in the level of crime with socioeconomic characteristics of offenders, victims, and neighborhoods (e.g., Blumstein et al. 1986; Brantingham and Brantingham 1984; Evans and Herbert 1989; Herbert 1982). Such theories, however, cannot explain the yearly, weekly, and daily rhythm in the level of crime, since socioeconomic characteristics tend to change in a much slower pace. In the present study, we try to explain empirically the daily, weekly, and yearly variations in the level of commercial robberies.

Daily and weekly variations in crime have hardly been the subject of study (exceptions are Jammers 1995; Morrison and O'Donnell 1994). There is,

---

We thank Editor James Finckenauer and three anonymous reviewers for their helpful comments on an earlier draft.

JOURNAL OF RESEARCH IN CRIME AND DELINQUENCY, Vol. 36 No. 1, February 1999 7-29

however, a long tradition in explaining changes in the level of crime during the year through seasonal and weather variations (Anderson 1987, 1989; Carlsmith and Anderson 1979; Cheatwood 1988, 1995; Cohn 1990, 1993; Cotton 1986; DeFronzo 1984; Falk 1952; Farrell and Pease 1994; Field 1992; Harries, Stadler, and Zdorkowski 1984; Lab and Hirschel 1988; LeBeau 1994; LeBeau and Corcoran 1990; LeBeau and Langworthy 1986; Rotton and Frey 1985; Tennenbaum and Fink 1994; Vrij, van der Steen, and Koppelaar 1994; Winslow, Rumbaut, and Hwang 1989). Adolphe Quetelet's (1842) so-called thermic law of criminality, specifying the relation between outdoor conditions and crime, apparently still holds: "Statistical studies show very uniformly that crimes against property reach a maximum in winter months, and crimes against the person and against morals, in the summer months" (Sutherland 1947:82).

This proposition is widely supported in research. For instance, Landau and Fridman (1993) found that the number of robberies peak in the winter. They explain this finding by the increase in cost of living and especially by environmental conditions that facilitate robberies. Unpleasant weather keeps people off the streets and makes those who go outdoors more vulnerable to being attacked.

The peak of crimes against persons in the summer months is usually explained by the increased number in interpersonal encounters because people are on holiday and spend more time outdoors, by the increase in alcohol consumption during the summer (Farrell and Pease 1994; Field 1990), and by the discomfort of extreme hot weather, which in turn causes aggression (Anderson 1989; Cheatwood 1988, 1995; Cohn 1990; DeFronzo 1984; Michael and Zumpe 1983; Warren, Smith, and Tyler 1983). An exception seems to be Milan, where all types of crime decrease dramatically in August simply because the Milanese criminals, as all other Milanese, in large numbers take a holiday in that month (Zimring, Ceretti, and Broli 1996).

In general, three types of theories are available to explain the level of crime at a certain point in time. Anderson (1989) reviewed psychological theories to explain the relation between temperature and aggression. He found that heat yields criminal behavior of the aggressive type, for instance, murder, assault, and wife battering. The relation is explained through a general increase in stress by extreme weather conditions. Individuals who already experience considerable stress may become aggressive under these circumstances. Thus, people are more aggressive in higher temperatures (Baron and Bell 1975), especially during the evening (Cohn and Rotton 1997), while low air pressure influences the level of depression in people (Briere, Downes, and Spensley 1983) and increases the number of complaints to the police (Lab and Hirschel 1988).

A second type of theory states that outdoor conditions influence criminal behavior indirectly through an effect on some aspects of social behavior. The routine activity approach (Clarke and Felson 1993; Cohen and Felson 1979; Felson 1986, 1987) suggests that crime depends on the convergence in time and space of (1) motivated offenders, (2) suitable targets, and (3) the absence of capable guardians against the crime. These, in turn, depend on what they call "routine activities" of offenders and victims. All three elements may change during the course of a day, a week, or a year, regularly or in other patterns. An instance of a regular pattern is that an unemployed criminal can be expected to prefer to sleep far into the day (Miedema 1993:114) rather than commit crime in the early morning; an instance of a less regular pattern is the influences of weather conditions on the motivation of offenders. Likewise, there are more or less regular patterns in the presence of capable guardians or the availability of suitable targets. The same type of target may typically be more suitable and less guarded at a certain point in time or simply unavailable at other moments.

A third type of theory is based on the assumption that criminals primarily seek to benefit themselves, and that involves making choices and decisions (Clarke and Cornish 1985; Cornish and Clarke 1986). Following that assumption, criminal behavior can be modeled as a series of sequential decisions, depicting microbehavior of criminals as making rational choices. This approach has been criticized, because most predatory crimes seem to involve youths with little skills and sophistication who show a downhill career rather than learning ability (Hirschi 1986). They do make choices but impulsively (Zey-Ferrell 1992).

The three approaches do not exclude each other. Activities may be routine, but routine activities also involve making choices by the criminal (Felson 1986). Psychological theories and the routine activity approach do not exclude each other either: Psychological influences of weather conditions, as reviewed by Anderson, can very well produce motivated offenders.

The theories discussed by Anderson, however, do not seem adequate to explain variations in the level of crime in moderate-climate countries like England or the Netherlands, neither can it explain the influence of other factors, like lighting conditions or variations within a day or week. Moreover, in research to date, psychological influences on variations in the level of crimes against persons are routinely found, while research seems to suggest that variations in the level of crimes against property are much less influenced by changes in psychological states (Anderson 1987; Anderson and Anderson 1984; Cotton 1986; DeFronzo 1984; Feldman and Jarmon 1979).

Many studies on the influence of season and weather in the level of crime, however, suffer from the disadvantage that they measure the independent

variables quite indirectly. If only monthly crime rates are used (Field 1992; Landau and Fridman 1993), for instance, a winter peak of robberies can mean a lot of things: that robbers prefer to rob in the dark, that low temperatures enhance robberies, or that targets tend to carry more money in winter (Cohn 1990). Previous studies have not addressed this issue. In the present study on commercial robberies in the Netherlands, we try to decompose these influences.

COMMERCIAL ROBBERY

Commercial robbery is a crime that is well defined: Offenders use threat to extort valuables from commercial targets, either indoors or outdoors. At the same time, these robberies show quite some variation, ranging from a single drug addict who, armed with a penknife, robs the local candy store without much preparation, to the well-organized gang that robs a bank after careful planning. Thus, it can be expected that depending on the kind of target, different times and circumstances produce different patterns of robberies.

Weather Conditions

The major motivation to commit a robbery is monetary gain (Feeney 1986; Katz 1991; Kroese and Staring 1993). Robbers select the target of a commercial robbery on the accessibility of as much money as possible. Unlike other types of crime, research failed to show significant relations between weather conditions and robbery (Anderson and Anderson 1984; DeFronzo 1984; Landau and Fridman 1993; Michael and Zumpe 1983). It should be noted that much of the research cited also includes street robberies. It is a reasonable assumption that commercial robberies—most of the time committed indoors—are even less influenced by weather conditions. Apparently, robbers are also less influenced by weather conditions than other types of criminals, since robberies are primarily motivated by economic needs and are not truly aggressive crimes (Anderson and Anderson 1984). The lack of influence of weather conditions probably also stems from the fact that many robberies are planned more than one day ahead when weather conditions at the time of the robbery are still unknown.

Winter Peaks

Nevertheless, robberies consistently show a peak in the winter months (Field 1992; Jammers 1995; Landau and Fridman 1993). A simple

explanation would be that evading adequate guardianship is easier in winter by wearing an extensive disguise; in summer, much clothing is rather conspicuous during the getaway. Practice shows, however, that a typical summer outfit such as a baseball cap and sunglasses is as good a disguise as, for instance, winter hats and balaclavas (van Koppen and Lochun 1997). Several explanations have been forwarded for the winter peak. The higher costs of living in the winter would produce more motivated robbers (Cohn 1990; Landau and Fridman 1993; Sutherland 1947), a higher winter rate of unemployment would do the same (Haran and Martin 1984; Landau and Fridman 1993), or the increased availability of cash money during Christmastime would attract more robbers (Field 1992). Another reason may be that robberies are better carried out in wintertime because there are more hours of darkness in winter.

The above possible explanations suggest several rival hypotheses for the winter peak in robberies. One hypothesis is the change in weather conditions in winter, allowing for a more extensive disguise. The present study can only provide for a weak test of this hypothesis, since it was performed in the Netherlands. The Dutch climate is comparable to the English: It is unusual for the weather to be uncomfortably hot, and extended periods of frost are rare. In the seven years under study, the longest period of continuous frost was 6 days, and only 22 out of 2,557 days had a maximum temperature higher than 30°C (86°F). In research in the United States, the weather showed a large influence but only on extremely hot and humid days and only on more person-oriented crimes (Lab and Hirschel 1988). Therefore, we do not expect the weather to exert a large influence on the number of robberies.

The second hypothesis is related to money. In winter, robbers may be attracted by the higher cash flow during the end of the year shopping season. To test this hypothesis, the Netherlands provides for a unique opportunity because the custom of giving presents at Christmas is only a very recent habit. More important is the *Sinterklaas* celebration on December 5.[1] Although more and more presents are given at Christmas, expenditure in shops for Sinterklaas's birthday still surpasses Christmas expenditure. For Christmas, the Dutch spend between 450 and 500 million guilders (about U.S.$225 to $250 million); for Sinterklaas, they spend between 750 and 800 million guilders (Fris 1995). If cash money causes the peak of robberies in winter, robberies in November should peak at least as highly as robberies in December in the Netherlands.

A third possible explanation for the winter peak is that there is not so much a winter peak but a summer low. Robbers also take summer holidays (Zimring et al. 1996). Therefore, a lesser number of robberies can be expected during summer school holidays. If this explanation is valid, the

winter peak extends much longer than only December or November, and also smaller dips must be found on other periods of school holidays.

A fourth explanation for a winter peak is that the cover of darkness facilitates robberies. In the Netherlands, there are only 7 hours and 43 minutes between sunrise and sundown on December 21, while on June 21, the day lasts 16 hours and 46 minutes. More important, the sunset is at 2203h[2] (allowing for daylight-saving time) in the middle of the summer and in the middle of the winter at 1628h, that is, while most shops and petrol stations are still open. If the cover of darkness is important for robbers, a symmetrical pattern can be expected; for example, the peak in January must be as high as the December peak, the November peak as high as the February peak, and so on.

The four hypotheses may be rival, but they do not exclude each other. Much cash money, for instance, makes targets more suitable to rob and at the same time motivates criminals to overcome security measures taken by the targets.

Weekly Peaks

To commit a robbery, the target must be available. Therefore, robberies are limited to opening hours of fixed targets. On Sunday, when most banks and shops are closed in the Netherlands, robberies can be expected to be rare. The same holds for bank robberies on Saturday. During opening hours, however, Friday seems to be the most popular day for a robbery. Morrison and O'Donnell (1994) report that in England and Wales one-quarter of all robberies take place on Friday. They do not give an explanation. One possible explanation is that robbers are more motivated toward the end of the week because they need money for their weekend festivities. Another explanation is that robbers expect targets to carry more money at the end of the week.

Daily Peaks

Robberies are also unevenly distributed over the day (Jammers 1995; Morrison and O'Donnell 1994). Of course, a prerequisite for a robbery is that the target must be available; that is, robberies are only possible during opening hours of the target.[3] During opening hours, however, some moments are more suitable for a robbery than others. Shops and petrol stations, for instance, can be expected to hoard more money at closing time than at other times. Banks and post offices, on the other hand, tend to have more cash money available early in the morning when the night safe is emptied. Money transports—most of these done by shopkeepers between their shop and the banks night safe— are often carried out right after closing or before opening

in the early morning. Hotels, restaurants, cafes, and cafeterias—further denoted HRC industry—also can be expected to carry more money at the end of the evening.

An essential element of each robbery is the getaway. The level of guardianship varies during the day, and robbers will time the robbery to minimize risk of apprehension. Bystanders enhance that risk. Thus, robbers will choose times when others than the employees of the target are sparse. For petrol stations, for instance, the evening and night are the most quiet periods.

As said, even within the fairly well-defined crime of robbery, there is quite a lot of variation. Some robbers invest more time and effort in preparation than others, and some targets require more preparations than others. Other robbers invest much less. Since almost all robbers are unemployed and this kind of criminal, in general, tends to live on a short-term basis (Gottfredson and Hirschi 1990; Walters 1990), it can be expected that the less professional robbers who rob the easy targets (shops, HRC industry) sleep well into the day and thus will not commit an early-morning robbery. Robbers of the more difficult targets (banks), however, can be expected to commit relatively more robberies in the early morning.

DATA

The advantage of a study on commercial robberies is that in almost all cases the police are notified immediately, often by way of a silent alarm to the police station. Therefore, the exact time of most robberies is known. Also, the Dutch National Crime Intelligence Service routinely receives data on all commercial robberies committed in the country from local police forces. The information on each robbery includes type of target, day, time, successfulness, loot, and number of robbers. The present analysis is done on the 11,860 robberies from January 1, 1988 until December 31, 1994 on banks, post offices, money transports, the HRC industry, shops, petrol stations, and so-called other targets. The latter category includes a variety of commercial targets but mainly consists of taxis, pizza and other food deliveries, and railway stations. The category "money transports" consists, apart from a few professional transports, almost exclusively of business people as shopskeepers who were robbed while bringing their deposits to the bank.

In the period under study, there has been a rise in robberies from 1,048 in 1988 to 2,350 in 1993, followed by a slight decline to 2,167 in 1994. The number of robberies on each day varied between 0 and 22 ($M = 5.2$, $SD = 3.5$). The distribution of the daily number of robberies is skewed toward lower numbers, but we found no outliers.

Weather data were drawn from the daily data supplied by the Koninklijk Nederlands Metereologisch Instituut (Royal Dutch Meterological Institute) in De Bilt. We took the data for the De Bilt weather station. It was considered that these data might suffice, because De Bilt is located in the center of this small and flat country, in which the weather does not vary much from one extreme of the country to the other. We coded for each day the maximum day temperature (range –6ºC to 35ºC), the minimum night temperature (–11ºC to 21ºC), the average day wind (0.5 to 11 m/s), hours of sunshine (0 to 15), total day's sun radiation (9 to 4,237 j/cm^4), precipitation (0 to 51 mm), and average day pressure (974 to 1,043 mbar).[4]

As can been seen from the ranges, the Dutch climate is quite moderate, without extensive heat or freezing periods. For instance, only 30 out of the 2,557 days in the period under study had a day maximum temperature below 0°C, and only 22 had a day maximum temperature above 30°C. Most days (53 percent) are dry, and only 2 percent of the days have a precipitation higher than 15 mm.

The variable "holiday" was constructed as follows. The country is divided into three regions for the purpose of school holidays. To support the government policy of spreading holidays, each region has different holiday periods, both for the summer holidays and for shorter holidays during the school year. Although there are different periods, they often overlap. The variable holiday is constructed by counting for each day the number of regions that had a holiday. Thus, this variable could take values of 0, 1, 2, or 3.

RESULTS

In the period from 1988 to 1993, the number of robberies on all types of targets show an increase (see Table 1) and decline slightly in 1994. Since bank robberies and robberies of post offices have virtually the same pattern in many respects, we do not make a distinction between them in the present analyses.

The Time of Day

Before discussing results, something must be said about opening hours in the Netherlands, because robberies are only possible during these hours. Due to strict shopping regulations in the Netherlands, most shops in the country are open from 0900h until 1800h from Monday to Friday, closing an hour earlier on Saturday. Shops, however, are open one evening each week until 2100h, either on Thursday or Friday, depending on the location. The largest

TABLE 1: Number of Robberies by Type of Target and Year

	Banks, Post Offices		*Money Transports*		*HRC Industry*		*Shops*		*Petrol Stations*		*Other Targets*		
Year	*Count*	*Percentage*	*Count*	*Percentage*	*Count*	*Percentage*	*Count*	*Percentage*	*Count*	*Percentage*	*Count*	*Percentage*	*Total*
1988	322	31	163	16	145	14	255	24	100	10	63	6	1,048
1989	393	33	130	11	159	13	304	25	143	12	75	6	1,204
1990	387	27	124	9	225	16	410	29	204	14	84	6	1,434
1991	527	33	120	8	277	17	402	25	176	11	97	6	1,599
1992	586	29	158	8	421	21	571	28	205	10	117	6	2,058
1993	518	22	232	10	527	22	681	29	224	10	168	7	2,350
1994	331	15	178	8	487	23	748	35	190	9	233	11	2,167
Total	3,064		1,105		2,241		3,371		1,242		837		11,860

NOTE: HRC = Hotels, restaurants, cafes, and cafeterias.

TABLE 2: Distribution of Robberies over Hours of the Day (*N* = 11,214; entries are column percentages; bold indicates above the hourly average)

Time[a]	*Banks, Post Offices*	*Money Transports*	*HRC*	*Shops*	*Petrol Stations*	*Other Targets*	*Total*	
							Percentage	*Count*
0	0	3	**12**	1	1	4	3	338
1	0	3	**8**	0	0	5	2	235
2	0	2	**5**	0	1	6	2	176
3	0	1	4	0	0	4	1	128
4	0	1	2	0	0	4	1	95
5	0	1	1	0	0	4	1	80
6	0	1	1	1	1	4	1	107
7	1	1	1	2	1	3	2	166
8	**6**	1	1	3	1	2	3	311
9	**23**	**5**	1	4	1	3	8	908
10	**13**	**5**	1	3	1	2	5	567
11	**11**	**5**	1	4	1	2	5	536
12	**5**	2	1	4	2	2	3	350
13	**6**	3	1	3	1	3	3	352
14	**7**	4	1	**6**	2	**5**	4	496
15	**10**	2	1	**7**	2	4	6	635
16	**7**	4	2	**13**	3	4	7	760
17	4	**12**	2	**21**	**6**	**5**	9	1,044
18	3	**15**	3	**7**	**11**	4	6	665
19	4	3	**5**	4	**17**	**6**	6	619
20	1	3	**7**	**7**	**22**	**7**	7	734
21	0	**17**	**11**	**5**	**17**	**8**	7	828
22	0	4	**14**	2	**8**	**5**	5	528
23	0	3	**19**	1	4	**6**	5	556
Total count	2,962	1,038	2,112	3,155	1,180	767		11,214

NOTE: HRC = Hotels, restaurants, cafes, and cafeterias.
a. Times are given in whole hours, that is, 19 means between 1900h and 1959h.

cities in the country, notably Amsterdam and Rotterdam, know a few so-called night shops, which sell food until midnight. Another exception is video rentals, a rather popular target, that commonly are open in the evening and on Sunday. Banks usually are open on Monday through Friday between 0900h and 1500h or 1600h. Exceptions are some banks located at railway stations, airports, and at the border that often are open each day, sometimes even 24 hours a day. Most of the robberies on targets in the HRC category took place on cafeteria and cafes. These are usually open from the beginning of the

evening until 0200h or 0300h. Most petrol stations in the Netherlands are open until 2100h. If a petrol station stays open later, it requires additional security measures, such as a silent robbery alarm, a drop safe, and an electronic lock on the shop's door. Only a few petrol stations along the motorways comply to these requirements.

The distribution of commercial robberies during the day roughly reflects the opening hours pattern (see Table 2). Within business hours, however, the robberies show the following three patterns: (1) Robbers commit relatively few robberies in the morning, (2) the number of robberies at each type of target peaks at moments when the most money can be expected, and (3) there is a preference for night robberies. The first effect is reflected in the general low number of robberies during the morning. The second effect results in different best times for different types of targets. Banks are robbed right after 0900h when they just opened. This is the exception to the robberies not being committed in the morning. As hypothesized, bank robbers are usually more professional (they attack more difficult targets) and may have less trouble with a regular day pattern. The HRC industry is attacked in the middle of the night when all the evening proceeds are there. Robberies on shops peak around closing time at 1800h and just before closing on the weekly shopping evening at 2100h. Petrol stations are almost exclusively robbed between 1700h and 2100h, when both the day's proceeds are still there and the robbery can be executed in darkness, at least in wintertime, and the number of bystanders is kept to a minimum.

Robberies on money transports follow the availability of targets. There is a moderate peak early in the morning (shopkeepers who bring yesterday's income to the bank), a peak at the regular closing hour, another peak at the closing hour of the weekly shopping evening, and an additional small peak at the lunch hour, when apparently some business people bring their money to the bank.

The peaks in the number of robberies for each type of target suggest that robbers expect the most money at those times. The data allowed for a check on this expectation of the robbers. The loot of successful robberies is noted by the police. The analysis shows, contrary to robbers' expectations, that the loot is generally higher at off-peak hours than at peak hours (see Table 3).

Day of the Week

As we expected, Friday is the most popular day for a robbery (see Table 4). Again, the expectation of cash money seems to be the most important determinant of the number of robberies. Money transports are more often robbed

TABLE 3: Mean Loot of Successful Robberies at Peak and Off-Peak Times in Different Categories of Targets during 1988-1994 (*N* = 7,967)

	Off-Peak Hours		*Peak Hours*		
Type of Target	N	*Index Loot* [a]	N	*Index Loot* [a]	*Peak Hours*
Banks, post offices	971	2,719	1,305	2,133	0900h-1159h and 1500h-1559h
Money transports	473	3,050	336	747	1700h-1859h and 2100h-2159h
HRC industry	671	354	997	179	2100h-0159h
Shops	1,208	577	1,008	311	1600h-1759h and 2000h-2159h
Petrol stations	454	110	544	100	1900h-2159h
All targets	3,777		4,190		

NOTE: HRC = Hotels, restaurants, cafes, and cafeterias.
a. Because of security reasons, the Ministry of Justice does not allow us to publish the actual loot. Therefore, we present an index figure, with the mean loot of peak-hour robberies on petrol stations set to 100.

TABLE 4: Distribution of Robberies over the Days of the Week (*N* = 11,860; entries are column percentages; bold indicates above the weekday average)

Day of Week	*Banks, Post Offices*	*Money Transports*	*HRC*	*Shops*	*Petrol Stations*	*Other Targets*	*Total*	
							Percentage	*Count*
Monday	**15**	14	14	12	**15**	12	13	1,585
Tuesday	**17**	12	13	14	13	11	14	1,685
Wednesday	**18**	9	14	13	13	14	14	1,675
Thursday	**20**	**19**	13	**20**	12	**15**	17	2,045
Friday	**29**	**22**	**15**	**23**	**15**	**23**	22	2,623
Saturday	2	**22**	**17**	**16**	**18**	**15**	13	1,542
Sunday	0	3	**15**	2	14	11	6	705

NOTE: HRC = Hotels, restaurants, cafes, and cafeterias.

near the end of the week, when business people bring away their weekly proceeds. However, there is also a slight peak on Monday, when weekend proceeds are brought to the bank, although the peak remains below the week's average. For the same reason, robberies of banks and of shops are skewed toward the end of the week. The HRC industry is mostly robbed in the weekend, when income is expected to be highest. The number of robberies on petrol stations shows little variation from weekday to weekday. Apparently, robbers do not expect more money on specific weekdays.

TABLE 5: Distribution of Robberies over the Months (*N* = 11,860; entries are column percentages; bold indicates above the monthly average)

Month	Banks, Post Offices	Money Transports	HRC	Shops	Petrol Stations	Other Targets	Total	
							Percentage	Count
January	**11**	**10**	**10**	**11**	**10**	**10**	11	1,269
February	**9**	**10**	**11**	**9**	**12**	**10**	10	1,170
March	**10**	8	**9**	**9**	**10**	8	9	1,080
April	7	7	6	7	5	8	7	777
May	7	6	8	6	4	5	6	725
June	6	7	6	6	5	6	6	748
July	8	6	7	6	6	6	7	788
August	8	5	7	7	6	7	7	820
September	8	7	8	7	8	**9**	8	915
October	7	**9**	**10**	7	**12**	**10**	9	1,014
November	**9**	**11**	**10**	**10**	**12**	**11**	10	1,198
December	**10**	**15**	**10**	**14**	**10**	**9**	11	1,356

NOTE: HRC = Hotels, restaurants, cafes, and cafeterias.

The Time of Year

As in previous research on robberies, we found a winter peak for all types of targets. The distribution of robberies over the months (see Table 5) suggests that the number of hours dark while targets are open is the main cause for the winter peak. If Sinterklaas and Christmas turnover of cash money would cause the winter peak, the number of robberies should be higher in November and December than in January and February. They are only slightly higher. If there would be a summer low because of holidays, rather than a winter peak, the winter peak would have been spread more widely, extending over September, October, March, and April. In fact, the months with the lowest number of robberies are not the typical holiday months July and August, but May and June.

The conclusion that the winter peak is caused by the number of dark hours is further supported by differences in the distribution of robberies over the day between the seasons (see Table 6 and Figure 1). For this analysis, we merged spring and autumn into one category, because we did not expect any differences between spring and autumn robberies, while keeping the number of categories as small as possible. Thus, November, December, January, and February are the winter period; March April, September, and October are the spring/autumn period; and the other months are the summer period. In Table 6 and Figure 1, the twenty-four hours of the day are divided into periods using the following cutoff points: sunset in midsummer (2203h), sunrise in midsummer (0517h), sunrise in midwinter (0848h), 1100h, sunset in midwinter (1626h), and end of business for most targets (1800h). Please note that these

TABLE 6: Distribution of Robberies over Day Periods by Season (*N* = 10,678; entries are percentages)

Type of Target	*Season Period*	*Full Night (2203h-0516h)*	*Early Morning (0517h-0847h)*	*Begin Business (0848h-1059h)*	*Full Day (1100h-1625h)*	*End Business (1626h-1759h)*	*Evening (1800h-2202h)*	*Total*
Banks, post offices	Winter	0	6	35	36	11	13	1,166
	Spring/autumn	0	7	37	44	6	5	948
	Summer	1	6	38	47	6	2	848
Money transports	Winter	11	4	9	15	16	45	463
	Spring/autumn	17	4	8	20	12	39	318
	Summer	21	2	12	22	18	26	257
HRC	Winter	57	3	1	5	2	32	842
	Spring/autumn	60	2	3	6	1	28	687
	Summer	67	4	3	5	3	18	583
Shops	Winter	3	6	7	25	31	29	1,391
	Spring/autumn	4	5	8	32	28	23	968
	Summer	6	5	10	36	27	17	796
Petrol stations	Winter	8	3	1	4	7	78	522
	Spring/autumn	13	3	2	10	5	67	402
	Summer	18	4	3	18	9	48	256
All robberies	Winter	15	5	12	20	15	33	4,690
	Spring/autumn	19	5	14	25	11	26	3,599
	Summer	21	5	16	30	12	16	2,925

NOTE: HRC = Hotels, restaurants, cafes, and cafeterias.

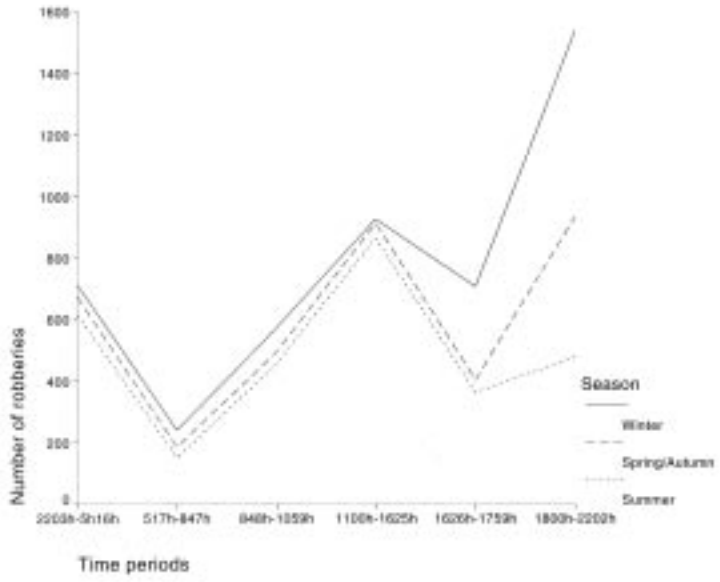

Figure 1: Differences in Distribution over the Day for the Seasons, All Robberies

cutoff points divide the day into six periods of different duration, but these were the most logical for the present analysis.

The sharp rise in number of robberies in the winter chiefly is due to the rise in robberies in the evening, when it is light in summer and dark in winter. This holds for all categories: banks (winter robbery in the evening rate is 674 percent higher than on summer evenings), money transports (214 percent), shops (197 percent), petrol stations (227 percent), and the HRC industry (163 percent). A smaller increase was found during winter in the period we called *end business*, when it is dark in dead winter and light in high summer, for banks (148 percent) and shops (100 percent). And robberies on shops are also higher in winter in the early morning period (with an increase of 107 percent).

There is one peculiarity in Table 6. The number of robberies during the night on the HRC industry is also much higher in winter than in summer (with 111 percent), while in both periods it is dark then. If cover of darkness would be the most important explanation for the winter peak, a difference between

the number of robberies in the full-night period between summer and winter would not be expected. We do not have an explanation for this exception.

The higher number of robberies during the winter is entirely caused by an increase during the evening, as can best been seen in Figure 1. This is not compensated by a decrease in daytime robberies during the winter.

Weekdays, Weather, and Months

The influences on the rate of robberies were tested against each other, using as unit of analysis the number of robberies committed on each day for each category of targets in the period under study. We used a stepwise regression analysis, because the nature of the data prohibited other methods, notably, ARIMA, which can be considered more appropriate for the data set (Cohn 1990). The analysis was done on the data after the effect of the changes from year to year had been partialled out. The regression analysis was used to analyze whether differences between the months were still meaningful after removing the effects of weekdays and national holidays, length of daylight, school vacations, and weather variables. Weekdays and months were entered as dummy variables. We coded national holidays as Sundays.

In a first step (see Table 7), the days of the week were entered. The days of the week show an effect that is mainly due to the availability of targets. The HRC industry and petrol stations that are usually open each day of the week show no robbery days that really stand out against the others. Only Saturday for the HRC industry and Thursday for petrol stations show a slight but significant increase and decrease, respectively.

In the next step, the number of robberies shows a relation with the duration of the day. The length of the day apparently plays a role in all types of commercial robberies. Only for robberies on banks and post offices and on money transports was an effect of the holiday found.

After introduction of these variables, none of the weather variables, as expected, had a significant influence on the number of robberies committed. The winter peak is not caused by the weather in our moderate climate. In the final step, months were introduced in the analysis. Only the number of robberies on banks and post offices in October and November, on shops in December, and on the HRC industry in February differed significantly from the other months. The coefficients concerning bank robberies in these two months, however, have a negative sign, indicating that the number of robberies is relatively lower, after partialling out all the effects in the previous steps, compared to the other months. There is no theory that would predict this effect, and considering the large number of coefficients in the table, this effect may be attributed to chance. The same holds for the single significant

TABLE 7: Regression of Independent Variables on Number of Robberies for Each Type of Target Separately. Dependent Is Residual after Removing Effect of Years. Units of Analysis Are Days (*N* = 2,557)

	All Robberies		*Banks, Post Offices*		*Money Transports*		*HRC*		*Shops*		*Petrol Stations*	
Predictors	B	β	B	β	B	β	B	β	B	β	B	β
Step 1, R^2=		.22		.30		.07		.01		.15		.01
+ Tuesday[a]	.16	.02	.22	.05**	–.07	–.03	–.07	–.02	.23	.06*	–.06	–.03
+ Wednesday[a]	.21	.02	.26	.06***	–.14	–.07**	–.01	–.00	.16	.04	–.07	–.03
+ Thursday[a]	1.38	.15***	.42	.10***	.16	.07***	–.04	–.02	.75	.18***	–.12	–.06*
+ Friday[a]	2.88	.31***	1.22	.30***	.27	.12***	.06	.02	1.02	.25***	–.01	–.01
+ Saturday[a]	–.13	–.01	–1.09	–.26***	.30	.14***	.19	.07**	.36	.09***	.08	.04
+ Sunday and national holidays	–2.56	–.28***	–1.19	–.29***	–.30	–.14***	.04	.01	–.86	–.21***	–.05	–.03
Step 2, R^2=		.33		.31		.11		.03		.20		.04
Minutes of daylight	–.01	–.33***	–.01	–.11***	–.01	–.18***	–.01	–.16***	–.01	–.23***	–.01	–.19***
Step 3, R^2=		.34		.32		.11		.03		.20		.04
Holiday	–.16	–.07**	–.09	–.09***	–.04	–.08**	–.01	–.01	–.04	–.04	.02	.04
Step 4, R^2=		.34		.32		.11		.04		.21		.04
Highest day temperature	–.01	–.03	.00	.01	.00	.02	–.00	–.02	–.01	–.07	.01	.06
Lowest night temperature	.00	.01	.00	.01	–.01	–.02	–.00	–.01	.01	.05	–.01	–.05
Average pressure in mbar	.01	.02	.01	.05	–.00	–.04	.00	.03	.00	.01	.01	.01
Minutes of sunshine	–.03	–.03	–.01	–.02	–.00	–.01	–.01	–.06	.00	.01	–.01	–.03
Average wind in m/s	–.08	.04*	.02	.02	–.00	–.00	.01	.02	.00	.00	.01	.03
Total precipitation in mm	.02	.02	.01	.02	–.00	–.01	.00	.01	.00	.01	–.00	–.00

(continued)

TABLE 7: Continued

Predictors	*All Robberies*		*Banks, Post Offices*		*Money Transports*		*HRC*		*Shops*		*Petrol Stations*	
	B	β	B	β	B	β	B	β	B	β	B	β
Step 5, R^2=		.35		.33		.12		.05		.22		.06
+ February	.56	.05	–.13	–.02	.05	.02	.31	.09**	.05	.01	.18	.07
+ March	.08	.01	–.17	–.03	–.07	–.03	.22	.06	.10	.02	–.04	–.02
+ April	–.73	–.06	–.39	–.07	–.04	–.01	.13	.04	–.08	–.01	–.28	–.10
+ May	–.45	–.04	–.50	–.10	.01	.00	.47	.14	–.03	–.01	–.33	–.13
+ June	–.10	–.01	–.54	–.10	.06	.02	.44	.13	.14	.03	–.25	–.09
+ July	.19	.02	–.14	–.03	.07	.02	.45	.13	.06	.01	–.25	–.10
+ August	–.02	–.00	–.27	–.05	–.04	–.02	.30	.09	.10	.02	–.25	–.09
+ September	–.55	–.05	–.42	–.08	.01	.00	.30	.09	–.15	–.03	–.12	–.04
+ October	–.47	–.04	–.45	–.09**	.02	.01	.19	.06	–.30	–.06	.08	.03
+ November	–.11	–.01	–.26	–.05*	.13	.05	.05	.01	–.11	–.02	.14	.05
+ December	.16	.01	–.21	–.04	.22	.08	–.07	–.02	.42	.08***	–.02	–.01
Constant	.92		–4.22		3.66		–1.20		1.41		–.48	

NOTE: HRC = Hotels, restaurants, cafes, and cafeterias; + = dummy variable.
a. If a national holiday falls on that day, this dummy variable is set to 0.
*p < .05. **p < .01. ***p < .001.

difference found in the number of shop robberies and number of HRC robberies between the months.

DISCUSSION

The present study shows that the distribution of commercial robberies over time of day, weekdays, and months is mainly due to the availability of suitable targets and the presence of adequate guardianship. Commercial robberies are, of course, committed only when the target is present, that is, during opening hours. But within opening hours, the robbers choose moments when they expect most money at the target site. Banks are attacked when the night safe is emptied, and shops and the HRC industry are robbed when most of the proceeds have been gathered. It should be noted, however, that these expectations of the robbers are wrong: Successful robberies outside these robbery-peak hours are more profitable. The second most important factor is related to the presence of guardianship: The preferred time to rob targets is when they are open during dark.

The winter peak in robberies can better be explained by the dark hours during the evening than by other possible factors. The weather gives no explanation at all for the winter peak. It should be noted, however, that the study was conducted in the Netherlands where extreme weather conditions, such as humid heat or bitterly cold winters, rarely occur. The present study does not allow to choose among the following two possible explanations. One is that the weather exerts less influence on property crime than on crimes against persons, as has been noted in previous research, which showed that variations in the level of crimes against property are much less influenced by changes in psychological states (Anderson 1987; Anderson and Anderson 1984; Cotton 1986; DeFronzo 1984; Feldman and Jarmon 1979). The second explanation is that extreme weather conditions may influence the number of robberies, but in a moderate climate such as in the Netherlands, such influence cannot be discerned. If there is a linear relation between weather and the number of property crimes, it does not extend to moderate climatological conditions.

In short, the explanation of changes in the number of robberies during the day, the week, and the year is quite straightforward: availability of suitable targets and adequate guardianship. There is no reason to seek more complicated and less elegant explanations for seasonal, weekly, and daily variations, like the cost of living during the winter, changes in the unemployment rate, or bad weather (Landau and Fridman 1993).

NOTES

1. On December 5, the birthday of *Sinterklaas* (Saint Nicolas), the bishop of Myra, is celebrated. Although Pope Paul VI struck him from the liturgical calendar in 1969, because he probably never existed, Dutch children are led to believe that he not only existed but is still alive. On the evening of December 5, children receive many presents. Adults also give each other presents, either with a teasing poem or a surprise wrapping or both. Santa Claus is derived from the figure of Sinterklaas (van Gilst, 1969).

2. For the purpose of this article, military time designations are used throughout.

3. An exception are so-called kidnap robberies, in which personnel of the target are kidnapped outside office hours to gain access to the target. These kinds of robberies are, however, quite rare.

4. That is, maximum day temperature (range 21ºF to 95ºF), the minimum night temperature (12ºF to 70ºF), the average day wind (0.26 to 5.7 naut. m/h), hours of sunshine (0 to 15), total day's sun radiation (58 to 27,336 j/sq. inch), precipitation (0 to 2.01 inch), and average day pressure (974 to 1,043 mbar).

REFERENCES

Anderson, Craig A. 1987. "Temperature and Aggression: Effects on Quarterly, Yearly, and City Rates of Violent and Nonviolent Crime." *Journal of Personality and Social Psychology* 52:1161-73.

———. 1989. "Temperature and Aggression: Ubiquitous Effects of Heat on Occurrence of Human Violence." *Psychological Bulletin* 106:74-96.

Anderson, Craig A. and D. Chris Anderson. 1984. "Ambient Temperature and Violent Crime: Tests of the Linear and Curvilinear Hypotheses." *Journal of Personality and Social Psychology* 46:91-97.

Baron, Robert A. and Paul A. Bell. 1975. "Aggression and Heat: Mediating Effects of Prior Provocation and Exposure to Any Aggressive Mode." *Journal of Personality and Social Psychology* 33:245-55.

Blumstein, A., J. Cohen, J. Roth, and C. Visher. 1986. *Criminal Careers and "Career Criminals" Vols. I and II*. Washington, DC: National Academy Press.

Brantingham, Paul J. and Patricia L. Brantingham. 1984. *Patterns in Crime*. London: Macmillan.

Briere, John, Anthony Downes, and James Spensley. 1983. "Summer in the City: Urban Weather Conditions and Psychiatric Emergency Room Visits." *Journal of Abnormal Psychology* 92:77-80.

Carlsmith, J. Merrill and Craig A. Anderson. 1979. "Ambient Temperature and the Occurrence of Collective Violence: A New Analysis." *Journal of Personality and Social Psychology* 37:337-44.

Cheatwood, Derral. 1988. "Is There a Season for Homicide?" *Criminology* 26:287-306.

———. 1995. "The Effects of Weather on Homicide." *Journal of Quantitative Criminology* 11:51-70.

Clarke, Ronald V. and Derek B. Cornish. 1985. "Modeling Offenders' Decisions: A Framework for Research and Policy." Pp. 147-85 in *Crime and Justice: An Annual Review of Research*, vol. 6, edited by M. Tonry and N. Morris. Chicago: University of Chicago Press.

Clarke, Ronald V. and Marcus Felson. 1993. *Routine Activity and Rational Choice*. New Brunswick, NJ: Transaction.

Cohen, Lawrence E. and Marcus Felson. 1979. "Social Change and Crime Rate Trends: A Routine Activity Approach." *American Sociological Review* 44:588-608.

Cohn, Ellen G. 1990. "Weather and Crime." *British Journal of Criminology* 30:51-64.

———. 1993. "The Prediction of Police Calls for Service: The Influence of Weather and Temporal Variables on Rape and Domestic Violence." *Journal of Environmental Psychology* 13:71-83.

Cohn, Ellen G. and James Rotton. 1997. "Assault as a Function of Time and Temperature: A Moderator-Variable Time-Series Analysis." *Journal of Personality and Social Psychology* 72:1322-34.

Cornish, Derek B. and Ronald V. Clarke. 1986. *The Reasoning Criminal: Rational Choice Perspectives on Offending*. New York: Springer.

Cotton, John L. 1986. "Ambient Temperature and Violent Crime." *Journal of Applied Social Psychology* 16:786-801.

DeFronzo, James. 1984. "Climate and Crime: Tests of an FBI Assumption." *Environment and Behavior* 16:185-210.

Evans, David J. and David T. Herbert. 1989. *The Geography of Crime*. London: Routledge.

Falk, Gerhard J. 1952. "The Influence of the Seasons on the Crime Rate." *Journal of Criminal Law, Criminology and Police Science* 43:199-213.

Farrell, Graham and Ken Pease. 1994. "Crime Seasonality: Domestic Disputes and Residential Burglary in Merseyside 1988-90." *British Journal of Criminology* 34:487-98.

Feeney, Floyd. 1986. "Robbers as Decision-Makers." Pp. 53-71 in *The Reasoning Criminal: Rational Choice Perspectives on Offending*, edited by D. B. Cornish and R. V. Clarke. New York: Springer.

Feldman, H. S. and R. G. Jarmon. 1979. "Factors Influencing Criminal Behaviour in Newark: A Local Study in Forensic Psychiatry." *Journal of Forensic Sciences* 24:234-39.

Felson, Marcus. 1986. "Linking Criminal Choices, Routine Activities, Informal Controls, and Criminal Outcomes." Pp. 119-28 in *The Reasoning Criminal: Rational Choice Perspectives on Offending*, edited by D. B. Cornish and R. V. Clarke. New York: Springer.

———. 1987. "Routine Activities and Crime Prevention in the Developing Metropolis." *Criminology* 25:911-31.

Field, Simon. 1990. *Trends in Crime and Their Interpretation*. London: HMSO.

———. 1992. "The Effect of Temperature on Crime." *British Journal of Criminology* 32:340-51.

Fris, P. 1995. *Detailhandelsomzetten: Verschuiving van Sinterklaas naar Kerst?* [Retail Turnover: A Move from Sinterklaas to Christmas?]. Zoetermeer, the Netherlands: Centrum voor Retail Research.

Gottfredson, Michael R. and Travis Hirschi. 1990. *A General Theory of Crime*. Stanford, CA: Stanford University Press.

Haran, James F. and John M. Martin. 1984. "The Armed Urban Bank Robber: A Profile." *Federal Probation* 48:47-73.

Harries, Keith D., Stephen J. Stadler, and R. Todd Zdorkowski. 1984. "Seasonality and Assault: Explorations in Inter-Neighborhood Variation, Dallas 1980." *Annals of the Association of American Geographers* 74:590-604.

Herbert, David T. 1982. *The Geography of Urban Crime*. London: Longman.

Hirschi, Travis. 1986. "On the Compatibility of Rational Choice and Social Control Theories of Crime." Pp. 105-18 in *The Reasoning Criminal: Rational Choice Perspectives on Offending*, edited by D. B. Cornish and R. V. Clarke. New York: Springer.

Jammers, Victor. 1995. "Commerical Robberies: The Business Community as a Target in the Netherlands." *Security Journal* 6:13-20.

Katz, Jack. 1991. "The Motivation of the Persistent Robber." Pp. 277-306 in *Crime and Justice: A Review of Research*, edited by M. Tonry. Chicago: University of Chicago Press.

Kroese, G. J. and R.H.J.M. Staring. 1993. *Prestige, Professie en Wanhoop: Een Onderzoek onder Gedetineerde Overvallers* [Prestige, Profession, and Despair: A Study among Robbers in Prison]. Arnhem, the Netherlands: Gouda Quint.

Lab, Steven P. and J. David Hirschel. 1988. "Climatological Conditions and Crime: The Forecast Is . . . ?" *Justice Quarterly* 5:281-99.

Landau, Simha F. and Daniel Fridman. 1993. "The Seasonality of Violent Crime: The Case of Robbery and Homicide in Israel." *Journal of Research in Crime and Delinquency* 30:163-91.

LeBeau, James L. 1994. "The Oscillation of Police Calls to Domestic Disputes with Time and the Temperature Humidity Index." *Journal of Crime and Justice* 27:149-61.

LeBeau, James L. and William T. Corcoran. 1990. "Changes in Calls for Police Service with Changes in Routine Activities and the Arrival and Passage of Weather Fronts." *Journal of Quantitative Criminology* 6:269-91.

LeBeau, James L. and Robert H. Langworthy. 1986. "The Linkages between Routine Activities, Weather, and Calls for Police Services." *Journal of Police Science and Administration* 14:137-45.

Michael, Richard P. and Doris Zumpe. 1983. "Annual Rhythms in Human Violence and Sexual Aggression in the United States and the Role of Temperature." *Social Biology* 30:263-78.

Miedema, Siep. 1993. *Omgaan Met Langdurige Werkloosheid: Een Levensstijlbenadering naar de Relatie Werkloosheid en Criminaliteit onder Jongvolwassen Mannen* [Handling Long Unemployment: A Lifestyle-Approach to the Relation of Unemployment and Criminality among Young Adult Males]. Groningen, the Netherlands: Onderzoekscentrum voor Criminologie en Jeugdcriminologie, Rijksuniversiteit Groningen.

Morrison, Shona and Ian O'Donnell. 1994. "Armed Robbery: A Study in London." Occasional Paper No. 15, University of Oxford, Centre for Criminological Research, Oxford, UK.

Quetelet, M. A. 1842. *A Treatise on Man and the Development of His Faculties* (English translation). Edinburgh: W. and R. Chambers.

Rotton, James and James Frey. 1985. "Air Pollution, Weather, and Violent Crimes: Concomitant Time-Series Analysis of Archival Data." *Journal of Personality and Social Psychology* 49:1207-20.

Sutherland, E. H. 1947. *Principles of Criminology*. Philadelphia: Lippincott.

Tennenbaum, Abraham N. and Edward L. Fink. 1994. "Temporal Regularties in Homicide: Cycles, Seasons, and Autoregression." *Journal of Quantitative Criminology* 10:317-42.

van Gilst, A. P. 1969. *Sinterklaas en het Sinterklaasfeest: Geschiedenis en Folklore* [Sinterklaas and the Sinterklaas Festivities: History and Folklore]. Veenendaal, the Netherlands: Midgaard.

van Koppen, Peter J. and Shara K. Lochun. 1997. "Portraying Perpetrators: The Validity of Offender Descriptions by Witnesses." *Law and Human Behavior* 21:663-87.

Vrij, Aldert, Jaap van der Steen, and Leendert Koppelaar. 1994. "Aggression of Police Officers as a Function of Temperature: An Experiment with the Fire Arms Training System." *Journal of Community and Applied Social Psychology* 4:365-70.

Walters, Glenn D. 1990. *The Criminal Lifestyle: Patterns of Serious Crime Conduct*. Newbury Park, CA: Sage.

Warren, Charles W., Jack C. Smith, and Carl W. Tyler. 1983. "Seasonal Variation in Suicide and Homicide: A Question of Consistency." *Journal of Biosocial Science* 15:349-56.

Winslow, Robert W., Ruben G. Rumbaut, and Jimmy Hwang. 1989. "Heat and Violence in the Dallas Field Data: Linearity, Curvilinearity, and Heteroscedasticity." *Journal of Applied Social Psychology* 19:1453-78.

Zey-Ferrell, Mary. 1992. *Decision Making: Alternatives to Rational Choice Models*. Newbury Park, CA: Sage.

Zimring, Franklin, Adolfo Ceretti, and Luisa Broli. 1996. "Crime Takes a Holiday in Milan." *Crime & Delinquency* 42:269-78.