

CASE 1. ANALYZING GEOGRAPHICAL PATTERNS IN CRIME PREVENTION

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Please note: due Thursday, April 6, 2017, 17.30h CET. Late submissions will not be considered by the jury.

Background

Crime has dropped substantially in Europe and the US since the 1990s. The study of what caused the crime drop has resulted in a greater attention to victim precaution. Government regulation resulted in greater levels of victim precaution over the last decades (including mandated anti-theft devices in cars in many parts of the world and changes in Building Codes in some places), but surveys suggest that households (and firms) also took many additional crime prevention measures of their own accord. This response to the crime risk may have limited the number of opportunities available to potential offenders, which may have contributed to a lower crime rate.

How households make such decisions is not as straightforward as it seems. It is commonly assumed that crime risk, the protective effect and the costs of the measure feature as inputs for crime preventive decision-making. The first of these elements, crime risk and protective effect, are exceedingly difficult to assess, however. Crime risk can vary greatly between seemingly similar streets, for instance. The protective effect of a device is uncertain, because households do not know which crimes did not happen as a consequence of the prevention measure. They only receive feedback in case of actual victimization – possibly indicating that prevention was too low – and unsuccessful attempts, which are relatively rare.

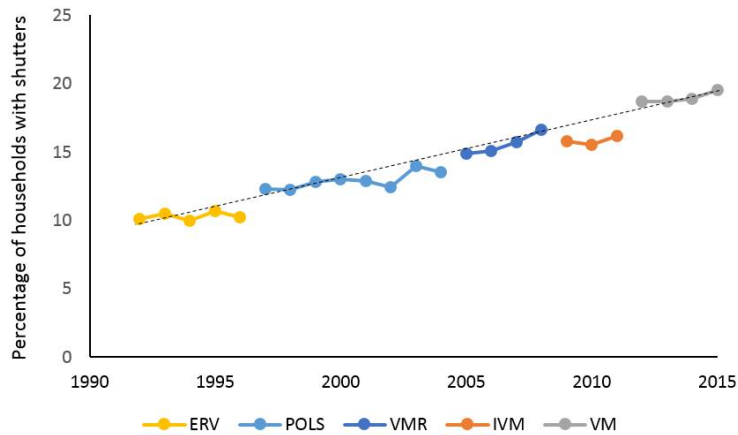
Households seem to follow two strategies to deal with this uncertainty. One strategy is to only act if victimization occurs. It has been well-documented that prevention measures are often taken in reaction to rather than in anticipation of victimization of crime. Another strategy is to copy the preventive behavior of others. This strategy also makes sense because of possible displacement of crime from well-protected victims to not-so-well-protected victims. This second strategy is of particular interest for today's case.

Today's challenge is to study the use of one particular crime prevention device: (roll-down) shutters in front of windows and doors. The picture to the right is a fairly typical sight in many residential areas in the south of the Netherlands – but not so in the north of the country. For reasons that are unclear, the use of shutters shows strong geographical variation. In municipalities in the north, currently some 10 percent of homes have shutters, whereas in municipalities in the south this share can be as high as 50 percent.



Figure 1. Roll-down shutters in the city of Venlo. Source: Google Maps.

Nationwide, the percentage of homes with roll-down shutters has been slowly increasing. Based on a



series of different surveys administered by Statistics Netherlands, Figure 2 shows how the use of shutters has grown from some 10 percent in the beginning of the 1990s to about 20 percent currently.

Your task is to uncover the geographical variation in the use of this device and to explore various hypotheses that may explain this variation.

Figure 2. Homes with (roll-down) shutters, the Netherlands. Source: CBS.

Data

Primary data source is a crime survey conducted in the Netherlands in 2005, 2006, 2007 and 2008. The data are provided in STATA 12 format; the file name is `VMR05060708_v12.dta`. The response rate to this survey about crime and disorder is relatively high, around 70 percent. The numbers of observations for each survey year are 5,242, 20,865, 19,128 and 19,789, respectively. The four waves have been appended into one data set. The survey is a repeated cross-section. It is a random sample drawn from the complete population of the Netherlands, with respondents being at least 15 years of age.

Most, but not all variable labels have been translated into English. In some cases, separate variables have been created for your convenience. For instance, the newly generated dichotomous variable `burglary` is based on the variable `inbraak`, which includes various responses to the question whether a household experienced burglary within the last five years. In case you wonder about Dutch terms that were not translated, you are referred to a brief dictionary of terms that are commonly used in the survey at the very end of this document.

Due to privacy concerns, the lowest geographical identifier is the municipality in which the respondent lives (variable `municipality`, with `gemcode2008` as corresponding identifier). In 2008, the Netherlands had 443 municipalities. Obviously, this low level of specificity is not ideal, but these are the data you have to work with. We enriched the data with the latitude (`latitude`) and the longitude (`longitude`) of centroid of each municipality. We also enriched the data with population of a municipality (`population`) and with religious background (`romancatholic`), another characteristic that is known to differ greatly between the north and south of the country.

The survey includes the following main categories of variables:

- *household and individual-level characteristics*, including marital status, age, education, income, household composition.
- *victimization of crime within the last 5 years*, including burglary, theft from car, bicycle theft, assault.
- *precautionary measures*, including shutters, burglar alarms, outdoor lights, additional front door locks and bolts, not answering door at night, avoidance behavior, car alarm.
- *assessment of prevalence of disorder and crime in the neighborhood*, including littering, dog fouling, purse snatching.
- *assessment of social cohesion of neighborhood*, including contacts with neighbors, perceived friendliness of fellow residents.
- *assessment of local police conduct and performance*, including visibility of local police.
- *feelings of unsafety*, including frequency of feeling unsafe (not further defined), not feeling safe at home, not feeling safe in public spaces in own neighborhood.

The data do not include weights at the municipality level. Simply assume that every individual is equally likely to be included in the survey. Abstract from the possibility that multiple persons in the same household have been interviewed.

In addition, Statistics Netherlands provided an older and smaller dataset that also includes information on the use of shutters. It is based on a survey conducted in 1993, 1994 and 1995. The data are provided in STATA 12 format; the file name is `ERV939495_v12.dta`. The three waves have been appended into one data set. The survey is a repeated cross-section. It is a random sample drawn from the complete population of the Netherlands, with respondents being at least 15 years of age. The survey design and the questionnaire are different from the more recent survey data described above.

Each observation is at the household level. Geographic identifier is the municipality. Again, weights are not provided, assume that each household has an equal chance of being included in the survey. Next to shutters, the data set provides a few other variables, including victimization of crime (defined differently from the more recent survey), other preventive measures and some household-level characteristics.

Please note the following: Statistics Netherlands asks you not to distribute the data and to delete the data after use for the Econometric Game 2017. If you would like to obtain access to these data (excluding geographic identifier) for other uses, then submit a request at DANS: <https://easy.dans.knaw.nl/ui/home>

Questions

To become familiar with the particular context, we ask you to do the following first:

a) DESCRIBE GEOGRAPHICAL PATTERNS

Visualize the geographical variation in the local use of shutters and also the other burglary prevention measures, based on the most recent survey (the earlier survey has a fairly small number of observations). One way is to produce choropleth maps using the shape file provided (`gem_2008_gn3_WGS84`), but you are free to use another way of presenting the data. Provide a test that assesses the extent to which the spatial distribution of shutters conforms to Tobler's first law of geography. Estimate how the probability of having shutters varies with longitude and latitude.

Next, you should address the following question:

b) EXPLORE EXPLANATIONS FOR GEOGRAPHICAL PATTERNS

Roll-down shutters seem to spread over the country like a contagious disease. Hotbed of the 'disease' is Belgium, which is bordering the Netherlands to the south. Belgium is known to have a very high penetration rate of shutters. The shutters seem to slowly spread northwards.

Two possible mechanisms that make shutters contagious are the following:

(1) roll-down shutters may be ugly and expensive, but the more nearby homes have shutters, the more acceptable they become;

(2) roll-down shutters are a very visible means of protection, and given the fear of being burgled home-owners may not want to stay behind and install shutters when neighboring homes have the device already.

Unlike the flu, the 'shutters-disease' is not going to go away because they are installed more or less permanently. As a consequence, the percentage of shutters can only remain the same or go up.

The spread northwards may be slowed by natural barriers like large rivers (such as the Maas and the Waal, which run from east to west) and probably rural areas with low population density that limit the two above-mentioned forms of interaction between home-owners.

If the spread of roll-down shutters is indeed driven by social contagion, then that implies that the use of shutters has little to do with 'local culture' of the south versus the north but everything with the reasons for why home owners copy the behavior of others. In other words, homes in the north are equally likely to be fitted with shutters; it just takes a while for the disease to spread.

Obviously, independent from geographical location, not all homes are equally likely to be fitted with shutters. For instance, rental homes, especially those owned by social housing corporations, are less likely to have shutters than a home that is private property. Apartments in an apartment building, especially those on higher floors, may be less likely to have shutters than single-family homes. As a consequence, the rate of saturation may differ between municipalities.

At this stage, this story of what explains the geographical patterns that you identified under (a) is a hypothesis. Using the two datasets, you are asked to put this hypothesis to the test. This is a pretty open-ended task, so be creative.

Note that the available data may not be ideal for all that you would like to do. For this reason, showing the limitations of your analysis, i.e. what you *cannot* do, is at least as valuable as showing what you *can* do. Whenever this comes up in your analysis, we ask you to point out what data you would like to ideally have and why.

Based on what you uncovered in the above, as a final step we ask you to predict what will happen in the future:

c) PREDICT FUTURE GEOGRAPHICAL PATTERNS

Using your findings for what explains the spread of shutters, provide the following prediction:

By which year will each municipality in the Netherlands be saturated with shutters?

Note that the saturation point at the level of a municipality may be much lower than 100 percent. Clearly state the assumptions on which your prediction is based.

Submit a printable file addressing the above three points plus accompanying figures/tables.

Some relevant literature:

On the effect of visibility of crime preventive devices:

Shavell, Steven, 1991, [Individual precautions to prevent theft: private versus socially optimal behavior](#), *International Review of Law and Economics*, 11, 123-132.

On identifying peer effects:

Manski, Charles F., 1993, [Identification of Endogenous Social Effects: The Reflection Problem](#), *Review of Economic Studies*, 60, 531-542.

An empirical study into copying behavior:

Sexton, Steven E. & Alison L. Sexton, 2014, [Conspicuous conservation: The Prius halo and willingness to pay for environmental bona fides](#), *Journal of Environmental Economics and Management*, 67 (3), 303–317.

Brief dictionary of Dutch terms commonly used in the survey

Dutch	English	Dutch	English
Ja	Yes	Helemaal mee eens	Fully agree
Nee	No	Mee eens	Agree
Vaak	Often	Niet mee eens, niet mee oneens	Don't agree, don't disagree
Soms	Sometimes	Mee oneens	Disagree
Nooit of bijna nooit	Never or almost never	Helemaal mee oneens	Fully disagree
Weigert	Refuses	Ik weet het niet	I do not know