**Nothing is permanent except change: a case study of crime displacement in
Switzerland**

Lionel Grossrieder, Julien Chopin, Manon Jendly, Thibault Genessay, Simon Baechler

Introduction

Since the 70s, issues about crime displacement show a discrete but constant interest from criminology and other crime sciences (Hesseling, 1994). Nevertheless, they deserve further references as they raise essential challenges to better understand the impacts of social reactions on crime, and especially those of the police. Indeed, people mobility, access to public and private transports and urban development are among the societal mutations that provide new opportunities for potential offenders to move around and commit crimes. Crime displacement may occur at a (micro-) local level (Ekblom, 1988; Forrester, Chatterton and Pease, 1988; Forrester, Frenz, O'Connell and Pease, 1990; Allatt, 1994), but in some situations, at a regional level as well (Ratcliffe, 2005; Teichman, 2005). In one case or another, it always presents complex methodological and theoretical issues (Weisburd *et al.*, 2006). This paper discusses these issues based on a case study that has been carried out in the French part of Switzerland, between the cantons of Vaud and Geneva. The question at stake is whether, between 2011 and 2012, the increase in recorded offences in Vaud results from the decrease in crimes in Geneva, and if it does, whether we face a crime displacement and to what extent, specifically regarding the type of crime and/or offender's profile.

Two analytical axes are highlighted. While the first axis focuses on recorded offences to the Swiss Criminal Code (SCC) in order to explore displacement issues linked to crime incidents, the second one focuses on displacement of offenders. In addition to police statistics (reported crime to the police), we used a regional intelligence database, and conducted observations *in situ* and exploratory interviews with both police forces' operational managers, to better understand the context, as well as the organization set up

by the operations during the period under study and their potential impacts on crime displacement.

CONTEXT

As a Western European country, Switzerland is a federal State subdivided into 26 cantons (states), which each has its own police forces. This study focuses on two cantons with a shared border in the French speaking-part of Switzerland: the cantons of Geneva and Vaud. The two geographical areas show dissimilar socio-demographical profile if considering their population density and surface, but are similar regarding their population's age and gender (Appendix 1).

The canton of Vaud is administratively subdivided into 10 districts with various urban/rural environments, which differences can impact crime displacement issues. On the contrary, the canton of Geneva is not subdivided into districts and shows an urban environment. A geographical situation of the two cantons is presented in Figure 1.

Police statistics show that in 2012, 66,423 offences to the SCC were committed in the canton of Geneva, which represents a decrease of 9% comparing to 2011 (72,821). In Vaud, 83,380 offences were recorded in 2012 against 70,392 in 2011, corresponding to an increase of 18.4%. At the time of these data releases, this difference was explained by the implementation of new police operations in Geneva between 2011 and 2012. The first one, in 2011, targeted burglaries and implied the allocation of more staff and the revision of work processes in the burglary unit, as well as the development of crime analysis. Two other operations increased the presence and visibility of policemen in Geneva city-center to reduce insecurity and street crime. The latter have led to the creation of a new anti-crime unit to target street crime, pickpocketing, larceny by trick

and aggression in early 2012. If these operations were set up for sure between 2011 and 2012, unfortunately, the exact moment of their implementation is not documented. Nevertheless, the difference of crime level between the canton of Geneva and the canton of Vaud has led to the hypothesis of a crime displacement during this period of time. No hasty conclusion could be drawn at this point though, as the validity of police statistics to measure crime is quite fragile and essentially reflects police activities rather than an accurate representation of criminality. In this context, our research focus on developing a strict methodological approach to exploit police data in order to analyze and try to better understand the potential crime displacement between the cantons of Geneva and Vaud from 2011 to 2012. This paper presents the main results of this approach and is subdivided into four sections: the theoretical background of the research, the methods and analytical framework used, the findings and finally, a general discussion regarding the interpretation of the results.

THEORETICAL BACKGROUND

According to Gabor's definition, crime displacement is hereby defined as "a change in offender behavior, along illegitimate lines, which is designed to circumvent either specific preventive measures or more general conditions unfavorable to the offender's usual mode of operating" (Gabor, 1990, p.66). Thus, crime displacement would be a collateral damage of the implementation of measures dedicated to prevent and/or reduce a crime phenomenon (Gabor, 1981; Guerette, 2009; Reppetto, 1976), as former studies mainly analyze programs aimed at reducing opportunities to commit crime in specific geographical areas (Hesseling, 1994). Crime displacement though is more than that, not only because it is still very complex to analyze the causes of its roots, but also because

it may take different forms. In fact, it is now generally assumed that crime displacement can be *spatial*, *temporal*, *target-related*, *tactical*, or *crime type-related*, and regularly a combination of these different forms (Braga, 2005; Eck, 1993; Gabor, 1990; Guerette, 2009; Hesselning, 1994; Reppetto, 1976). If most studies focus on *spatial* displacement, analyzing whether the intended crime to the intended type of target is committed in another place, a sixth type of displacement gained interest since the 90's and focuses on the *perpetrator* displacement. For instance, Gabor's studies (1990) show that offenders of in-person crime are less likely to move than offenders of property crime, especially because of the difference of motivational sources between these types of crime. Spontaneous and instinctual nature of in-person crime partially explains the low displacement of offenders to commit their felony. On the contrary, profit would be the main cause of property crime and explains the higher mobility of its offenders. Motivational factors consequently are of importance to explain crime displacement. This type of displacement directly refers to the displacement of *opportunities* that might influence the offenders' perception to commit a crime (Tilley and Webb, 1994). As Barr and Pease would say, "Here, a crime opportunity is so compelling that different offenders are always available to commit the crime" (Barr and Pease, 1990, p. 279). In the same way, Guerette (2009) demonstrates that opportunities considered by a potential offender as interesting determine the time and place of his displacement to commit a crime. Crime opportunities, once again combined with the motivation and the offender's familiarity with his environment, would then be the primary variables that impact his decision to commit a crime. Finally, some repeated behavioral characteristics of *perpetrators* involved in crime displacement have been highlighted. For instance, drug addicts would be more likely to move than non-addicts (Gabor, 1990). Following

Reppetto (1976), Bennett and Wright (1984) found out that active burglars with a serious crime record are found to have a higher resistance to preventive responses than less prolific offenders. While studying characteristics of mobile offenders, Vanier (2009) points out a visible buffer area between the offender's home and the crime site for sex offenders, while on the contrary, this buffer area is fuzzier for in-person and property crime offenders.

This empirical knowledge has led to strengthen the theoretical background of situational approaches in criminology¹, which constitutes in turn a solid analytical ground for crime displacement prevention. These approaches focus on criminal acts and consider that crime highly depends on the immediate circumstances surrounding it. The *routine activity theory* considers that criminal acts require the convergence in space and time of likely offenders, suitable targets and the absence of capable guardians (Cohen and Felson, 1979). The combination of these components characterizes a deviant action as an opportunity with specific patterns. If one of these components is missing, crime is less likely to occur. First used to explain predatory crime², routine activity theory can be applied to property crime like burglary or other thefts. In the *routine activity theory*, the supply of motivated offenders is supposed to be constant in the general population. In the *rational choice theory*, the criminal is presumed to be a rational being making rational decisions (Cornish and Clarke, 1986; Felson and Clarke, 1998). This theory specifies the difference between the decision to commit a crime to satisfy needs and wants, and the decision regarding the specificities surrounding the act, such as when, where and how to commit it, which vary individually. Accordingly, offenders are motivated by short-term benefits and expect the latter to outweigh the eventual disadvantages of their action (Cusson, 2005). Crime in this dynamics is not a purpose

but a mean to reach a subsequent goal. Finally, the *crime pattern theory* seeks to explain how motivated offenders find suitable targets (P. J. Brantingham and P. L. Brantingham, 1978, 1981; P. L. Brantingham and P. J. Brantingham, 1993). During his legal daily activities, a motivated offender can go through target areas where crime opportunities exist. The familiarity with the place supports the rational choice theory: it might be seen easier and cheaper for an offender to commit a crime on his daily journey, rather than having to endure a special journey to do it.

Clarke's and Eck's (2005) crime triangle fits into these theoretical elements and summarizes crime opportunity according to situational approaches. The crime triangle includes the offender, the victim/target and the place. The convergence of these three components defines a crime opportunity related to specific characteristics and situations. It is possible to consider the crime triangle with Pareto's principle (Boba, 2009). The latter defines an empirical phenomenon noticed in several domains, which states that 80% of the effects come from 20% of the causes. This principle might be applied to crime as well: relatively few "hot spots" concentrate most predatory crimes (Sherman, Gartin, and Buerger, 1989); only a small proportion of persons endures repeated victimization (Weisel, 2005); and few criminals are prolific offenders (Heaton, 2000). Therefore, a low number of prolific offenders can have a significant impact on crime level in case of displacement. Similarly, changes in the type of targets or in the characteristics of the place can impact crime level as well.

Situational approaches have led to situational prevention which goal is to prevent crime or at least its severity, and to limit crime opportunities by increasing perceived risks of arrest and/or by decreasing expected advantages (Jendly, 2013). A common critic to

situational prevention is its potential crime displacement effect, also called the hydraulic view of offending (Cornish and Clarke, 1987). The suppression or decrease in opportunities would only move crime towards other targets (Killias, Aebi, and Kuhn, 2012). In other words, a greater protection for some individuals would neglect the safety of the general public. Yet, empirical studies tend to be more tempered (Clarke and Weisburd, 1994; Hesselning, 1994). Indeed, some of them demonstrate that crime displacement is never total: it happens in 25% of cases with situational measures, which in fact corresponds to the same proportion of the diffusion of their benefits (Guerette and Bowers, 2009; Masuda, 1992)³. In addition, crime displacement can be viewed under another perspective as stated by Barr and Pease (1990), who distinguish between “malign” displacement and “benign” displacement. As “malign” displacement is defined as the changes in crime “in ways that are deemed to be socially undesirable” (Barr & Pease, 1990, p. 289), “benign” displacement is seen as given positive consequences even if the displacement appears to be total. Indeed, a dispersion of crime from a high crime area has positive externalities for this particular area and allows to have more equitable patterns of victimization. From this point of view, the presence of a crime displacement does not mean that crime prevention has failed.

Theoretical hypothesis

Based on this theoretical and contextual background, we made the following theoretical assumption for our case study: crime displacement can be attributed to a displacement of offenders themselves, through space, time and/or tactical, but it can also be attributed to a displacement of crime opportunities where the suitable conditions to commit a crime “move” from a place to another, creating a displacement effect without

necessarily involving the same offenders. As it is geographically much larger, inter-regional displacement is more likely to present such type of crime displacement than displacement at a neighborhood city-level. Thus, our study focuses on inter-regional crime displacement and combines two analytical axes: crime displacement of crime incidents in the one hand, and crime displacement of offenders, in the other hand.

METHODS

The methodology of our assessment is developed around two analytical axes, one of them looking into crime incidents displacement, and the other looking into offenders' displacement. A joint qualitative approach completes this analysis in order to contextualize the findings as well as the limits of the study (Weisburd *et al*, 2006).

Data

Crime incidents

Data considered in this study is provided by the Swiss cantonal police forces of Vaud and Geneva. The sample is constituted by all offences to the Swiss Criminal Code⁴ recorded by both police forces between 2009 and 2012 in the cantons of Vaud and Geneva. The two geographical areas show similar amount of recorded offences (Appendix 2). For the analysis, we have only considered the offences which incidence represents 5% or more of the total amount of offences and for which the variation in crime rates between 2011 and 2012 is greater in Vaud than in Geneva. After the selection, 9 offences remain: *common assault*⁵, *acts of aggression*⁶, *criminal damage*, *pickpocketing*, *break-in theft*, *break-in vehicle theft*, *simple theft*, *threat*, *home invasion* (Table 1). For each offence, the date of commission⁷, the XY coordinates, and the location (district and canton) are known.

A second source of data was used to complete police statistics: the PICAR⁸ database, which is a regional crime intelligence database used by the CICOP⁹, the regional center for crime analysis in the French-speaking part of Switzerland. This database collects all crime events related to serial or itinerant crime. Unlike police statistics, it allows a bottom-up analysis because it is designed to produce and use crime intelligence. A crime event in the PICAR database does not exactly correspond to the legal definition of a specific offence found in the SCC. Anyhow, the situational classification operated in PICAR and the systematic follow-up of serial crime enable to carry out a more suitable analysis than the traditional legal categorization (Birrer, 2010; Ribaux and Birrer, 2008; Rossy, Ioset, Dessimoz and Ribaux, 2013). The sample is composed of all crime events recorded in the PICAR database between 2009 and 2012 in the cantons of Vaud and Geneva, Switzerland. There again, we have only considered the offences for which the incidence is 5% or more of the total amount of offences and for which the variation in crime rates between 2011 and 2012 is greater in Vaud than in Geneva. After the selection, 4 crime events remain: *burglary*, *pickpocketing*, *break-in vehicle theft* and *simple theft* (Table 2). For each offence, the date of commission¹⁰, the XY coordinates, and the location (district and canton) are known.

Offenders

As for the offenders, we exploited the police offender databases of Geneva and Vaud. The sample is composed of all offenders recorded by police forces between 2009 and 2012 in the cantons of Geneva and Vaud for the offences against the Swiss Criminal Code. Unfortunately, there was no automatic or direct way to identify offenders who had been acting in both cantons since both police departments have different databases. Moreover, both police databases are designed primarily to process data on a case-by-

case basis. To identify inter-regional offenders, a simple name comparison was not enough because of the possible existing bias, e.g. miswriting, homonyms, incomplete or false identities. Since there was no common identity system between the two cantons, we had to combine several variables to identify identical offenders. A script in Python was developed to compare the 44,126 offenders in Vaud to the 53,642 offenders in Geneva with the following variables: first name, last name, gender, birthday, birthplace, birth country, first and last name of the father, and first and last name of the mother. These 10 variables are supposed to be stable for a same individual unlike nationality or address that can change over time. For each comparison, a score from 0 to 10 was computed depending on how many of the ten variables matched. Based on the distribution observed, a threshold of a minimal score of 7 was set to match the offenders, in other words to consider an individual identical between offenders in Vaud and offenders in Geneva. This is not a foolproof solution, e.g. false positive and false negative elements might remain in the sample, but it is quite a reliable standard to overcome the pitfall of aggregating different databases with their respective identity systems. At the end, our sample is composed of 1,595 inter-regional offenders (3.18%) and 48,510 regional offenders (96.82%).

Analytical framework

Difference-in-Differences estimation

In this study, crime displacement is measured at an inter-regional level and over a long period of time unlike traditional crime displacement analysis. Thus, it is difficult to control potential confounding factors that could influence crime rates. The Difference-in-Differences (DD) method is used in an attempt to control these confounding factors, due to its simplicity and its potential to estimate causal relationship (Bertrand, Duflo &

Mullainathan, 2004; Card & Krueger, 1994; Meyer, 1995). This quasi-experimental design allows to compare a treatment group to a control group post- and pre-treatment in order to determine the “real” effect of the treatment.

Weighted displacement quotient

Measuring crime displacement is not easy and only few standardized methodologies exist (Bowers and Johnson, 2003). It is important to select adequate indicators and be aware of their methodological weaknesses (P. L. Brantingham and P. J. Brantingham, 1994). In order to measure crime displacement, we have used weighted displacement quotient (WDQ). This indicator developed by Bowers and Johnson (2003) measures crime displacement between two geographical areas. However, three areas are required: area A is an action area in which a crime prevention action is operated; area B is the displacement zone; and area C is a control area. Before using WDQ, a pretest is needed to determine the net effect (NE) of the intervention which determines if one might carry on or not the crime displacement analysis (Bowers and Johnson, 2003).

NE is calculated with this equation:

$$NE = \frac{A_{t0}}{C_{t0}} - \frac{A_{t1}}{C_{t1}}$$

A_{t0} and A_{t1} are crime rates at time 0 and time 1 in area A and C_{t0} and C_{t1} are crime rates at time 0 and time 1 in area C. If NE is close to zero or negative, it means that the intervention does not have an impact on area A and WDQ cannot be applied. If NE is positive, then WDQ can be calculated.

WDQ is calculated with this equation:

$$WDQ = \frac{B_{t1}/C_{t1} - B_{t0}/C_{t0}}{A_{t1}/C_{t1} - A_{t0}/C_{t0}}$$

A_{t0} and A_{t1} are crime rates at time 0 and time 1 in area A; B_{t0} and B_{t1} are crime rates at time 0 and time 1 in area B; and C_{t0} and C_{t1} are crime rates at time 0 and time 1 in area C. The numerator of WDQ indicates if there is a displacement between A and B, while the denominator indicates the nature of the crime prevention intervention in A (Cahill, 2011). A positive score indicates a diffusion of benefits as positive effect of intervention, and a negative score indicates a crime displacement as negative effect of intervention (see Bowers & Johnson, 2003).

Displacement hypotheses

To measure crime displacement between the cantons of Geneva and Vaud, four hypotheses have been tested by varying the subdivisions of areas A, B and C. Geographical subdivisions correspond to the 10 districts of the canton of Vaud, and Geneva is considered as a district in itself because of its small geographical size. The hypotheses are drawn on the available data and the information gathered in the course of our exploratory interviews. The four hypotheses are presented in Figure 2. Crime rates used for WDQ are rate per 100,000 population for the selected offences.

WDQ presents several advantages since few data are needed but it only identifies trends. It is a descriptive and intermediary measure to study crime displacement and it needs to be completed by other indicators to confirm or reject a hypothesis of displacement. Researchers who have used WDQ advise to combine it with a qualitative approach (Bowers and Johnson, 2003; Cahill, 2011).

Additional qualitative analysis

In order to obtain a better representation of the crime situation in the selected geographical areas, exploratory research on the field has been undertaken. Four semi-directive interviews have been carried out in police forces of Geneva and Vaud with policemen involved in tactical and operational management. Interviews were directed on the following topics: police operations set up since 2009, the meaning of their impact and potential displacement for the respondents, and the several obstructions to the success of these operations from their point of view. These interviews have been completed by documentary analysis of police operations using available police operation reports. Finally, four observations in the field have been carried out with police patrols to better understand the nature and complexity of police activity. This material was used to support the formulation of our hypotheses and refine our interpretation of the results.

FINDINGS

Displacement of crime incidents

Whereas a progressive increase was observed between 2009 and 2011, a descriptive analysis of police statistics in Geneva shows a general decrease for all selected offences between 2011 and 2012. Opposite trends characterize the canton of Vaud: crime rates kept on increasing between 2011 and 2012. An analysis with PICAR data shows similar results (Figure 3): the two trends seem to follow the same progression, but in 2012, there was a crime drop in Geneva while crime kept on increasing continuously in Vaud¹¹. The DD estimation of police operations for SCC offences in Geneva is - 2,667.71, but for the control experiment of previous years, we notice opposite trends

with 801.14 and 131.79 with DD estimation (Table 3). Even if these results do not indicate similar trends between Geneva and Vaud before 2012, they show an increasing trend of offences for Geneva. Similar observations are made considering DD estimation for crime events (Table 4). The DD effect is almost the same between 2009/2010 and 2010/2011, supporting the fact that there is a general crime trend increasing stronger in Geneva than in Vaud before 2012. However, even if we can reasonably think that the crime drop in Geneva results from police operation setting up between 2011 and 2012, it is difficult to say that offenders moved to Vaud with the help of this indicator only. Indeed, the increase of crime rates seems to continue on the same trend as during previous years in Vaud. Moreover, it is relatively difficult to apply the DD method because the two geographical areas studied are larger than a city and there are too many potential confounding factors that could influence crime trends.

Results of WDQ confirm these trends observed in the descriptive analysis (Appendix 3). As previously mentioned, WDQ was calculated only if NE was higher than 0.1. For hypotheses 1 and 4, all offences to the SCC except the act of aggression have a negative score, which reveals a crime displacement. Figure 4 shows the cumulative proportion of WDQ scores for each offence to SCC as well as for each event in PICAR, according to each hypothesis. 10 types of crime out of 13 present a trend to crime displacement. Only threat, simple theft (SCC) and act of aggression are not submitted to displacement but instead show a diffusion of benefits. Concerning the different hypotheses, there is two negative means for WDQ score: hypotheses 1 and 4 (mean H1= -0.45 and mean H2= -0.75). All offences and events that have negative scores present larger WDQ in absolute value for hypotheses 1 and 4. The major difference between these two hypotheses and

the two remaining ones is the inclusion of the south-east of the canton of Vaud (and north only for H4). Crime displacement seems to be more important in this zone than in the rest of the region.

An analysis of offenders' displacement can now highlight these results and bring additional information to interpret the crime displacement observed.

Displacement of offenders

After a descriptive analysis of offences with at least one offender recorded, it appears that inter-regional offenders are implied in 9.77% (18,404) of all offences (188,454). The proportion is almost the same between the two cantons: 10.08% (11,035) for Geneva and 9.33% (7,369) for Vaud. It is very interesting to notice that inter-regional offenders represent 3.18% of all recorded offenders. Thus, few inter-regional offenders can impact significantly the volume of crime. These results reflect Pareto's principle previously exposed.

The distribution of offences committed by inter-regional offenders during the 2009-2012 timeframe is shown in Figure 5. We notice that rates reversed between Geneva and Vaud in 2011 and 2012. For all offences committed by inter-regional offenders in Geneva between 2009 and 2012, 28.66% have been recorded in 2011 and 28.47% in 2012. On the contrary, the rates of offences recorded in Vaud soared, going from 24.94% in 2011 to 33.57% in 2012. This reversal occurs in the second half of 2011 and in the first half of 2012. A greater proportion of offences in Geneva is observed in the second half of 2011, while Vaud witnesses the greatest proportion in 2012.

To explore more thoroughly the assumption of a displacement during this timeframe, inter-regional offenders have been classified into three groups:

Group 1: Inter-regional offenders who committed at least one offence between January 2009 and August 2011

Group 2: Inter-regional offenders who committed at least one offence between September 2011 and December 2011

Group 3: Inter-regional offenders who committed at least one offence between January 2012 and December 2012

Frequencies of offences per month from 2009 to 2012 with the three groups are shown in Figure 6. Group 1 does not follow any specific trend. On the contrary, the potential mobile offenders of group 2 have committed a more important proportion of offences in 2012, especially in Vaud. In addition, group 3 shows a greater proportion of offences committed during the second half of 2011, especially in Geneva. These results strongly support that the offenders who were acting in Geneva between September and December 2011 are the same who were committing offences in Vaud in 2012.

Looking more closely into the geographical distribution of offences committed by inter-regional offenders between 2011 and 2012 (Figure 7), a decrease in Geneva and an increase in the south-east of Vaud come up very clearly between 2011 and 2012.

Regarding the profile of inter-regional offenders, we have only analyzed the database of the police forces of Vaud to avoid methodological bias and misinterpretation, as differences in the definition of variables between Vaud and Geneva are quite significant. Moreover, this has no impact on inter-regional offenders profile because all of them are recorded in both databases.

Table 5 shows frequencies of socio-demographic characteristics for regional and inter-regional offenders. Inter-regional offenders are mostly 18 to 35 years old (mean = 33.5) while there is a low proportion of under 18 and quite a lot of 45 years old and older among regional offenders. Inter-regional offenders include a greater proportion of single men with a foreign origin¹².

Additional findings highlight potential differences concerning the origin of inter-regional offenders. However, as we do not have enough information about social status of offenders, we cannot conclude about the real impact of origin (Appendix 4 and 5). We can only notice a larger proportion of French, Romanian, Algerian, Georgian and Tunisian origins in the inter-regional group, while Swiss and Portuguese¹³ origins are over-represented in the regional group. If we narrow the timeframe of crime activity for inter-regional offenders, the evolution of offenders' origins shows an increase in Romanian, Algerian and Tunisian origins, and a decrease in French, Georgian and Portuguese offenders between 2009 and 2012.

DISCUSSION

For some offences, the above-mentioned findings confirm a crime displacement both of offenders and incidents from Geneva to Vaud between 2011 and 2012. However, it is important to recall some methodological limits that temper this conclusion. The data we used represent police activity and depend highly on the way they were collected and recorded. Moreover, databases show disparities in their use and only offenders acting in the two cantons were taken into account.

Existence of a crime displacement

Analyses converge towards a displacement of crime incidents, mostly for property crime. Even if burglary is not a formal offence in the SCC, the close link between break-in theft, criminal damage and home invasion is an accurate indicator of burglar¹⁴. Thus, for displacement of crime incidents, we notice a displacement of burglary, pickpocketing, simple theft, and break-in theft in vehicle from Geneva to Vaud between 2011 and 2012. The south-east and north of the canton of Vaud suffer more from this displacement than the west and the center of the canton. The same conclusion can be drawn for crime displacement of offenders. Just like displacement of crime incidents, the south-east and north-west of Vaud are once again the most affected areas. The profile of inter-regional offenders shows a majority of males aged from 18 to 35 years old. Despite a low proportion of inter-regional offenders (about 3%), the latter commit 10% of offences, a proportion that abides to Pareto's principle. Consequently, even a limited number of very mobile offenders can impact crime volume, especially for property crime (Cornish and Clarke, 1986). These results are relevant to the theoretical background we referred to earlier, which states that crime displacement mainly concerns offenders with profitmaking goals (Gabor, 1990). The existing opportunities deemed interesting for the offender determine both the time and place of his displacement (Guerette, 2009). With their recent urbanization, the south-east and the north of the canton of Vaud clearly offer new crime opportunities.

Potential causes of the displacement

Even if a crime displacement is noticed, understanding the underlying causes of this displacement represents quite a challenge and has to take into account several factors

(Hesseling, 1994). Five explanatory hypotheses, exposed and combined hereafter, might help to better understand the displacement effect:

- 1) First, the displacement observed might result from crime prevention and repression interventions set up in the canton of Geneva between 2011 and 2012. Many large police operations have been conducted in Geneva during the period under study and these operations possibly deflect part of the targeted-offenders toward the canton of Vaud. It has been empirically proved that prolific offenders prefer either to stop temporarily their criminal activities or move to avoid arrest (Braga, 2005; Gabor, 1990). However, in our case study, this hypothesis cannot be tested because of missing elements needed to do so.
- 2) The second hypothesis links crime displacement with urban development of the south-east of Vaud, which produces more crime opportunities that favor the arrival of new offenders and the displacement of part of the Geneva ones. The more residential, inhabited and unprotected an area is, the more attractive the opportunities perceived by potential offenders might be (Felson and Clarke, 1998). The findings of the geographical displacement analysis partly support this hypothesis by highlighting a displacement trend in the south-east and the north of the canton of Vaud.
- 3) Results extracted with the PICAR database show a high increase in crime events in Geneva in 2011. The third hypothesis suggests considering the decrease in 2012 in Geneva as a statistical phenomenon called “regression towards the mean” which implies no real displacement. This statistical fact is a research bias that can affect linear trends and implies to go back to the average when outliers are noticed (T. H. Wonnacott and R. J. Wonnacott, 1991). However, this

hypothesis is unlikely to be confirmed because of the variety of the data sources we used, which all show the presence of a crime displacement. The displacement of offenders invalidates this hypothesis because it should not be affected by a regression towards the mean.

- 4) This increase in Geneva in 2011 highlights a new hypothesis linked with the exodus of North-African population towards Europe, and especially Switzerland, following the Arab spring. Geneva is a well-known and geographic point of entry in the south of Switzerland with its airport and its large border with France. It is likely that new groups of offenders have arrived during this period, and after offending in Geneva in 2011, moved to the canton of Vaud by following the natural shore of the Geneva Lake. Some additional findings partially support this hypothesis such as the increase in the number of Tunisian and Algerian offenders between 2011 and 2012. However, additional analyses on profiles of inter-regional offenders are needed to validate further this hypothesis.
- 5) Finally, the last hypothesis concerns likely changes in the way offences have been counted and recorded in police statistics between 2011 and 2012 in Geneva. Even a slight difference in these processes can significantly impact the statistics produced and thus, explain the decrease observed in Geneva in 2012. However, this hypothesis seems to be unlikely because crime displacement appears through a variety of data sources. A change in data entry practices could not have affected the whole data sources. Furthermore, no change in recording practices has been reported to us by police officers and managers during the interviews.

If the results assist in testing these hypotheses, it remains impossible to completely validate one or another to explain crime displacement. Explanatory tracks exposed here require deeper analysis and should be confronted to other data sources, and be part of a longitudinal study. However, when they are bound together, they show a more accurate picture of the situation and allow to bring perspectives for further research. As already mentioned, additional analyses focusing on inter-regional offenders and specific crimes could test previous hypotheses to better explain the crime displacement observed. We strongly consider enlarging the scope of this research by widening the geographical area of the study, following up the crime trends including data of 2013 and following years, and adding a qualitative study to specify the profile and motivation of inter-regional offenders. We would also consider very interesting to analyze crime displacement intra-regionally, as offenders may have moved to boundaries of each canton instead moving from one canton to another.

Involvement for security

Our study of displacement and its results call for a reinforcement of collaboration between police forces and the monitoring of crime phenomenon. Offenders do not stop at administrative borders of states, cantons or countries and many offences generating harm or insecurity often show both serial and mobile characteristics. Particularly for burglary, pickpocketing and break-in theft in vehicle which present a high potential of displacement according to our results. There is a need for a common overview on a regional level to better address this crime problem. The development of a systematic and operational coordination to elaborate, set up, monitor and evaluate common police

operations seems to be one possibility to consider. In addition, crime intelligence and monitoring process can provide useful information to mitigate crime mobility. Crime displacement studies allow to target specific geographic areas likely to be the destination of a crime displacement (e.g. the south east and the north of the canton of Vaud in the present research) and it can be planned to set up particular measures targeting crime incidents subject to displacement. On the other hand, crime displacement observed is not necessarily a negative consequence. It can be seen as “benign” because displacement is not total and the kinds of crimes measured are similar in seriousness. The dispersion of crimes from a high crime area such as Geneva can lead to a redistribution of crime more socially desirable than the pre-displacement situation (Barr & Pease, 1990). The present study and its findings result from a collaboration between academics and police forces which we believe to be a very fruitful way to foster security and research. Such collaborative studies enable academics to access relevant data sources, to leverage the knowledge base of police forces, and to address current security problems. In turn, police forces may take advantage of scientific findings to better understand their crime environment, allocate resources consequently and tailor future operations.

Conclusion

Knowing that studying crime displacement may shed a useful light on crime trends and on the effect of crime reduction strategies, this paper aimed at determining whether there had been a crime displacement at a regional level, by combining different analyses and data sources, based essentially on the perspective of crime rates. As crime displacement measurement is methodologically tricky, it is possible to balance

weaknesses of indicators by (1) multiplying sources of data and considering different classification (legal vs situational) and purpose (police statistics vs crime intelligence), (2) confronting different analytical frameworks (DD vs WDQ), and (3) considering two kinds of crime displacement, potentially independent (crime incidents vs offenders). Considered individually, data sources and analytical frameworks are not enough to establish the presence of a crime displacement at a regional level, but together they address the regional crime situation more accurately, as the case study shows it. Obviously, as displacement is quite a complex phenomenon, it is definitely caused by a combination of several factors. Although any definitive explanation to this phenomenon cannot be given, a big step forward has been made to identify the symptom itself. The original method presented here enables to identify and measure displacement at a regional level. The case study considered the situation in western Switzerland but the method is believed to be transposable to other regions or even at the country level. It brings a scientific added value to policing, but also requires a strong integration of police action. In our federal State, these findings underline the importance of inter-regional collaborative work between police forces, at both tactical and strategic levels, while respecting their local specificities (Teichman, 2005). They also promote a new culture of crime intelligence, which could be embodied in a systematic coordination of police operations. The latter would promote a more mobile- and trans- crime monitoring and solving oriented approach, as the old saying of Heraclitus states that *nothing is permanent except change*.

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Table 1: Frequencies and variation in SCC offences (n= 519,196)

		Geneva		Vaud	
Type	Offence	2009-2012 frequencies	2011-2012 variation	2009-2012 frequencies	2011- 2012 variation
In-person crime	<i>Common assault</i>	52.66% (4,987)	-20.38%	31.38% (3,933)	15.34%
	<i>Acts of aggression</i>	19.82% (1,877)	-19.96%	60.39% (7,568)	-2.87%
	<i>Other (17)</i>	27.52% (2,607)		8.23% (1,031)	
	Total	100.00% (9,471)		100.00% (12,532)	
Property crime	<i>Criminal damage</i>	25.86% (55,978)	-12.17%	34.38% (70,873)	16.56%
	<i>Pickpocketing</i>	11.41% (24,710)	-5.24%	4.77% (9,823)	47.71%
	<i>Break-in theft</i>	13.25% (28,682)	-10.08%	16.77% (34,569)	22.07%
	<i>Break-in theft in vehicle</i>	7.04% (15,234)	-29.83%	5.55% (11,432)	49.99%
	<i>Simple theft</i>	15.81% (34,225)	-5.48%	14.06% (28,975)	5.40%
	<i>Other (57)</i>	26.63% (57,674)		24.547% (50,447)	
	Total	100.00% (216,503)		100.00% (206,119)	
Liberty	<i>Threats</i>	14.53% (3,715)	-3.59%	12.09% (5,926)	17.33%

crime	<i>Home invasion</i>	83.72% (21,407)	-10.03%	87.49% (42,870)	17.47%
	<i>Other (5)</i>	1.75% (449)		0.42% (204)	
	Total	100.00% (25,571)		100.00% (49,000)	

Table 2: Frequencies and variation in crime events (n=140,376)

Type of event	Geneva		Vaud	
	2009-2012 frequencies	2011- 2012 variatio n	2009-2012 frequencies	2011- 2012 variatio n
<i>Burglary</i>	42.78% (18,983)	-34.08%	43.27% (41,541)	4.15%
<i>Break-in theft in vehicle</i>	10.72% (4,756)	-8.31	10.5% (10,081)	30.06%
<i>Simple theft</i>	8.65% (3,840)	-8.75%	8.39% (8,051)	21.43%
<i>Pickpocketing</i>	6.74% (2,989)	-11.18	6.8% (6,526)	29.96%
<i>Other (24)</i>	31.11% (13,809)		31.04% (29,800)	
Total	100.00% (44,377)		100.00% (95,999)	

Table 3: Geneva and Vaud: SCC offences rates per 100,000 pop. during the years before and after police operation in Geneva

	Geneva	Vaud	Difference
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<i>Experiment of interest</i>	2011	11,644.96	7,665.14	3,979.82
	2012	10,350.23	9,038.12	1,312.10
	Difference	-1,294.73	1,372.98	-2,667.71
<i>Control experiments</i>	2010	9,734.44	6,555.76	3,178.68
	2011	11,644.96	7,665.14	3,979.82
	Difference	1,910.52	1,109.38	801.14
	2009	9,860.75	6,813.86	3,046.89
	2010	9,734.44	6,555.76	3,178.68
	Difference	-126.31	-258.10	131.79

Table 4: Geneva and Vaud: Crime events rates per 100,000 pop. during the years before and after police operation in Geneva

		Geneva	Vaud	Difference
<i>Experiment of interest</i>	2011	2232.41	2472.96	402.48
	2012	1807.60	2875.44	-424.81
	Difference	-240.55	-1067.85	-827.30
<i>Control experiments</i>	2010	1483.46	1964.02	508.94
	2011	2232.41	2472.96	748.95
	Difference	-480.57	-240.55	240.01
	2009	1130.40	1857.52	106.50

	2010	1483.46	1964.02	353.06
	Difference	-727.12	-480.57	246.56

Table 5: Socio-demographic characteristics with type of offenders (n= 25,575)

Characteristic s	Type of offenders			Measure of Associatio n
	Regional	Inter-regional	Total	
Age	100.0% (23,915)	100.0% (1,536)	100.00% (25,451)	$\chi^2= 318.414$ sig. =.000
<18	10.6% (2,539)	4.6% (71)	10.3% (2,610)	
18-25	26.8% (6,409)	34.8% (535)	27.3% (6,944)	
26-35	24.2% (5,788)	36.8% (566)	25.0% (6,354)	
36-45	17.1% (4,087)	16.5% (254)	17.1% (4,341)	
>45	21.3 (5,092)	7.2% (110)	20.4% (5,202)	
Marital status	100.0% (24,039)	100.0% (1,536)	100.0% (25,575)	$\chi^2= 103.272$ sig. =.000
<i>married</i>	23.6% (5,679)	15.4% (236)	23.1% (5,915)	
<i>separated</i>	13.7% (3,302)	9.1% (140)	13.5% (3,442)	
<i>single</i>	62.6% (15,058)	75.5% (1,160)	63.4% (16,218)	

Gender	100.0% (24,030)	100.0% (1,535)	100.0% (25,565)	$\chi^2= 189.045$ sig. =.000
<i>female</i>	25.8% (6,202)	10.2% (156)	24.9% (6,358)	
<i>male</i>	74.2% (17,828)	89.8% (1'379)	75.1% (19,207)	
Origin	100.0% (24,039)	100.0% (1,536)	100.0% (25,575)	$\chi^2= 275.756$ sig. =.000
<i>Swiss</i>	42.3% (10,159)	21.7% (333)	41.0% (10,492)	
<i>foreign</i>	57.7% (13,880)	78.3% (1,203)	59.0% (15,083)

Figure 1: Administrative borders of the cantons of Geneva and Vaud with their districts

Figure 2: Crime displacement hypotheses (A: response area; B: displacement area; C: control area)

Figure 3: Evolution of crime rates per 100,000 population

Figure 4: Cumulative histogram (%) of weighted displacement quotient score for each type of crime

Figure 5: Incidence rate of offences of inter-regional offenders per month

Figure 6: Incidence rate of offences per month for the three groups

Figure 7: Spatiotemporal evolution of offences committed by inter-regional offenders in Geneva and Vaud

Appendix 1: Socio-demographic profiles of cantons of Geneva and Vaud in 2012 (OFS, 2012)

Characteristics	Vaud	Geneva
Area (km²)	3,212	282.4
Population	734,356	463,101
Population density (people per km²)	228.63	1,639.88
Variation in population rates (2011-2012)	1.16%	0.56%
Age		
<i>Younger than 18</i>	19.88%	19.04%
<i>Older than 18</i>	80.12%	80.96%
Gender		
<i>Male</i>	48.88%	48.31%
<i>Female</i>	51.12%	51.69%

Appendix 2: Offences to Swiss Criminal Code per canton and year (n = 547,180)

	2009	2010	2011	2012	Total
Vaud	62,792	62,316	73,150	83,863	282,121
Geneva	63,905	61,910	72,821	66,423	265,059
Total	126,697	124,226	145,971	150,286	547,180

Appendix 3: Weighted displacement quotient (WDQ) and net effect (NE) for each type of crime

		Hypothesis	Hypothesis	Hypothesis	Hypothesis
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		1		2		3		4	
Source	Type of crime	WD	NE	WD	NE	WD	NE	WD	NE
		Q		Q		Q		Q	
SCC	<i>common assault</i>	-9.17	0.05	-1.30	0.30	-0.52	0.58	-0.90	0.32
	<i>act of aggression</i>	2.01	0.16	2.91	0.15	4.94	0.15	1.57	0.10
	<i>criminal damage</i>	-1.98	0.15	-0.54	0.28	-0.25	0.34	-1.53	0.15
	<i>pickpocketing</i>	-0.44	2.04	0.04	2.89	-0.01	2.72	-0.31	2.11
	<i>break-in theft</i>	-0.24	0.38	-0.12	0.40	0.15	0.43	-0.66	0.24
	<i>break-in theft in vehicle</i>	-0.16	3.43	0.00	2.73	0.08	2.81	-0.44	1.94
	<i>simple theft</i>	-3.20	0.05	0.56	0.49	0.80	0.41	-1.58	0.08
	<i>threats</i>	-0.91	0.08	0.92	0.23	1.83	0.28	-0.06	0.11
	<i>home invasion</i>	-0.38	0.19	-0.13	0.20	0.25	0.22	-0.93	0.13
PICAR	<i>burglary</i>	-0.04	1.80	-0.05	1.66	-0.04	1.45	-0.15	1.51

	<i>pickpocketing</i>	-1.54 0.2 8	-0.42 0.3 8	-0.38 0.4 0	-1.81 0.2 1
	<i>break-in theft in vehicle</i>	-0.87 0.3 1	0.02 0.4 3	-0.25 0.3 8	-0.70 0.2 8
	<i>simple theft</i>	-0.44 0.3 1	-0.40 0.2 8	-0.13 0.2 9	-0.82 0.2 0
<i>Mean</i>		-0.45	0.12	0.50	-0.75

Appendix 4: Origin with type of offenders (n=25,575)

Origin	Type of offenders			Z-test	
	Regional	Inter-regional	Total	Z	sig.
<i>Switzerland</i>	42.26% (10,159)	21.68% (333)	41.02% (10,492)	18.73	0.001
<i>France</i>	6.91% (1,662)	12.11% (186)	7.23% (1,848)	6.12	0.001
<i>Romania</i>	3.57% (859)	10.87% (167)	4.01% (1,026)	9.09	0.001
<i>Algeria</i>	1.85% (445)	7.16% (110)	2.17% (555)	8.00	0.001
<i>Georgia</i>	1.44% (346)	5.27% (81)	1.67% (427)	6.66	0.001
<i>Tunisia</i>	1.86% (446)	3.97% (61)	1.98% (507)	4.18	0.001
<i>Kosovo</i>	2.71% (651)	3.39% (52)	2.75% (703)	1.43	N.S.
<i>Serbia</i>	1.73% (417)	2.47% (38)	1.78% (455)	1.82	N.S.
<i>Guinea</i>	0.25% (60)	2.28% (35)	0.37% (95)	5.31	0.001
<i>Portugal</i>	8.08% (1,943)	1.95% (30)	7.71% (1,973)	15.54	0.001
<i>Morocco</i>	1.33% (319)	1.82% (28)	1.36% (347)	1.42	N.S.
<i>Other countries (143)</i>	28% (6,732)	27.02% (415)	27.95% (7,147)	0.84	N.S.

Total	100.00% (24,039)	100.00% (1,536)	100.00% (25,575)		
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**Appendix 5: Origin of inter-regional offenders with timeframe of crime activity
(n= 1,536)**

Group 1 (n=1,147)		Group 2 (n=369)		Group 3 (n=708)	
Jan. 2009 – Aug. 2011		Sept. 2011 - Dec. 2011		Jan. 2012-Dec. 2012	
Origin	Inter-regional offenders	Origin	Inter-regional offenders	Origin	Inter-regional offenders
<i>Switzerland</i>	23.89% (274)	<i>Switzerland</i>	17.34% (64)	<i>Switzerland</i>	20.9% (148)
<i>France</i>	13.08% (150)	<i>Romania</i>	11.92% (44)	<i>Romania</i>	12.85% (91)
<i>Romania</i>	8.63% (99)	<i>France</i>	11.11% (41)	<i>Algeria</i>	10.03% (71)
<i>Algeria</i>	6.71% (77)	<i>Algeria</i>	8.4% (31)	<i>France</i>	9.18% (65)
<i>Georgia</i>	5.32% (61)	<i>Tunisia</i>	4.34% (16)	<i>Tunisia</i>	5.79% (41)
<i>Kosovo</i>	3.75% (43)	<i>Georgia</i>	4.07% (15)	<i>Kosovo</i>	3.25% (23)
<i>Serbia</i>	3.05% (35)	<i>Kosovo</i>	2.98% (11)	<i>Georgia</i>	2.97% (21)
<i>Tunisia</i>	2.35% (27)	<i>Albania</i>	2.71% (10)	<i>Guinea</i>	2.54% (18)
<i>Portugal</i>	2.35% (27)	<i>Morocco</i>	2.71% (10)	<i>Morocco</i>	2.40% (17)
<i>Guinea</i>	2.35% (27)	<i>Bulgaria</i>	2.17% (8)	<i>Albania</i>	2.26% (16)
<i>Russia</i>	1.57% (18)	<i>Portugal</i>	1.90% (7)	<i>Serbia</i>	2.12% (15)
<i>Other (74)</i>	26.94% (309)	<i>Other (47)</i>	30.35% (112)	<i>Other (56)</i>	25.71% (182)
Total	100.00%	Total	100.00% (369)	Total	100.00% (708)

	(1,147)				
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¹ Also called ‘opportunities theories’ or ‘environmental criminology’.

² Crime involving direct human victim.

³ Diffusion of benefits refers to the spread of positive effects ensuing from the responses given to criminality, beyond the places, individuals, and/or acts that they were initially targeting.

⁴ Drug and traffic offences are not included.

⁵ According to art. 123 of the Swiss Criminal Code, common assault is defined as “Any person who wilfully causes injury to the person or the health of another” (Swiss Criminal Code, 2014).

⁶ According to art. 126 of the Swiss Criminal Code, acts of aggression is defined as “Any person who commits acts of aggression against another that do not cause any injury to the person or health” (Swiss Criminal Code, 2014).

⁷ When there is an interval between dates (i.e. burglary), only the latest date of the event is considered.

⁸ The acronym PICAR stands for *Plateforme Intercantonale d’Analyse et de Renseignement* (in English: Intercantonal crime analysis and intelligence platform).

⁹ The acronym CICOP stands for *Concept Intercantonale de Coopération Opérationnelle et Préventive* (in English : Intercantonal Concept for Operational and Preventive Cooperation).

¹⁰ When there is an interval between dates (i.e. burglary), only the latest date of the event is considered.

¹¹ It may be unusual to observe a greater amount of offences in Geneva than in Vaud according to police statistics and a reversal with a greater amount of events in Vaud than in Geneva according to PICAR database. The progressive use of PICAR database can explain this observation. PICAR was developed in the canton of Vaud before being implemented in other cantons such as Geneva. Because of that, the way events are counted and recorded can be slightly different between cantons. However, this slightly impacts our analysis because we put the emphasis on the evolution of events through years and not on the absolute volume.

¹² That is to say people whose country of origin is not Switzerland, independently of their (il)legal status in Switzerland or their nationality.

¹³ A strong Portuguese community is settled in Switzerland, among the strongest one outside Portugal. This could explain why Portuguese nationals are over-represented in the regional group with Swiss nationals. A strong French community is also settled in Western Switzerland but France is a very close neighbouring country, even surrounding almost totally Geneva. That could explain why French offenders are associated with the inter-regional offenders, as it is not clear whether French offenders are settled in Switzerland or in France (or elsewhere) when considering their origin only.

¹⁴ These three offences are recorded for every burglary in Switzerland.