

# How much should we trust crime statistics? A comparison between EU and US

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**Abstract** We discuss measurement issues in crime rates in a cross-country comparative perspective. We show that while homicide and general crime rates follow quite similar patterns in the US this is not always the case in Europe. We provide an explanation of the observed patterns based on the use of fire harms.

**Keywords** Crime statistics · Criminal behavior

**JEL Classification** K42

## 1 Introduction

Measuring crime is a challenging issue for social scientists. A correct measurement is crucial to study the evolution of crime rates over time and space and for assessing the effectiveness of policy interventions. However, by its very nature, crime is a hidden phenomenon and official statistics may not record crime rates correctly because of measurement errors or misreporting.

In this paper we study to what extent using homicides as a proxy for general crime rates' is a valuable option for those interested in comparing crime rates' across countries. Indeed, homicides suffer to a lesser extent from underreporting issues that could be a problem for cross-country comparisons (both for the descriptive and the inferential analysis) when underreporting varies over time. Our

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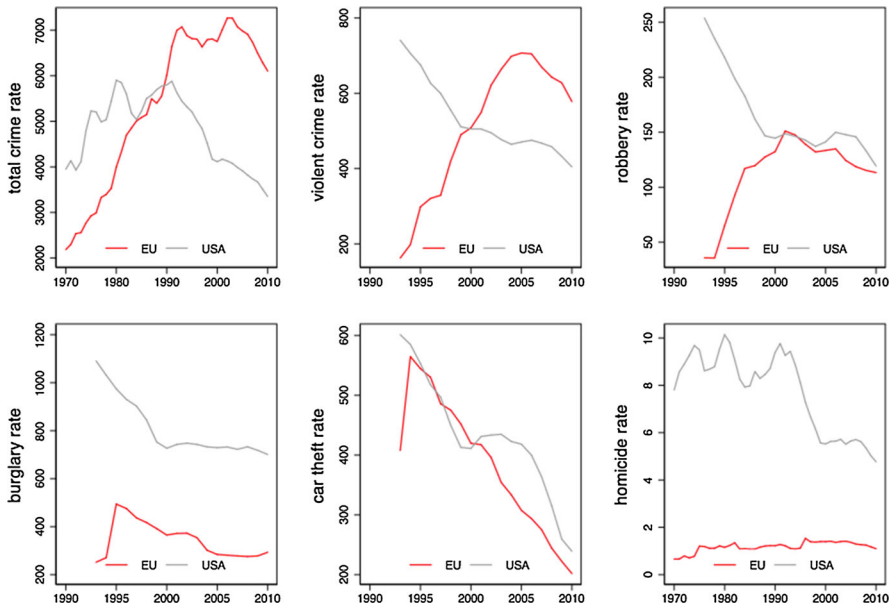
exercise proceeds as follows. We start from a previous analysis whose aim was to compare total crime rates between Europe and US and to provide causal evidence on the factors determining different trends across countries (Buonanno et al. 2011). We observe that such an exercise, at least in its descriptive part, may lead to inaccurate conclusions if measurement error of crime rates varies over time and over space. Then, instead of total crime rates, we replicate the descriptive part of the exercise of Buonanno et al. (2011) using homicide rates. We do this because homicides are much less subject to underreporting and tend to be more uniformly classified across countries. Hence, if homicide rates and total crime rates followed the same trends both in Europe and in the US, this would suggest that total crime rates do not suffer from measurement error varying over time. If instead, homicide and total crime rates follow different patterns, we need to explore why this happens and ask how much we should trust crime statistics for cross-country comparisons. Our analysis provides some evidence that we more likely fall in this second case, namely that homicides and total crime rates had different patterns in the EU, whereas they have the same trend in the US. Thus our paper tries to provide some reason to understanding the divergence between total crime rates and homicide rates and opens new questions on the reliability of official crime statistics. Hereafter we briefly summarize our exercise.

Buonanno et al. (2011) documented a “reversal of misfortunes” between the two sides of the Atlantic, namely that both property and violent crimes (with the exception of homicides) are now more widespread in Europe than in the United States, while the opposite was true thirty years ago. As largely discussed in Buonanno et al. (2011), existing crime data show that the US experienced an unexpected drop in crime rates after 1990, while in Europe crime rates have been on the rise since at least 1970 and crime rate is today higher in Europe than in the US. Figure 1—reported in Buonanno et al. (2011)—shows the dynamics of total crime rate, violent crime rate, robbery rate, burglary rate, car theft rate and homicide rate in the US and in Europe.<sup>1</sup>

We start our analysis by questioning the findings reported in our previous study through the adoption of a conservative and careful approach. Thus, as it is standard in the crime literature (see for example Parker 1985; Levitt 1998; Fajnzylber et al. 2002), when underreporting might be a concern, in our analysis we will compare trends in homicide and other crime rates. Unlike any other type of crime, homicides should not be affected by underreporting. Moreover, in a cross-country comparison, potential changes in classification systems about crime acts should not impact on the measure of homicides. The careful comparison of homicides and other crime rates time series can be particularly useful to reveal measurement problems affecting recorded crime rates. As for the “reversal of misfortunes”, the graphical evidence provided significantly varies when we consider homicide rate. From Fig. 1 we observe that, unlike any other type of crime, despite it halves since 1990, US homicide rate remains 5 times higher than the corresponding one in the EU. More importantly, it appears that in the EU homicide rate is more stable over time,

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<sup>1</sup> A detailed discussion of the data sources of the crime data is presented in Sect. 2.



**Fig. 1** Evolution of crime rates in the US and in Europe

although the figure, as we will show later, masks substantial heterogeneity in the patterns of homicides across EU countries.<sup>2</sup>

As it will be clear in the rest of the paper, for the US the evolution of homicides parallels that of any other crime category, including the total crime rates used in Buonanno et al. (2011). This suggests that measurement error when considering the evolution of total crime rate in the US is not a crucial issue: homicides as well as other types of crime as registered by official statistics are declining. For the European countries, however, we cannot draw the same conclusion: the trend of homicides does not parallel the one displayed by other crime rates and this, in principle, could cast some doubt on the reliability of official crime statistics in the EU. Shall we then dismiss any analysis based on aggregate crime data from European countries as something that we cannot trust? While measurement error (due, for example, to misreporting or under-reporting) in other crime rates in European countries is a potentially valid explanation, there is another plausible explanation to reconcile the divergent trends between crime and homicide rates that goes as follows. In the US homicides might parallel overall criminal activity because other crimes are more likely to turn into a homicide, while this might not be the case in Europe. One plausible reason underlying this argument is related to the diffusion and use of guns and firearms in the US that are likely to be related to variations in homicides (Duggan 2001; Cook and Ludwig 2006).

Overall, while we cannot exclude that the trends in crime rates in the EU countries are affected by measurement error (e.g. caused by misreporting), the

<sup>2</sup> It is worth noticing that spikes in EU homicide trend are due to mafia wars in Italy.

differential dynamics response of homicides and crime rates in EU could be driven by a difference in the factors affecting criminal behavior. To corroborate our hypothesis, we test the role played by firearms in explaining the parallel evolution between crime rates and homicide rate in the US. The idea is simple: when firearms are more easily available, it is more likely that they are used both by criminals and victims respectively as a mean to perpetrate a crime or as a way to protect private safety and property. As widely discussed in the existing literature gun ownership is significantly and positively related to changes in the homicide rate (Duggan 2001; Cook and Ludwig 2006). In our simple exercise we document that total crime rate and homicides do not follow the same patterns when we control for a measure of guns availability. In summary, the discussion of the previous findings and our evidence suggests that the larger availability of firearms in the US can be a plausible explanation of why homicides follow a different trend in EU countries.

The rest of the paper is organized as follows. In Sect. 2 we widely present the methodological issues in measuring crime, while in Sect. 3 we discuss similarities and differences in crime trends between the US and Europe. Section 4 explores the role of firearm in explaining the differences between the US and Europe. Section 5 concludes.

## 2 Measuring crime

Measuring crime is a challenging and crucial task since it is a necessary condition for a correct assessment of its determinants and then for the implementation crime control policies. In a cross-country framework, there are several issues to consider. First, reported crimes underestimate the true (unobserved) number of committed crimes. This fact may be a source of bias when doing inferential analysis. In particular, measurement error can bias the estimates of the effect of those determinants of criminal activity that are correlated with the extent of underreporting. In fact, especially for minor crimes such as petty crimes, there are many reasons inducing citizens to not report crime to the police. Anecdotal evidence suggests that people do not report crime because sometimes they blame themselves for having being victimized or because they fear stigmatization from peers or from the police officers. In many other circumstances, people do not report crime to the police because they consider the crime suffered as minor and not too serious to be reported or because the monetary value involved is little. Usually, trust in the ability of the police to find a criminal and to investigate is also a driving force of the reporting rate. Many other reasons determine the reporting rate, and these factors may have differential impacts in different countries. A full investigation of the issue is an interesting task for future research. In the context of our application, it is important to note that the underreporting issue is very relevant: in the sample of countries and years considered the range of variation is between 37 and 70%.

This problem is well known in the economic and criminological literature (MacDonald 2002). When doing inferential analysis, a standard way to deal with this problem is using logarithms of crime rates and exploiting the longitudinal structure of data, when available, by including geographical and time fixed effects

(see, for instance, Ehrlich 1996; Levitt 1996; Gould et al. 2002; Oster and Agell 2007; Dalla Pellegrina 2008; Fougère et al. 2009). The use of logarithms alleviates the underreporting problem by reducing the potential skewness of the distribution in crime data determined by a few (measured with error) outliers and at the same time make it easy the interpretation of the estimated impact in term of elasticity. The inclusion of geographical and time fixed effects sweeps out measurement errors that are constant within space (over time) or within time (across space).

As widely discussed in the criminological literature (see Aebi 2004; Aebi and Linde 2010), reported crime to police, despite being not an appropriate instrument for the study of cross-national differences in crime levels, offers a reasonably valid basis to study the evolution and the trend in crime trends under the assumption that reporting and recording procedures have not experienced substantial changes. Specifically, the main issue is the heterogeneity of reporting rates across space and time. Reporting rates differ across countries and vary over time in a non-uniform way, as it is suggested by comparing victimization surveys data with official crime reported to the police (see, for instance, Soares 2004; Van Dijk et al. 2007). Van Dijk et al. (2007) estimate that the rate of reporting to the police in the US was 57% in 1988 and 49% in 2004. The corresponding rates in Europe were 63% and 61% in Germany, 71 and 59% in the UK, 62 and 54% in France, 36 and 47% in Spain, 42% (in 1991) and 50% in Italy.

Another problem in using criminal statistics is related to crime classification. Indeed, the classification of crimes may vary across countries, because of different criminal codes. For instance, an act that is a violent crime in country A may be classified as a property crime in country B. Moreover, the crime system classification may change over time in the same country. As a consequence, it is required a measure that is unaffected both by underreporting and classification issues in order to perform cross-country comparison. No statistical remedy can be found in this case, in both the inferential and descriptive analysis.

A standard approach both in the economic and criminological literature is to rely on homicide rate (for instance Parker 1985; Levitt 1998; Fajnzylber et al. 2002). The popularity of this approach is mainly due to the fact that underreporting is negligible for homicides and homicides tend to be more uniformly classified across countries. Despite this obvious advantage of the homicide measure, we could question whether homicide rate represents a credible measure for crime rates in general. In other words, the use of homicide is meaningful under the assumption that the evolution of homicide rate follows the same patterns of other types of crime; otherwise we might be tempted to argue that the determinants of homicides differ from the determinants of other crimes.

For all these reasons, we consider several measures of crime discussing the pros and the cons of each measure considered in our analysis. The two main variables we consider in our analysis are the total number of homicide reported to the police per 100,000 inhabitants as main measure of criminal activity, and the total number of crimes (of any kind) recorded by the police per 100,000 inhabitants as in Buonanno et al. (2011). In addition, we consider also more detailed crime category: burglary, robbery and car theft.

Our panel dataset comprises annual observations at country level for Austria, France, Germany, Italy, Netherlands, Spain, UK and USA over the period from 1970 to 2010. Data have been collected from official national sources and from Eurostat for EU countries and from UCR for the US.<sup>3</sup> The total number of homicides comes from national police statistics.<sup>4</sup>

### 3 Crime in Europe and in the US: trends comparison

As stressed in Buonanno et al. (2011), Fig. 1 reveals three important facts:

- a. Crime rates in Europe increased sharply from 1970 to 1990; the total crime rate stabilized afterwards, with property crimes decreasing since the early 2000s and violent crimes increasing steadily (with a few exceptions);
- b. Crime rates in the US increased from 1970 to 1980, have no obvious trend in the 1980s and decline sharply in the 1990s. The rate of decline is less sharp from 2000 onward;
- c. Crime rates in the US were above the corresponding rates in Europe in 1970, but they have been below European levels in recent years (with a few exceptions for property crime).

We termed this pattern as the “reversal of misfortunes” in crime rates. In this section we aim at looking more in depth at crime trends. In particular, we are interested in understanding how crime rates evolve over time and what we can learn from comparing the evolution of homicides against total crimes and other crime categories both in a single country and in a cross-country setting. Two crucial aspects should be understood from this analysis.

First, by comparing the evolution of homicides (which should not be subject to measurement error) and another crime categories, we can learn if both crimes are likely affected by the same structural factors.<sup>5</sup> If they do not exhibit parallel trends, then there are two not-mutually exhaustive explanations: (a) some underlying factors have different impacts on the two crime categories, (b) the measurement error in measuring the crime categories other than homicides change over time within the same country.

Second, if we want to look at the evolution of crime trends across countries, finding parallel trends for homicides and other crime categories for each country, would lend support for the use of official crime data for the analysis of the evolution of crime across different countries. For example, if homicides exhibit parallel trends with total crime rates in any country, then the “reversal of misfortunes” in crime

<sup>3</sup> <http://epp.eurostat.ec.europa.eu/portal/page/portal/crime/data/database>.

<sup>4</sup> Only Spanish data are drawn from cause of death statistics.

<sup>5</sup> In principle, although it is unlikely to happen, it is possible that the two types of crime have parallel trends and still be affected by different factors. An example may be useful to clarify this point. Assume that socio-economic factors A and B have a positive impact on crime x and that crime x and y have parallel trends. A and B should have the same impact on crime y and x, unless changes in A and B are compensated by idiosyncratic shocks in way that.

rates between the United States and the European countries would be supported by further descriptive evidence.

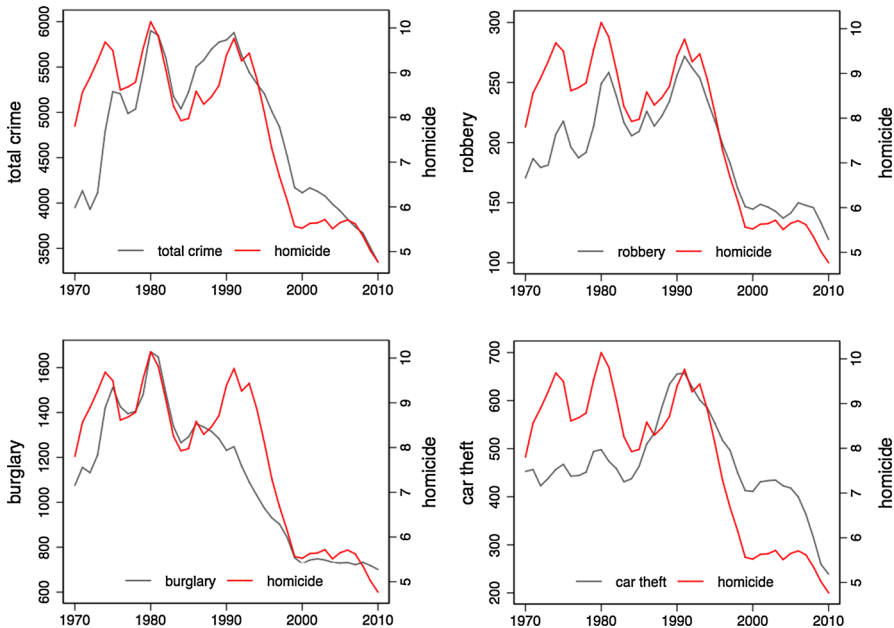
Our graphical analysis aims at studying in depth the relationship between crime rates and homicides in order to shed light on the determinants of crime patterns over time. In Fig. 2, we compare the evolution of a set of crime rates (total crime, burglary, robbery and car theft) together with the evolution of homicide rate for the US over the period 1970–2010. Even from simple eyeballing, it clearly emerges how crime rates and homicide rates tend to move in parallel exhibiting an almost identical trend, suggesting that the determinants that are responsible for the drop in homicides can be in principle also responsible for a generalized drop in crime rates.

Figures 3, 4, 5, 6, 7, 8, 9 and 10 present the same exercise for EU and every single EU country considered in our sample. When we consider EU as a whole, we observe that total crime rates and homicide rates show some similarities in their evolution over time, even if the two trends hardly mimic each other as in the US case. When we consider each EU country, we obtain a more heterogeneous picture. With a few exceptions, homicides do not follow a parallel trend with respect to other types of crimes in European countries. One natural explanation is that homicides in European countries are more volatile. In fact, being lower by a factor of five with respect to the United States, homicides in European countries are potentially subject to large variation with respect to other crimes. This is to say that parallel trends as those reported for the United States would be more difficult to be observed in European countries. In the UK, for example, a closer look (Fig. 7, first panel) suggest that homicides and total crimes follow a similar trend, although this is not confirmed when we disaggregate by types of crime. However, we observe that in most of the cases homicides and other types of crime exhibit divergent trends. In Austria, for example, robberies go up from the mid-nineties until 2007 while homicides with some positive and negative spikes, on average, go down. Many other examples can be found from these figures. In summary, while for the United States we have that homicides and other types of crime evolve together, this is not the case for Europe. Strong measurement errors in measuring the crime categories other than homicides or different factors having differential impact on total crimes and homicides are equally plausible explanations.

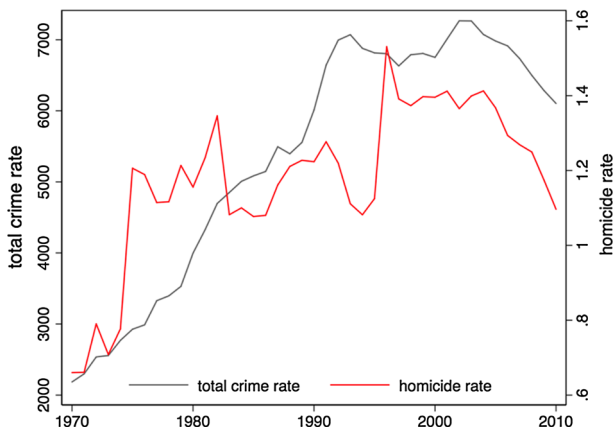
In the next section, we propose a potential explanation to interpret the patterns suggested by the figures reported above.

#### **4 How can we explain the parallel trend of homicides and general crime rates in the US?**

At this point of the analysis it is natural asking why we do observe parallel trends in the United States between homicides and total crime rates. An in depth analysis of this issue goes beyond the scope of this paper and would make the object of an interesting analysis. Nonetheless here we explore one particular aspect: the potential role played by firearms. The idea is simple; when firearms are more easily available it is more likely that they are used both by criminals and victims respectively as a mean to perpetrate a crime or as a way to protect private safety and property. UCR



**Fig. 2** Crime rate trends in the US (1970–2010)



**Fig. 3** Total crime rate versus homicide rate in EU (1970–2010)

statistics provide compelling evidence about the use of guns in committing crime. In particular, official statistics showed that firearms were used in 67.7% of the US murders, 41.3% of robberies, and 21.2% of aggravated assaults. This evidence might explain part of the correlation between homicides and other crimes in the US. On the other side of the Atlantic, given a much stricter regulation in guns' possession we expect a lower correlation between homicides and other crimes. Such a hypothesis is consistent with previous literature. McDowall (1986) found little



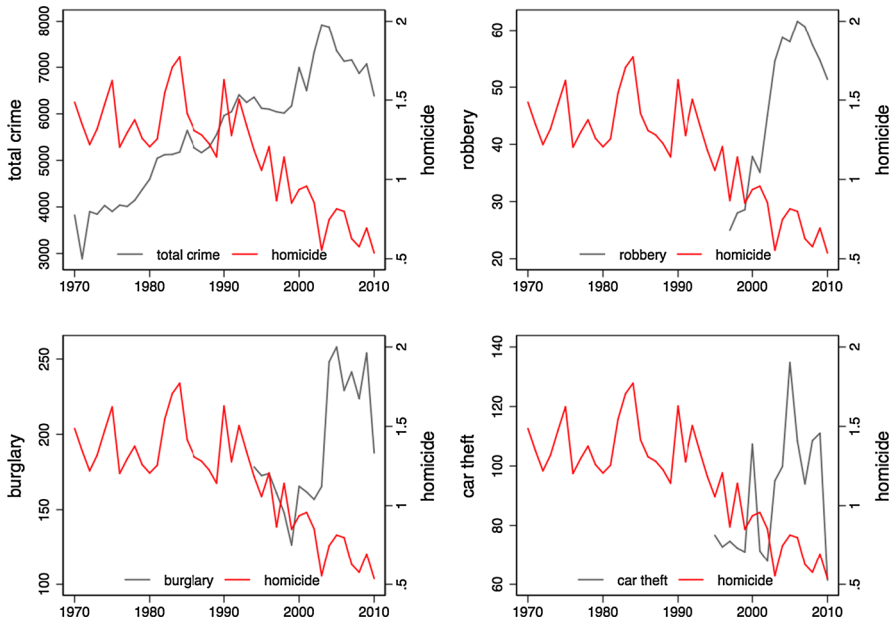


Fig. 4 Crime rate trends in Austria (1970–2010)

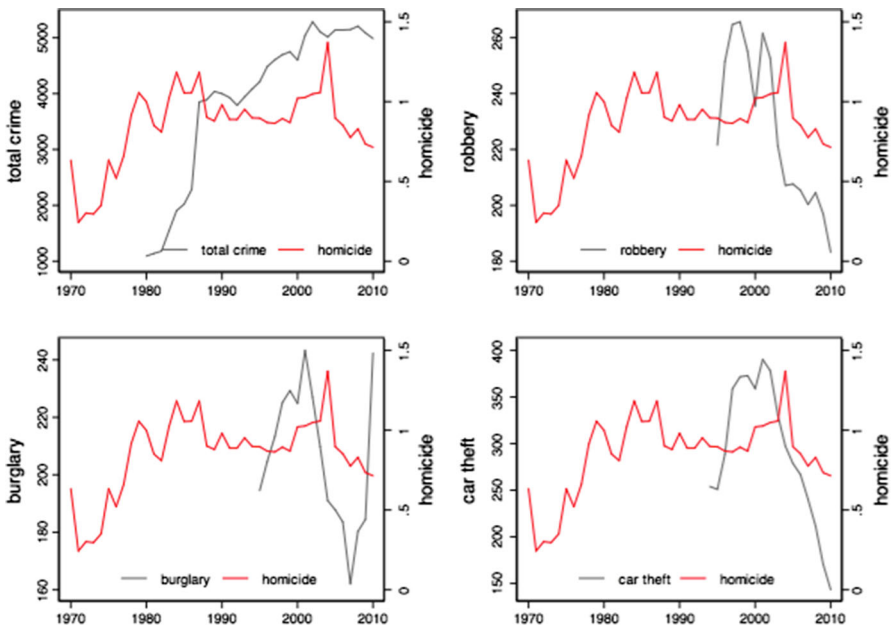


Fig. 5 Crime rate trends in Spain (1970–2010)

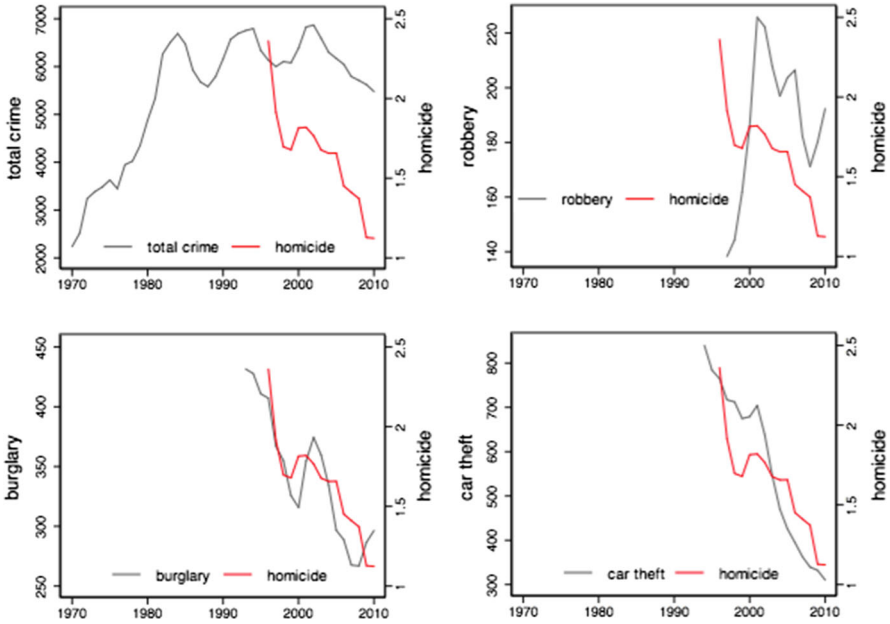


Fig. 6 Crime rate trends in France (1970–2010)

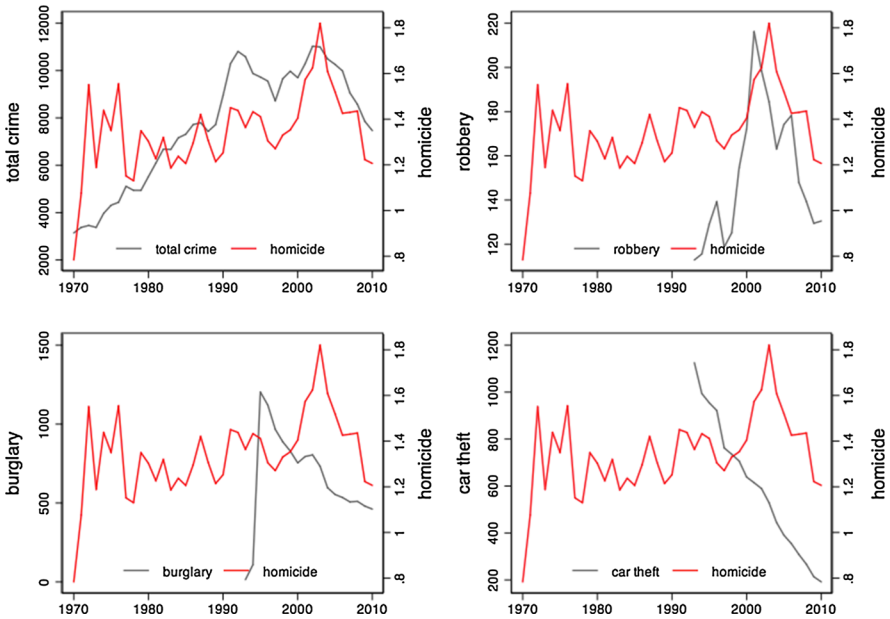


Fig. 7 Crime rate trends in United Kingdom (1970–2010)

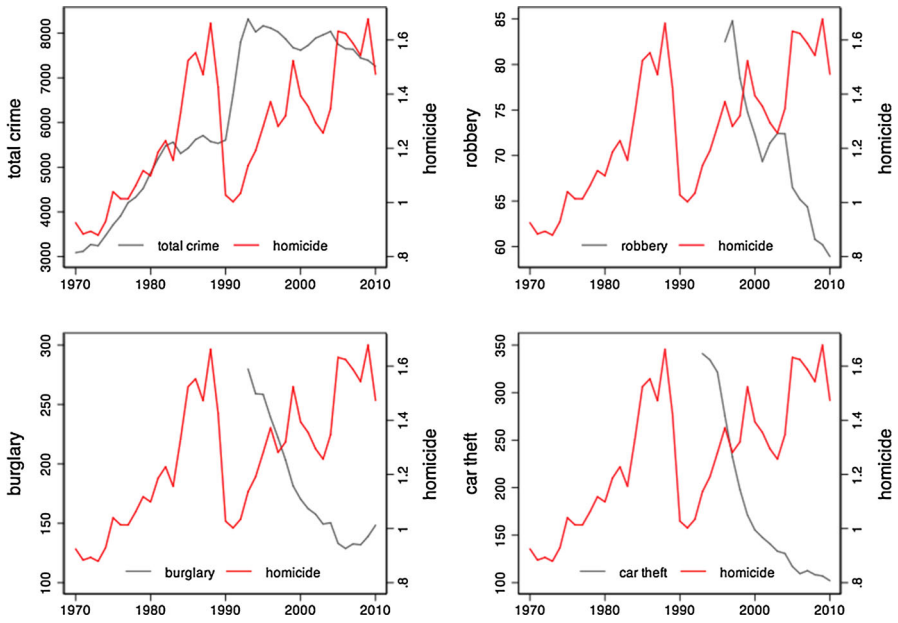


Fig. 8 Crime rate trends in Germany (1970–2010)

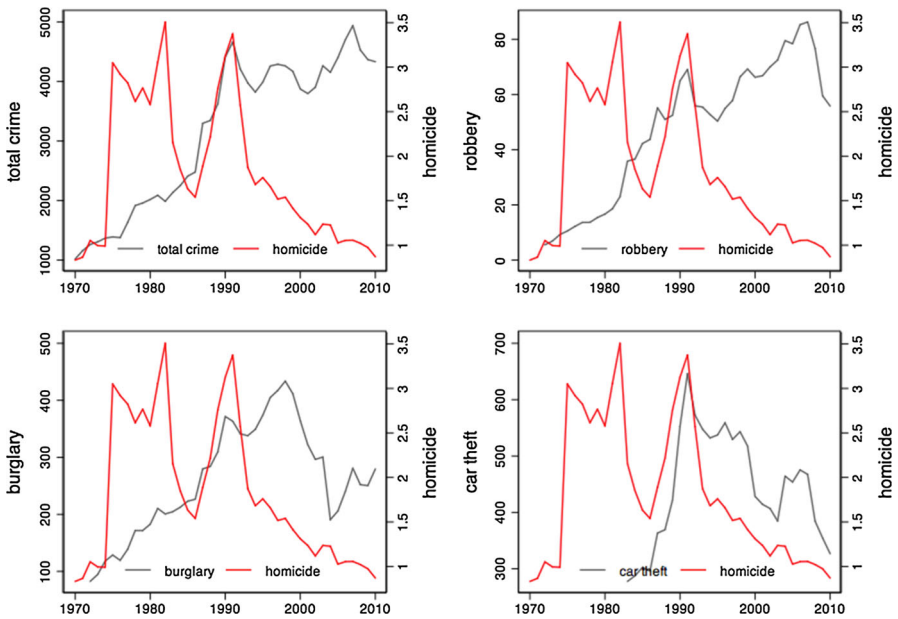
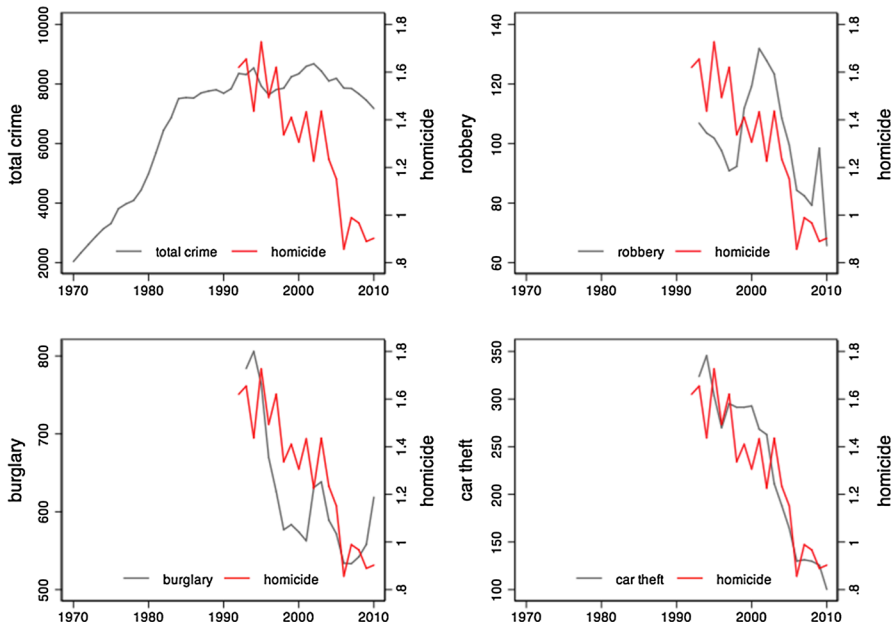


Fig. 9 Crime rate trends in Italy (1970–2010)



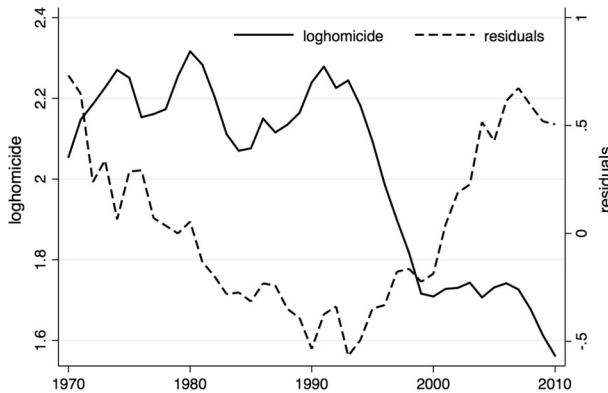
**Fig. 10** Crime rate trends in the Netherlands (1970–2010)

relationship between total robbery rates and gun density, but a strong cyclical relationship between gun density and the fraction of robberies committed with a gun. More recently, Duggan (2001) examined the relationship between gun ownership and crime demonstrating that changes in gun ownership are significantly and positively related to changes in the homicide rate, while a less marked effect is found for all other crime categories. Cook and Ludwig (2006), using county- and state-level panels for 20 years, estimate the elasticity of homicide with respect to gun prevalence as between 0.1 and 0.3.

In order to investigate this hypothesis, hereafter we perform a simple analysis that allows us to test whether the parallel trend between total crime rate and homicide rate survive once we account for the use of firearms.

The measurement of gun prevalence is subject to several issues. Indeed, as stressed in Cook and Ludwig (2006) administrative data on firearms ownership are not reliable or general available and household surveys data, despite being the only direct source of information on gun ownership, are not always available or reliable. Thus, alternative proxy for gun prevalence has been used in the literature. In particular, the more popular proxy is the fraction of suicides committed with a firearm (FSS) (Azrael et al. 2004; Kleck 2004). For our exercise, we collected FSS at the national level for the US over the period 1968–2010.

Our basic empirical approach is to estimate the relationship between total crime rate and gun prevalence over a 40-year period. We regress the log total crime rate against FSS. FSS is lagged by one period to take into account concern for reverse causation (Duggan 2001; Cook and Ludwig 2006). We derive the unexplained part of the relationship between total crime rate and firearms by computing the residual.



**Fig. 11** Crime rate trends residuals from firearms and homicides

Thus, we observe whether the component of total crime rate not explained by firearms is parallel to homicide rate.

As shown in Fig. 11, that presents the final step of our exercise, it emerges that the parallel trend existing between total crime rate and homicide rate (reported Fig. 2) disappears. This result confirms the potential role played by firearms. In our view this is an important and interesting finding despite being a preliminary one. In fact, an alternative explanation is the presence of omitting variables that determine both FFS and crime rates. Future research should try to further explore this fascinating issue and to pin down the mechanism relating homicides and other crime rates. However, this kind of exercise is beyond the scope of this paper.

## 5 Concluding remarks

In this paper we discuss the evolution of crime patterns on the two sides of the Atlantic over 40 years starting from 1970. In doing this we investigate the reliability of the data coming from official crime statistics in performing a cross-country analysis of the crime trends. Following the criminological literature, in order to address this basic problem, we have adopted the approach of resorting to the use of homicides rates as a potential measure of crime. Homicides' indeed, contrary to other kind of crimes, do not suffer (or suffer much less) from under reporting. Such an approach led us to uncover some interesting pattern. While homicides and other crime rates follow the same trends in the US, this is not true in Europe. We cannot exclude the possibility that unlike American data, European crime statistics suffer from measurement error varying over time. However, in this study we have investigated an alternative hypothesis. In particular, we have studied why crime rates parallel homicide rates in the US and among the many potential explanations we have focused on the role of fire arms that in the US can be more easily employed by people committing crime. In the US, but not in other countries, the wide diffusion of firearms might imply that other crimes are more likely to turn into a homicide. Thus, we have presented some explorative regression analysis of the log

total crime rate against the rate of suicides committed with a firearm (used as a proxy of firearms availability). We computed the unexplained part of the relationship between total crime rate and firearms. Then we tested whether the component of total crime rate not explained by firearms is parallel to homicide rate. Our results show that the parallel trend existing between total crime rate and homicide rate disappears when we take the role of firearms into account. This result confirms the potential role played by firearms.

In conclusion, this paper provides some cross country comparison and poses some question on whether or not we can use aggregate crime statistics to make sound inference on the role of factors affecting crime rates in a cross-country perspective. The fact for the European countries homicides and crime rates do not follow parallel trends suggests that homicides should not be used as a reliable measure of crime. At the same time, it leaves to future research a deeper investigation on whether this finding reflects measurement error varying over time. This analysis shows that further comparative research is actually needed and welcome.

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