EUI Working Paper RSC No. 96/13

Estimating the Economic Model of Crime in the Presence of Organised Crime: Evidence from Italy

RICCARDO MARSELLI
and
MARCO VANNINI

EUI WORKING PAPERS

EUROPEAN UNIVERSITY INSTITUTE

EUI Working Paper RSC No. 96/13

Marselli/Vannini: *Estimating the Economic Model of Crime in the Presence of Organised Crime: Evidence from Italy*

The Robert Schuman Centre was set up by the High Council of the EUI in 1993 to carry out disciplinary and interdisciplinary research in the areas of European integration and public policy in Europe. While developing its own research projects, the Centre works in close relation with the four departments of the Institute and supports the specialized working groups organized by the researchers.

EUROPEAN UNIVERSITY INSTITUTE, FLORENCE

ROBERT SCHUMAN CENTRE

Estimating the Economic Model of Crime in the Presence of Organised Crime: Evidence from Italy

RICCARDO MARSELLI

Istituto universitario navale, Naples, Italy

and

MARCO VANNINI

Università di Sassari, Italy and CRENoS

EUI Working Paper **RSC** No. 96/13

BADIA FIESOLANA, SAN DOMENICO (FI)

Printed in Italy in March 1996
European University Institute
Badia Fiesolana
I – 50016 San Domenico (FI)
Italy

Robert Schuman Centre

Programme in Economic Policy

The Working Papers series

The Schuman Centre's Programme in Economic Policy provides a framework for the presentation and development of ideas and research that can constitute the basis for informed policy-making in any area to which economic reasoning can make a contribution. No particular areas have been prioritized against others, nor is there any preference for "near-policy" treatments. Accordingly, the scope and style of papers in the series is varied.

Visitors invited to the Institute under the auspices of the Centre's Programme, as well as researchers at the Institute, are eligible to contribute.

ABSTRACT: The economic model of crime is tested using a panel dataset of Italian regions for the period 1980-1989. Four different crimes are considered: murder, theft, robbery and fraud. To take account of the presence of criminal organisations -a salient feature of the Italian context and a relevant factor usually disregarded by the empirical literature- we exploit the panel structure with unobservable individual components Our results suggest that: (i) the probability of punishment is relatively more effective than both the severity of punishment and the efficiency of police authority in deterring crime; (ii) among the variables representing the opportunity costs of participating in illegal activities, the rate of unemployment, the value of public works started by government and the proportion of people employed in the service sector have a significant effect; (iii) for three types of crime the regional unobservable component is correlated with the regressors; (iv) spillovers from drug consumption to theft are substantial; (v) with the exception of fraud, the results are in contrast with the predictions of the standard economic model of crime.

JEL classification: K42.

Correspondence to: Marco Vannini, Dipartimento di Economia, 15 Viale Regina Margherita, 07100 Sassari, Italy; tel. +79 228982, fax +79 228975, e-mail vannini@ssmain.uniss.it.

*The paper is the result of a joint effort; for formal purposes, however, sections 1, 3 and 6 may be attributed to M. Vannini, while sections 2, 4 and 5 to R Marselli. We would like to thank M. D'Antonio, A. Graziani, L. Guiso, R. Cooter, E. Eide and P. Zweifel and seminar participants at CRENoS (University of Cagliari), GREAT (University of Naples), IGIER (L. Bocconi University, Milan), Eastern Economic Association (New York), European Economic Association (Prague) and European Association of Law and Economics (Gerzensee) for helpful comments. We also thank P.L. Capellino for providing assistance in data collection. The usual disclaimer applies.

I. Introduction

Despite its remarkable features, Italy's criminal activity has received little attention and remains largely neglected by the economics of crime literature sprung from the seminal contributions of Becker (1968) and Ehrlich (1973)[1]. Indeed, if one goes through this copious literature one will hardly find any allusion to Italy[2], or to any other european country with a civil law legal system[3]: the large majority of studies considers common law countries, like the U.S. and Canada (Taylor (1978), Schmidt and Witte (1984), Trumbull (1989)), Australia (Whiters (1984), Lewis (1987)) and England (Wolpin (1978, 1980), Field (1990)). This is rather surprising for a variety of reasons, not least because the phenomenon in question appears as extraordinary and unique, both quantitatively and qualitatively, as many other intriguing problems -like the North South divide or the sustainability of Italy's public debt- much debated among international scholars.

In our opinion, this neglect needs remedying not only for the sake of the geographic completeness of the empirical evaluation of the economic model of crime (EMC), which should hold worldwide, but also for a better understanding of how crime and punishment work in a meaningfully different environment.

The salient features of Italy vis-à-vis the most studied countries seem to be: (i) a large variability of crime rates across time and space; (ii) a pervasive presence of organised crime with strong regional roots[4]; (iii) a

---

[1] Only recently, in Italy, we are witnessing a surge of papers based on the economic approach and its methods both inside and outside the field of economics (Campiglio (1990), Zamagni (1992), Gambetta (1988, 1992), Della Porta (1992), Sacconi (1992), Palumbo (1992), Commissione Parlamentare Antimafia (1993)).

[2] We are ignoring passing references to Beccaria's *Dei delitti e delle pene* (1764) and Lombroso's *L'uomo delinquente* (1876).

[3] We must mention, however, some notable exceptions, like Sandelin and Skogh (1986) and Wahlroos (1981).

[4] It is well known that Italy is the motherland of such archetypal criminal organisations as Mafia, Camorra, 'Ndrangheta and the newborn Sacra Corona Unita.

higher frequency of offences involving material gains relative to those related to passion or ethnic/racial conflicts; (iv) a criminal justice system based on a codified criminal law, where the judge is not a law maker -as in many common law countries- and in which the sentencing process is strictly predetermined by the penal code[5].

Each of these distinguishing characteristics, in principle, may affect both the specification and estimation of a crime equation based on the EMC. As is well known, this model reflects the presumption that "even if those who violate certain laws differ systematically in various respects from those who abide by the same laws, the former, like the latter, do respond to incentives", and "links formally the theory of participation in illegitimate activities with the general theory of occupational choices by presenting the offender's decision problem as one of an optimal allocation of resources under uncertainty to competing activities both inside and outside the market sector, rather than a choice between mutually exclusive activities" (Ehrlich, 1973, p.522). Within this framework "some individuals become criminals because of the financial and other rewards from crime compared to legal work, taking account of the likelihood of apprehension and conviction, and the severity of punishment. The amount of crime is determined not only by the rationality and preference of would-be criminals but also by the economic and social environment created by public policies, including expenditure on police, punishments for different crimes, and opportunities for employment, schooling, and training programs" (Becker, 1993, p. 390).

Interesting though it may be, the estimation of crime rate determinants with Italian data is by no means straightforward, since the main categories of reported offences reflect the operation of both individual and organised crime. Moreover, in the absence of official data[6] on the spatial distribution and internal structure of these criminal conglomerates, it is impossible to

---

[5]A very useful overview of the legal systems of the U.K., the major Commonwealth countries, the U.S.A. and the countries of Western Europe can be found in the compendium by Walker (1980). On the principles and policies of the English criminal law and penal system see, respectively, Ashworth (1991) and Vinciguerra (1992).

[6]The entry "delitti per Associazione di tipo mafioso" features in the official recorded crime categories only since 1988 (see ISTAT, *Statistiche giudiziarie*).

include a direct measure of this factor in the equations to be estimated. It becomes necessary to develop an estimation strategy capable of resolving or reducing the problems associated with unobserved explanatory components.

Our objective here, therefore, is twofold: (i) to assess the empirical performance of the EMC in a context marked with some invaluable features for this kind of exercise; (ii) to acknowledge, attempting this evaluation with Italian regional data, the existence and pervasiveness of organised crime. We consider four categories of crime -murder, robbery, theft and fraud- which represent, on average, more than 75 percent of all recorded crimes and have recently reached very alarming rates of growth (see Table 1).

The remainder of the paper proceeds as follows. Section II describes the main characteristics of Italy's crime rates. Section III reviews the basic version of the EMC and illustrates its empirical implications. Section IV describes the data and the estimation procedure. Section V presents the results. Section VI summarises and concludes the paper.

II. Few stylised facts about Italy's crime rates

One of the striking characteristics of Italy, relative to the most investigated countries, is the considerable disparity of crime rates through time and across regions. On the basis of the latest official records, the diffusion of crime in the "Bel Paese" can be depicted as in Figure 1. Two aspects are worth noting. First, the intensity of the phenomenon across regions varies dramatically according to the offence considered: while the total crime rate identifyies very few regions with low per capita amount of offences, when specific offences are examined, the picture gets more composite. Furthermore, only in the case of robbery and crimes against the property two or more contiguous regions seem to display similar high rates. Second, the ranking of regions depends on the type of crime selected: Umbria (Central Italy), for instance, ranks very high with respect to crimes against the person and very low for both robbery and crimes against the property, the opposite happens to Campania.

Further insight into the properties of these crime rates is provided in Figure 2, which shows the coefficient of variation relative to both the time

and space dimension for the four offences examined below. The first part of the picture reveals that nowadays, for all crimes considered, heterogeneity is higher than in the early 1980's, and that there is no tendency for the observed discrepancies to decrease overtime: the interregional coefficient of variation fluctuates with a rising trend for theft and murder, while it remains relatively stable for fraud and robbery. The second part on the other hand shows that there is little homogeneity in the variability through time within each region.

Another way to look at the same data is to contrast the crime rates at the beginning and at end of the sample period[7], as is done in Figure 3. The regions located in the upper right (lower left) quadrant have experienced crime rates higher (lower) than the average during the whole period. The position of those regions located in the upper left (lower right) quadrant has deteriorated (improved). In three instances the regions are clearly clustered[8], whereas they are scattered around the picture in the case of fraud. Besides, with only few exceptions (Abruzzo, Molise, and Basilicata), the Southern regions are generally located in the upper right quadrants. This is easily noticed when we consider murder: four regions (Sicilia, Campania, Calabria and Puglia) clearly dominate the scene. What these regions have in common is certainly a massive presence of criminal organisations, which operate nationwide but exert their strongest influence whithin those areas where they historically emerged[9].

---

[7] The reason why the sample period ends in 1989 is twofold: i) the official statistics have some delays (the latest available data refer to1992) and ii) a significant reform of the criminal procedure took place in 1990. This change is likely to have produced a structural break, which cannot adequately be taken into account with only two observations after the break.

[8] This is much more evident for murder and robbery than for theft.

[9] Mafia, Camorra and 'Ndrangheta come from Sicilia, Campania and Calabria respectively, while the newborn Sacra Corona Unita emerged in Puglia. It goes without saying that these criminal groups affect their habitat not only directly, committing offences, but also indirectly, controlling legal and illegal businesses and shaping in a variety of ways norms and wants that govern individual attitudes toward crime. An extended framework of rational choice which explicitly acknwledges a role for norms in this context has been recently developed by E. Eide (1995).

In the absence of official data on the number of people involved in criminal organisations, we can only speculate on the impact and the influence of such organisations from observed crime rates. As documented in Figure 4, the average crime rates by region changes quite substantially as we move from fraud and theft to robbery and murder, that is as we move towards offences increasingly associated with organised crime. In the case of murder we find four peaks that differentiate dramatically Southern regions from the rest of the country.

III. The Economic Model of Crime

As Becker (1993) put it in his Nobel Lecture, "individuals maximise welfare as they conceive it, whether they be selfish, altruistic, loyal, spiteful, or masochistic. Their behaviour is forward-looking, and it is also assumed to be consistent over time" (p. 386). This vision of human behaviour does not make any assumption about specific motivations[10], rather it defines a method of analysis which can be applied to social issues beyond those commonly studied by economists, like crime.

According to this approach, a potential offender acts as an expected-utility maximiser who allocates his time among competing activities, legal and illegal, with uncertain consequences. To prevent any misunderstanding, it is worth recalling that people are not assumed to have the same "taste for crime" and that their ethical attitudes do matter. Everybody has his own vulnerability threshold defined positively by his moral or negatively by his proclivity to commit crime. However, individuals respond to incentives, and if the incentive structure associated with an action changes, their choices are also likely to change. Therefore, unlike most criminological studies that try to explain deviant behaviour on the basis of social privation or deviant factors (psychological and/or physiological) unique to criminals[11], the

10 "I have tried to pry economists away from narrow assumptions about self-interest. Behaviour is driven by a much richer set of values and preferences" (Becker, 1993, p. 385).

economic approach takes personal tastes as given and emphasises the role of competing legal and illegal opportunities in determining the offender's choice.

As pointed out by Heineke (1978, p. 3), the choice of potential offenders has been modelled in two different ways, which differ as to whether time or wealth is to be allocated to illegal activities. But since illegal activities, apart from income tax evasion and the like, are usually time consuming, the offence decision problem is formally a labour supply problem with uncertain consequences[12]: the time allocation approach seems more appropriate than the portfolio approach.

To illustrate the basic results of the time allocation approach consider an individual who is contemplating how to split his total time available (T) between time spent in illegal activities (t_I) and time spent in labour market activities (t_L=T-t_I). The individual's expected utility can be written as

$$(2.1)\ E\,U(W) = (1-p)\,U(W_S) + p\,U(W_u)$$

where U(W) is the utility of wealth function, p is the probability of detection and (1-p) the probability of getting away with crime. Wealth W denotes the money value of the pecuniary and non-pecuniary gains from the chosen time allocation, while W_u and W_S represent the amount of wealth accruing to the individual in the unsuccessful and successful state respectively, i.e.

$$(2.2)\ W_u = W_O + G\,(t_I) + L\,(t_L) - F\,(t_I)$$

$$(2.3)\ W_S = W_O + G(\,t_I) + L\,(t_L)$$

---

[11]The article by Opp (1989), directed both to economists and sociologists, illustrates the fundamental theory of differential association and develops a theoretical confrontation of the economic and sociological perspectives on crime.

[12]For an in-depth analysis of the criminal choice within a labour choice framework see also Block and
Heineke (1975).

where G and L are the monetary returns resulting from illegal and legal activities and F is the monetary value of the penalty. An individual will engage in illegal activities if increasing t_I increases his expected utility, i.e. if

(2.4) $E'(U) > 0$

where E'(U) is the derivative of the expected utility with respect to t_I given $t_I=0$. Expanding (2.4) gives

(2.5) $(1-p)U'(W_S)(G'-L') + pU'(W_u)(G'-L'-F') > 0$
but since at $t_I=0$, $W_u = W_S$ and $U'(W_S) = U'(W_u)$, it follows that

(2.6) $(G'-L') > pF'$

Condition (2.6) says that a rational agent will embark on some illegal activity as long as the marginal return from crime exceeds the marginal return from legal occupation by more than the expected value of the penalty. As for the effects of changes in exogenous factors on t_I, it turns out that while the amount of time devoted to illegal activities decreases unambiguously as the probability of apprehension increases, the remaining effects are ambiguous in principle. A change in the initial level of wealth, for instance, has no effect on time devoted to illegal activities if the individual is risk neutral, while it has a positive effect if the individual is risk averse and risk aversion decreases with wealth. Similarly, an exogenous positive shift in the return from crime function has a positive effect on the amount of time devoted to crime only under risk neutrality or decreasing absolute risk aversion[13]. Finally, a stiffening of sanctions, represented by a positive shift of the penalty schedule, will have a negative effect on time devoted to crime under either risk neutrality or risk aversion.

---

[13]These ambiguities arise here, as in the labour/leisure choice framework, because the income and substitution effects are discordant. An increase in the expected return to crime is analogous to an increase in the wage rate: the substitution effect is positive but the sign of the income effect depends on individual's preferences toward risk. To have an overall positive effect requires the same assumptions entailed by $dt_L/dW_O \geq 0$.

The plausible conclusions of this elementary model of participation to illegitimate activities do not carry over to more sophisticated (and reasonable) versions of the model. More precisely, as shown by Heineke (1978), as soon as non-monetary aspects of both the time allocation problem and the penalty are incorporated into the analysis, "it is not possible to establish the sign of any one of these comparative static derivatives unless one is willing to make much stronger assumptions about the preference of offenders" (p. 25).

Despite the unsettled micro-theoretic underpinnings, the economic approach to crime has provided guidance for a host of studies intended to explain the observed (aggregate or individual) frequency of offences in terms of factors such as the probability and severity of punishment, legal and illegal opportunities, and tastes. The empirical counterparts of these theoretical constructs, mostly used in applied works (see Taylor (1978), Schmidt e Witte (1984)), are as follows: an objective measure of the probability of punishment, like the fraction of all offenders convicted, to approximate the subjective probability of detection; the average time served in prison to reflect the cost of punishment; the level of consumption and some indicator of labour market conditions to measure legal and illegal opportunities; characteristics like race, age, education, geographic location and sex to control for attitudes toward crime.

IV. Data and Empirical Formulation

To analyse illegal behaviour in Italian regions we selected four categories of crimes reported to the judicial authorities: murder, theft, robbery and fraud. The first category, which refers to crimes against the person, has been restricted to those types of offences (first-degree murder and attempted murder) that are cause for great social concern and that often culminate in extremely violent episodes. To ensure that the series was as consistent as possible we did not include in this category, centred on offences against the person, "voluntary personal injuries". This omission is relatively unimportant as this entry is steadily fading away. It may be noted, however, that many offences of this kind, like certain varieties of wounding, are probably not being reported because of reticence or, worse, because of

the growing habit of criminal enterprises to override the warning stage and suppress their rivals straight away. The last three are forms of property crime, although robbery cannot be easily labelled as purely property or purely personal. The focus, in any case, is on so-called crimes of profit, i.e. offences committed to get hold of somebody's goods either directly, as in the case of housebreaking and robbery, or indirectly, as in the case of blackmailing and kidnapping.

For each of the selected categories of crime we constructed three deterrence variables (UNKNOWN, PROBABILITY and SEVERITY) intended to capture the effect of the criminal justice factors potentially affecting the regional level of crime: UNKNOWN is the ratio of crimes committed by persons unknown to all recorded crimes in a given category, and cares for the deterrence effect stemming from the criminal investigation efficiency of the local police force and from its knowledge of the local underworld; PROBABILITY is the ratio of the number of offenders convicted to the total number of offenders recorded in a given category of crime (it is our empirical counterpart of the probability of punishment in the standard EMC); SEVERITY is the average time to be served in prison according to the final judgement in a given category of crime. The coefficient of variation of these variables are shown in Figure 5. Not surprisingly, due to the characteristics of the sentencing process, among the deterrence factor severity appears to be the more stable one.

As for the economic factors affecting crime, we considered both the level of regional real consumption per capita (CONSUMPTION) and the regional rate of unemployment (UNEMPLOYMENT). The level of consumption is usually included in this kind of study to capture the effect of the business cycle; while unemployment enters as an indirect measure of the opportunity cost from crime. It has been noted, however, that if the rate of unemployment is the only economic indicator among the explanatory variables, it ends up channelling mainly the effect of the business cycle (Freeman (1983))[14]. In principle the relation between crime and the business cycle/consumption is multiform, and depends on the specific type of crime

---

[14]In the case of Italy, though, is more likely that consumption and unemployment embody structural differences among regions.

considered. With regard to property crime, for instance, Field (1990) points out three sorts of effect: (i) an opportunity effect (when business is booming, and consumption is growing, opportunities and returns for crime increase simultaneously with both the number and the value of goods); (ii) a lifestyle effect (consumption growth induces change in routine activities in a direction that favours potential criminals); (iii) a motivation effect (during booms there is more room for the lawful acquisition of goods, and vice versa). Opportunity and lifestyle effects have a positive impact on crime rates, while the influence of the motivation effect is negative. Obviously, when the cycle is proxied by the rate of unemployment, the same effects are operative with reversed signs.

In addition to these variables, that feature regularly in the empirical literature on the EMC, we also considered a set of socio-economic and demographic variables. Public works (PBWORKS), for instance, has been introduced as an indicator of social privation, since it represents government efforts to invest in regional social fixed capital. Although we would expect a priori a negative relationship between this variable and the regional crime rate, we should emphasise that it may be proxying several influences, the most important of which, we believe, is the growth of rent (and profit) seeking activities associated with public spending programmes. Another socio-economic variable used in the analysis is the number of employed in the service sector relative to the total number of employed (SERVICES), which in this context acts as a measure of the opportunities linked to white collar crimes, but again it should be stressed that it may capture, at least indirectly, other important factors affecting crime which are positively correlated with the growth of the service sector, like income inequality[15]. Social security benefits (BENEFITS) and average monthly salary (WAGE), on the other hand, represent further indicators of opportunities associated with participation in legitimate activities. Finally, to take account of the widespread opinion that the younger and the less educated the population the greater the crime rate, we defined two more variables representing,

---

[15] The nexus between growth of the service sector and income inequality is discussed in Nelson-Lorence (1985) and Campiglio (1990). On the general relationship between income inequality (as a measure of the level of transferable goods and assets in the economy) and crime see Ehrlich (1973, p.538-39).

respectively, the percentage of all males in the age group 14 - 29 (YOUTH) and the number of students who have completed secondary and high schools relative to the population (EDUCATION)[16]. The coefficient of variation of these variables over the sample period are presented in Figure 6.

We based our estimation on pooled data concerning 19 Italian administrative regions (there are twenty of them, but we aggregated Valle d'Aosta and Piemonte) for the 10 years 1980-1989. Since we were working with only 10 annual observations for each region, the time-series analysis has been necessarily limited, and we dealt primarily with the question of whether there existed a homogeneous structure capable of adequately representing the phenomenon of illegal behaviour across different regions.

As already mentioned, the most striking feature of the Italian context is the dominant role played by organised crime,[17] whose ramifications extend throughout the country but are particularly thick and deep-rooted in certain regions of the South, where criminal organisations like the Mafia, Camorra and 'Ndrangheta emerged far back in history. This phenomenon, that certainly differentiates regions, evolves gradually through time. In modern econometric language (Hsiao, 1986, p. 25) it can be regarded as an attribute that is the same for a given cross-sectional unit through time but that varies across cross-sectional units. When this is the case, and the specific attribute is not observed, one can take advantage of the panel structure and estimate a model treating these specific effects either as fixed constant or as random variables. (Hsiao (1986))[18].

---

16 Variables are detailed in the data appendix.

17 Here, by organised crime we mean primarily crime organised by such criminal enterprises as Mafia, Camorra and 'Ndrangheta. It goes without saying that there is not an objective definition of organised crime, and that most crime is rarely disorganised. Leaving aside historical consideration as to the origin of these criminal formations, we agree with Schelling (1984, p. 182) interpretation that organised crime "seeks not only influence, but exclusive influence. In the overworld its counterpart would be not just organised business, but monopoly. And we can apply to it some of the adjectives that are often associated with monopoly -ruthless, unscrupulous, greedy, exploitative, unprincipled".

18 To our knowledge, this is the first attempt at estimating the economic model of crime in the presence of organised crime. The same technique, however, has been used recently by

In the first case the model takes the following form:

$$(3.1) \quad y_{it} = \alpha + \mu_i + \beta' \mathbf{x}_{it} + u_{it} \qquad i = 1,...,N; \qquad t = 1,...T; \sum_{i=1}^{N} \mu_i = 0$$

where α is the population mean, μ_i is the variable that captures the effects of the individual time-invariant components measured as deviations from the common mean α, and μ_{it} is an indipendently identically distributed random variable with mean zero and variance σ^2_{μ}. Using matrix notation the model can be written as:

$$(3.2) \quad \mathbf{y}_i = \mathbf{i}\alpha + \mathbf{i}\mu_i + \mathbf{X}_i\beta + \mathbf{u}_i$$

where **i** is a (Tx1) vector of ones.

Operationally, one can either estimate model (3.2) as it stands by ordinary least squares (OLS) or, in order to reduce the number of parameters, apply the OLS procedure to the transformed model which can be obtained measuring individual observations as deviations from individual means (over time). To carry out the transformation define a (TxT) idempotent matrix:
$\mathbf{M} = \mathbf{I}_T - (1/T)\mathbf{ii}'$
and premultiply the ith equation of (3.2) by M to get:

$$(3.3) \quad \mathbf{M}\mathbf{y}_i = \mathbf{M}\mathbf{i}\alpha + \mathbf{M}\mathbf{i}\mu_i + \mathbf{M}\mathbf{X}_i\beta + \mathbf{u}_i = \mathbf{M}\mathbf{X}_i\beta + \mathbf{u}_i, \qquad i = 1,...,N$$

Under the assumptions concerning μ_{it} the OLS estimator of (3.3)

$$\hat{\beta}_F = \left(\sum_{i=1}^{N} \mathbf{X}_i' \mathbf{M} \mathbf{X}_i \right)^{-1} \left(\sum_{i=1}^{N} \mathbf{X}_i' \mathbf{M} \mathbf{y}_i \right)$$

is the best linear umbiased estimator (BLUE).
Alternatively, instead of treating the unobserved individual specific components as fixed, one can treat them as random variables.

Cornwell and Trumbull (1994) for the purpose of determining the statistical consequences of ignoring unobserved heterogeneity, like jurisdictional differences in crime reporting without data on actual crimes.

Consequently the model can be written as:

(3.4) $y_{it} = \alpha + \beta' \mathbf{x}_{it} + \mu_i + u_{it} = \alpha + \beta' \mathbf{x}_{it} + e_{it}$,

where $e_{it} = \mu_{it} + u_{it}$ and μ_{it} and u_{it} are white noises orthogonal to the regressors.

Equation (3.4) can be written more compactly as:

(3.5) $\mathbf{y}_i = \mathbf{i}\alpha + \mathbf{X}_i\beta + \mathbf{e}_i$

The similarity between the two formulations is apparent: in (3.2) the omitted individual specific effects are subsumed under the intercept term; in (3.5), where they are treated as a sample of random drawings from a population, they enter the model's disturbance term. Now, however, the least square estimator is no longer best linear unbiased, since the covariance matrix is not diagonal.

In matrix notation, model (3.5) can be written

(3.6) $\mathbf{y} = \alpha^* + \mathbf{X}\beta + \mathbf{e}$

and the BLUE in this case is the generalised-least-squares (GLS) estimator[19],

$$\hat{\beta}_C = \left(\mathbf{X}' \hat{\mathbf{W}}^{-1} \mathbf{X}\right)^{-1} \mathbf{X}' \hat{\mathbf{W}}^{-1} \mathbf{y}$$

Despite the terminology, "fixed" versus "random" individual effects, the difference between model (3.2) and (3.6) does not depend so much on the nature of the unobserved component, but rather on whether or not this component and the explanatory variables included in the model can be

[19]The literature provides many procedure to estimate matrix W, see for instance Greene (1990) and Judge et alii (1988). Note, further, that when $\sigma^2_\mu = 0$ the GLS estimator is the like of an OLS estimator applied to a classical regression model; whereas when $\sigma^2_u = 0$, to apply the GLS estimator to model (3.6) is equivalent to run OLS on model (3.2). For, in this latter case, variations across individuals would depend only on the μ_i components, which are constant through time by assumption.

considered orthogonal[20]. For , as shown by Mundlak (1978), in order to obtain efficient estimates it woul be advisable to apply the GLS procedure to model (3.6) if the answer is positive, and the OLS estimator to either model (3.2) or (3.3) otherwise.

Within this framework, the model selection procedure can resort to several tests. First of all, to check whether the random effects or the fixed effects model conveys more information than a classical regression model, one can apply an F test for the joint significance of the individual fixed components in the former case, and a Breusch-Pagan (1979) LM test on the null $\sigma^2_{\mu} = 0$ in the latter case. Furthermore, to decide whether the individual unobserved effects are better modelled as "fixed" or " random", one can perform a Hausman (1978) test on the orthogonality of the omitted individual components with respect to the explanatory variables explicitly included in the model. Finally, to allow for components that are the same for all cross-sectional units at a given point in time but that vary through time, model (3.1) can be slightly modified and written as:

(3.1') $y_{it} = \alpha + \mu_i + \lambda_t + \beta' \mathbf{x}_{it} + u_{it}$

where λ_t is the period individual-invariant variable. An LR test on the joint significance of these t components can be used to assess the legitimacy of model (3.1) or (3.1').

V. Estimation results

For each category of crime considered we estimated a general formulation of both model (3.2) and (3.6), including as regressors of each crime equation all empirical counterparts of the independent variables suggested by the EMC plus the set of background socio-demographic variables. We then simplified the estimated equations dropping those variables that turned out highly insignificant (i.e. with a t-ratio smaller than 1), opportunely testing at each step the imposed restrictions[21].

---

[20] This claim was made by Mundlak (1978) and is discussed in Hsiao (1986, p.45).

The results are set out in Table 3, where for each category of crime both the "fixed effects" and the "random effects" model are reported along with the Breusch-Pagan LM test and the Hausman test[22]. As we noted earlier, the former test enables to discriminate between a classical regression model with homogeneous groups and a linear model in which variation across groups is admitted: on the basis of both this test results and the joint significance of the regional dummies, the classical model is always rejected. The latter test, on the other hand, allows one to choose between a "fixed effects" or a "random effects" representation of the heterogeneity among groups. Finally, the LR statistics, which has a χ^2 distribution with 10 degrees of freedom under the null hypothesis, provides a test on the validity of the inclusion of a time effect common to all regions.

Leaving aside random and fixed effects to begin with, the results indicate that under all the specifications the estimated coefficients of average monthly salary (WAGE), percentage of all males in the age group 14-29 (YOUTH) and number of students who have completed secondary and high schools relative to the population (EDUCATION) are statistically insignificant. Perhaps these variables are very weak proxies of the influences that we wished to capture. This seems particularly true for the variable EDUCATION, which ideally should represent the average cultural profile of the population but that in practice, as pointed out by Tabellini and Piras (1992), fails to accomplish this task because it varies very little across regions and, in many instances, it simply reflects the choice of the only available alternative to unemployment[23]. The same reasoning, however, does

---

21 During the simplification process we checked that the choice we made were not affected by high standard errors due to multicollinearity. In particular, whenever we excluded a block of variables, we also verified that each of them, taken alone, was not significant. The results seem robust on the grounds that i) the cell values of the correlation matrix for the regressors are never greater than 0.7 ii) for each estimated model, the condition number of the X'X matrix takes values around 19.5. According to Belsley, Kuh e Welsch (1980) only for values of this ratio greater than 30 a linear dependence among the columns of X exists that may seriously affect the standard error of the estimated coefficients.

22 All variables are in logs, except for UNEMPLOYMENT and SERVICES .

not apply to a variable like YOUTH, which accurately identifies an age and sex group that, both in theory and practice, is considered more prone to crime[24]. As suggested by Figure 6, however, the variability of YOUYH across regions over the sample period is very small, so that it fail to discriminate the offenders participation to illegitime activities across the observational units.

With reference to model (3.2), regional dummies are jointly significant for each type of crime, thus a regional analysis of crime is potentially fruitful.

On the whole, we observe a considerable uniformity of estimated parameters and their significance across different crimes under both versions of the model. Moreover, in all instances but one, the Hausman test suggests the adoption of a "fixed effects" representation: which means that the unobserved regional component is highly correlated with the set of regressors that explain crime. This result is quite reasonable, given that the Hausman statistic is significant for those offences (murder, theft and robbery) that, unlike fraud, are more closely related to organised crime[25]. Estimated fixed effects are represented in Figure 7. It may be noted that while the graph concerning fraud is relatively smooth, the graphs associated with the remaining offences are spikier and have some distinctive peaks corresponding to those regions involved with organised crime.

Looking at the estimated equations, *prima facie* they would appear to contradict what one would expect on the basis of the standard version of the

---

[23]Future applications should be able to exploit the recently published 1990 Census informations to estimate, using inter-censal linear interpolation, a more reliable proxy for completed schooling.

[24]That young men are more crime-prone is an opinion largely supported by the fact that this group is over-represented in reported crime. But it can be justified on sociological grounds, as in Field (1990, p. 41-42) who shares Easterlin's view that "for a given opportunity structure and means of social control ... persons in large cohort will face relatively fewer opportunities for social advancement, and relatively fewer social controls, than persons in small age cohorts".

[25] It goes without saying that this claim does not apply to criminal enterprises in general, but seems plausible within the italian context, where organised crime is still "strongly anchored to its predatory stage" (Becchi (1993), p.89).

EMC (Becker (1968)), which predicts a negative relationship between crime and the probability and severity of punishment. We mentioned, however, that more realistic versions of the basic EMC have ambiguous implications, so the role of empirical investigation is to help assessing the direction and weight of the partial effects suggested by the theory. We now examine each equation separately.

The results for murder show first of all that the percentage of all murders cleared by the judicial authority appears not to have a statistically significant association with the level of this offence, whereas both the probability of conviction and the severity of punishment are significant: a 1 percent increase in the probability of conviction causes a 0.13 percent reduction in murder; a 1 percent increase in the average sentence length induces a 0.19 percent increase in murder.

These findings have a number of possible explanations. One is that since murder is one of the most serious crimes, the judicial apparatus spends considerable efforts on identifying those who commit this offence: knowing this,[26] murderers are more discouraged by the probability of arrest and conviction than by the likelihood of being identified. It is certainly not unusual to hear of a "mafioso" guilty of murder, whose presence is evident but whom nobody manages to convict. As for the positive sign attached to the severity variable, it may be noted that harsh sentences, that put out of circulation dangerous criminals (think of Mafia bosses and the like), may end up by increasing crime simply because they trigger a fight among criminal rivals over the market share left unattended or, more generally, because "incapacitation effects *benefit* potential entrants as they are now safe from the threat of entry repelling activity by the former incumbents" (Cameron, 1988, p. 305).

Turning to the socio-economic variables, the unemployment rate has a positive and significant effect: a 1 percent increase in the rate of unemployment leads to a 7.9 percent increase in murder. One can interpret this result either in terms of falling opportunity costs of crime inducing more offences or, taking unemployment as a proxy for the business cycle, by saying that of the three effects linking business cycles to crime the *motivation effect* dominates. On this point, it should be noted that contrary

[26] As the saying goes:"Murder will out!"

to the findings of other researchers (Trumbull (1989), Field (1990)), here the unemployment rate has a positive and significant effect in all crime equations, despite the presence, among the regressors, of a variable like consumption, which in theory is more closely related to the business cycle. A plausible explanation of this result is that public transfers to Italian regions, that traditionally have tended to supplement household incomes, have weakened the link between consumption and business cycles. Also the number of employed in the service sector relative to the total number of employed, among this set of variables, has a positive and significant effect, and provides some evidence about the importance of including explicitly some measures of income distribution among the explanatory factors[27]. As for the variable BENEFITS, an obvious way to rationalise its positive and significant impact is to think of this variable as proxying changes in initial wealth, e.g. increased welfare payments, in which case, the standard EMC predicts that time devoted to illegal activities will increase with wealth.

The equation for robbery shows that all three of the criminal justice variables have a significant impact on this type of offence, but whereas the percentage of all murders cleared by the judicial authority and the probability of conviction have the expected signs, the severity of punishment has the wrong sign. To explain this finding one can resort to the same considerations previously made concerning murder, plus two further qualifications. The first is that stiffer sentences in a region may shift criminal activity to other regions, and if the importing regions retaliate by the same token, one may observe crime rising in tandem with severity (*spillover effects*). The second is that since rational potential victims may reduce their level of self-protection if deterrence is increased (*self-protection effect*), the equilibrium between demand and supply might entail a higher level of robberies[28].

---

[27] This result can also be interpreted from a structuralist perspective: the growth of the service sector, especially of services oriented towards the local market and non-market services, captures many features of the local socio-economic context (like the existence of protected sectors easily penetrable by organised crime subsidiaries) particularly suited for the expansion of illegitimate activities (D'Antonio-Scarlato (1993)).

[28] A full account of the economic explanations as to why punishment need not deter can be found in Cameron (1988).

Of the remaining variables in the robbery equation, in addition to UNEMPLOYMENT and SERVICE, the amount of public works started by Government intervention (PBWORK) has a significant positive association with crime.

The theft crime rate is found to vary in the expected direction with the clear-up rate and the severity of punishment; in contrast, it shows no significant relation with the probability of punishment. This finding calls for an interpretation akin to the one given for murder. For, it can be argued that thieves are relatively more deterred by the probability of being identified than arrested and convicted, because the judicial apparatus pursues and punishes this type of offender less vigorously than more serious offenders. Among the socio-economic variables, only UNEMPLOYMENT appears to affect theft significantly, although with a negative sign, which means that for this specific crime the "lifestyle" and "opportunity" effects dominate the "motivation" effect. It should be stressed that the results concerning theft may be heavily affected by the huge increase of offences related to the use of hard drugs, which in many countries constitutes a crime in its own, and by the strategies adopted to fight this phenomenon. A policy shift from harassing buyers to harassing sellers, for instance, is likely to push up the price of illegal drugs and to increase total expenditure on them, which in turn may increase the number of property crimes.

We made an attempt to establish the spillover from drug consumption to property crime by including in the final equation for theft an additional regressor, namely the number of reported AIDS cases, as a proxy for the number of drug consumers. This choice was motivated by the strong evidence that in Italy the HIV syndrome is acquired mostly by needle sharing, and hence it is highly correlated with the number of hard drug addicts. The estimation results shown in Table 4 confirm the existence of significant spillovers. But even more interesting is the finding that, once we control for drugs consumption, the regional fixed effect is greatly reduced (Figure 8): the inclusion of this new variable has allowed us to unravel a substantial part of the regional unobservable component previously left unexplained.

Whereas the results examined so far stand in contrast to the basic EMC, those concerning fraud lend credibility to it. All three of the deterrence variables have the expected signs and are statistically significant,

and the same happens for the opportunity costs factors. Moreover, this is the only case in which consumption, rather than unemployment, turns out (marginally) significant. To some extent, this result holds no surprise, since the core of this specific crime, represented by an offender deceiving a potential victim, is such that considerations about time and psychic costs are relatively unimportant. Thus the basic hypotheses of the model seem appropriate.

VI. Conclusions

There are a number of reasons why testing the EMC with Italian regional data can be a fruitful exercise: the substantial variability of crime rates across time and space; the prevalence of offences involving material gains relative to crimes of passion or related to ethnic/racial conflicts; the long-standing presence of organised crime in many areas of the country; a codified criminal law which severely limits the exercise of discretion by the judge. In this context, guided by the economic model of crime, we studied the determinants of four categories of crime, namely murder, robbery, theft and fraud. The results relative to the first three categories stand in contrast to the predictions of the standard version of the EMC (Becker (1968), Erlich (1973)); whereas those concerning the last one lend some support to its hypotheses.

Since more sophisticated versions of the model (Heineke (1978)) have ambiguous implications, the exercise was also meant to assess empirically the partial effects on crime of the main factors suggested by the theory. Among these factor, we also considered organised crime, a phenomenon usually neglected in the empirical literature on the EMC. The major findings are: (i) the certainty of punishment appears more effective than the severity of punishment and the investigation efficiency of the criminal justice system, among the deterrence variables; (ii) proxies for the relative returns from legitimate and illegitimate activities, such as the rate of unemployment, the amount of public works started and the relative size of the service sector, are found to have a significant impact on crime, while the average monthly wage has no effect; (iii) the available measure of the level of education and the percentage of all males in the age group 14 e 29 do not appear significant in

any of the estimated equations. Moreover, many unexpected partial effects can be rationalised in the light of the nature of the unobserved component (organised crime).

Though the overall results, and their interpretation with reference to the peculiarities of the Italian context, disclose many interesting aspects, the conclusions must be mitigated by some cautionary remarks on the caveats of this kind of aggregate level work. First of all, as stressed repeatedly in the literature (Taylor (1978), the set of observations is affected by very serious measurement problems: we want to explain crime, but we can only use recorded crime, and as is well known many crimes are not reported at all. Perhaps, on this point, the consistency of qualitative results between murder, which is measured correctly, and robbery, which is not, may be considered reassuring. Second, there is the issue of simultaneity, stemming from the fact that in general the criminal justice system do respond to observed crime levels and to social concern about them. According to the distinction recently made by Cornwell and Trumbull (1994, p. 361), in this study we left aside (basically for lack of valid instruments) endogeneity arising from "conventional simultaneity" and concentrated on endogeneity due to "neglected heterogeneity". Here, however, the former source of endogeneity should be less important than elsewhere, especially in those applications regarding common law countries, in view of (i) the greater variability of the regional criminal justice equation relative to the regional crime equation and (ii) the scanty margins of discretion left to judges in our judicial system. In other words, with reference to our sample, we believe that the two reasonable arguments for identification (see Taylor, 1978, p. 59-62) that can be made once one takes a broader view of the problem are likely to be met.

November 1995

REFERENCES

ASHWORT, A. (1992) *Principles of Criminal Law*, Oxford, Clarendon Press

BECCHI, A. (1993) "La criminalità organizzata come impresa economica in Italia: paradigmi incerti", in Commissione parlamentare antimafia, *Economia e criminalità*, Roma, Camera dei Deputati, 80-91

BECKER, G. S. (1968) "Crime and Punishment: an Economic Approach" *Journal of Political Economy*, 78(2), 169-217.

BECKER,G.S. (1993) "Nobel Lecture: The Economic Way of Looking at Behavior", *Journal of Political Economy*, 101(3), 385-409.

BELSLEY, D. A.- E. KUH - R. E. WELSCH (1980) *Regression Diagnostics: Identifying Influential Data and Sources of Collinearity*, New York, John Wiley.

BREUSCH, T.-A. PAGAN (1980) "The Lagrange Multiplier Test and its Application to Model Specification in Econometrics", *Review of Economic Studies*, vol.47, 239-253.

CAMERON, S. (1988) "The Economics of Crime Deterrence: a Survey of Theory and Evidence", *Kyklos*, 41(2), 301-323.

CAMPIGLIO, L. (1990) "L'illecito", in IRER-Progetto Milano, *Tensioni e nuovi bisogni della città in trasformazione*, Milano, F.Angeli.

COMMISSIONE PARLAMENTARE ANTIMAFIA (1993) *Economia e criminalità*, Roma, Camera dei Deputati.

CORNWELL, C. - W. TRUMBULL (1994) "Estimating the Economic Model of Crime with Panel Data", *The Review of Economics and Statistics*, 76 (2), 360-66.

D'ANTONIO, M. - M. SCARLATO (1993) "L'economia del crimine. Parte I: il ruolo economico", *Economia e Lavoro*, 3, 107-122

DE LEO, G. - P. PATRIZI (1992) *La spiegazione del crimine. Bilancio critico e nuove prospettive teoriche*, Bologna, Il Mulino.

DELLA PORTA, D. (1992) *Lo scambio occulto. Casi di corruzione politica in Italia*, Bologna, Il Mulino.

EHRLICH, I. (1973) "Partecipation in Illegitimate Activities: a Theoretical Analysis and Empirical Investigation", *Journal of Political Economy*, 81, 521-565.

FIELD, S. (1990) *Trend in Crime and Their Interpretation: a Study of Recorded Crime in Post-War England and Wales*, Home Office Research Study, London.

FREEMAN, R. B. (1983) "Crime and Unemployment", in *Crime and Public Policy*, J.Q.Wilson (a cura di), San Francisco, ICS.

GAMBETTA, D. (1989-90) "La mafia elimina la concorrenza. Ma la concorrenza può eliminare la mafia?", *Meridiana*, 7-8.

GAMBETTA, D. (1992) *La mafia siciliana*, Torino, Einaudi.

GREENE, W. H. (1991) *Econometric Analysis*, New York, Macmillan.

HAUSMAN, J. (1978) "Specification Tests in Econometrics", *Econometrica*, v.46, 69-85.

HEINEKE, J. M. (1978) *Economic Models of Crime Behavior*, Amsterdam, North Holland.

HSIAO, C. (1986) *Analysis of Panel Data*, Cambridge, Cambridge University Press.

ISTAT (1989) "La criminalità attraverso le statistiche", *Note e relazioni*, 3.

JUDGE, G. G.-R. CARTER HILL-W. GRIFFITHS-H. LUTKEPOHL-T. LEE (1980) *The Theory and Practice of Econometrics*, New York, Wiley.

LEWIS, D. E. (1987) "The Economics of Crime: a Survey", *Economic Analysis & Policy*, 17(2), 195-219.

MUNDLAK, Y. (1978) "On the Pooling of Time Series and Cross Section Data", *Econometrica*, 46, 69-85

OPP, K. D. (1989) "The Economics of Crime and the Sociology of Deviant Behavior: a Theoretical Confrontation of Basic Proposition", *Kyklos*, 42(2), 405-430.

PALUMBO, N. (1993) "Fra estorsione e protezione. Analisi delle organizzazioni mafiose e delle associazioni anti-racket in una prospettiva normativa", *Politeia*, 58.

REILLY, B.-R. WITT (1992) "Crime and Unemployment in Scotland: an Econometric Analysis Using Regional Data", *Scottish Journal of Political Economy*, 39(2), 213-228.

SACCONI, L. (1991) *Etica degli affari*, Milano, il Saggiatore.

SCHMIDT, P.-D. WITTE (1984) *An Economic Analysis of Crime and Justice,* New York, Academic Press.

TABELLINI, G.-PIRAS, G. (1992) "Al sud meno aiuti e più legge", *Il Sole 24 Ore*, 14 maggio.

TAYLOR, J. B. (1978) *Econometric Models of Criminal Behavior: a Review*, in J. M. Heineke (1978).

TRUMBULL, W. (1989) "Estimation of the Economic Model of Crime Using Aggregate and Individual Data", *Southern Economic Journal*, n.2, October, 423-39.

VINCIGUERRA, S. (1992) *Introduzione allo studio del diritto penale inglese*, Padova, Cedam

WALKER, D. (1980) *The Oxford Companion to Law*, Oxford, Clarendon Press

WHITHERS, G. (1984) "Crime Punishment and Deterrence in Australia: an Empirical Investigation", *The Economic Record*, 60(169), 176-185.

WOLPIN, K. (1978) "An Economic Analysis of Crime and Punishment in England and Wales", *Journal of Political Economy*, 86, 815-840.

WOLPIN, K. (1980) "A Time Series-Cross Section Analysis of International Variation in Crime and Punishment", *Review of Economics and Statistics*, 417-423.

ZAMAGNI, S. (1992) *Mercati illegali e mafie*, Bologna, Il Mulino.

Data Appendix

All data are from ISTAT. In particular, criminal data are from the *Annuario delle statistice giudiziarie* [ASG], whereas the socio-economic data are from *Annuario statistico nazionale* [ASN], *Indagine trimestrale sulla forza lavoro* [IFL] and *Conti economici regionali* [CER]. For each class of crime, the sequence number in the classification provided by ISTAT criminal statistics is given in brackets.

MURDER (#2,3,5,8)	First-degree murder and attempted murder. It includes: for robbery or theft; mafia, camorra or 'ndrangheta; passion; terrorism; others. Thousand of population (people ≥14 yrs.). [ASG]
THEFT (#90,91,92,93)	Theft and aggravated theft. It includes: cattle-lifting, pocket-picking, bag snatching, shop theft and residential burglary; theft of vehicle; theft from a vehicle (cars, long trucks or rail); paintings and archaelogical materials; others. Thousand of population (people ≥14 yrs.).[ASG]
ROBBERY (#94,95,96,97)	It includes: robbery (bank or post office robbery; to the expense of jewels agents, asset carriers, prostitutes, lorries, others); extortion; kidnapping (for ransom, robbery, sexual offences, terrorism, others). Thousand of population (people ≥14 yrs.). [ASG]
FRAUD (#110)	Thousand of population (people ≥14 yrs.). [ASG]
UNKNOWN	For each class of crime, it is equal to the ratio of "Crimes reported to judicial authority committed by uknown offender" to "Crimes reported to judicial authority". [ASG]
PROBABILITY	For each class of crime, it is equal to the ratio of "Convicted according to region of committed crime" to "Crimes reported to judicial authority - no. of offenders". [ASG]
SEVERITY	For each class of crime, it is equal to the average lenght of time to be served in prison (i.e. the effective sentence to be served), not depending on the stage of the proceeding), according to the region of committed crime. [ASG]
CONSUMPTION	Total final expenditure. Thousands of billion lire at 1985 prices. Thousand of population (people ≥14 yrs.).. [CER]

PBWORKS	Public works started. Thousands of billion lire at 1985 prices. Thousand of population (people ≥14 yrs.). [CER]
BENEFITS	Social security benefits. Thousands of billion lire at 1985 prices. Thousand of population (people ≥14 yrs.). [ASN]
WAGE	Average monthly salary. Thousand of population (people ≥14 yrs.). [CER]
UNEMPLOYMENT	Rate of unemployment. [IFL]
SERVICES	Ratio of employed in tertiary industry to total employment. [CER]
YOUTH	Ratio of male 14-29 yrs. to total male resident population. [ASN]
EDUCATION	Number of secondary school-leaving certificates. Thousand of population (people ≥14 yrs.). [ASN]

Note: as far as criminal data are concerned, resident population has been corrected to take into account that Massa Carrara is part of the Genova Court of Appeal.

Table 1 **Reported Crimes** - *mean values ; ratios to hundred thousands of residents*

	1951-1960 (a)	1961-1970 (b)	1971-1980 (c)	1981-1987 (d)	(d) / (a) Δ%	(d) / (b) Δ%	(d) / (c) Δ%
First-degree murder, attempted murder, child murder	3.8	2.6	3.3	4	5.26	53.84	21.21
Manslaughter	12.1	11.9	11	8.6	-28.92	-27.73	-21.81
Personal injuries	304.6	282.6	205.1	169.2	-44.45	-40.12	-17.50
Personal offences	82.7	56.9	40.3	36.8	-55.50	-35.32	-3.50
Crimes against family and public morality	52.1	55.1	36.2	25.1	-51.82	-54.45	-30.66
Theft	540.8	748.7	2290.2	2287.6	323.00	205.54	-0.10
Robbery, extortion and kidnapping	6.1	5.7	24.8	70	1047.50	1128.10	182.20
Fraud	81	68.5	60.7	84.9	4.81	23.94	24.20

Source: "La criminalità attraverso le statistiche", ISTAT - Note e relazioni n.3, 1989

Table 2 **Organised Crime Murder**

Regions	Jan.-July 1992	% total murder	Jan.-July 1991	% total murder	Δ%
Sicilia	163	52.2	59	25.8	176.3
Campania	147	63.1	105	58.7	40.0
Calabria	108	58.4	70	38.9	54.3
Puglia	18	15.3	4	5.7	350.0
Other regions	18	5.4	33	11.8	-45.4
ITALY	454	38.5	271	28.9	67.5

Source: Home Office

Table 3. Estimation results

	Murder		Robbery		Theft		Fraud	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects
UNKNOWN			0.8496*	1.0525*	2.3645*	2.7843*		
			(0.1656)	(0.1594)	(0.5635)	(0.5443)		
PROBABILITY	-0.13575*	-0.1407*	-0.19441*	-0.20112*			-0.30585*	-0.3050*
	(0.02408)	(0.02389)	(0.03542)	(0.03459)			(0.03044)	(0.02953)
SEVERITY	0.19256*	0.19019*	0.15394**	0.18875**	-0.19125*	-0.08047	-0.10657	-0.106***
	(0.0738)	(0.07338)	(0.0769)	(0.0762)	(0.0733)	(0.0648)	(0.06744)	(0.05647)
UNEMPLOYMENT	7.9777***	8.9019**	7.3754**	4.6427	-6.082**	-10.559*		
	(4.115)	(3.973)	(3.326)	(2.976)	(2.353)	(1.672)		
PBWORKS			0.09359***	0.15094*				
			(0.0564)	(0.0537)				
CONSUMPTION							0.81954**	0.5145***
							(0.3487)	(0.2712)
BENEFITS	1.2747*	0.71252**					-0.5095***	-0.378***
	(0.3877)	(0.3653)					(0.3013)	(0.2278)
SERVICES	5.3402**	2.3653	2.0631**	2.7468*			2.0483**	2.3529*
	(2.402)	(1.863)	(0.8932)	(0.7878)			(0.9189)	(0.6755)
CONSTANT	-7.449*	-6.0441*		-3.5429*	3.6281*	3.558*		-6.2328*
	(0.995)	(0.8145)		(0.5182)	(0.1404)	(0.1418)		(0.4546)
$\overline{R}^2$	89.68		93.55		90.56		74.53	
$LR_{(10)}$	36.20*		13.85		44.239*		17.09	
HAUSMAN	14.85**		26.47*		15.24*		8.617	
LM	369.38*		294.21*		312.8*		251.45*	
LR_{gen}	1.032		0.59		8.5		2.28	
NO.RESTR.	6		5		8		6	
STEPS	3		1		1		1	

Note:
Standar errors in brackets; * ** *** reject the null at 1%, 5% 10% level, respectively. $LR_{(10)}$ is a test for the significance of the trend component; HAUSMAN is a test for the orthogonality of the stochastic component with respect to the set of regressors in model (3.6); LM is the Breusch-Pagan test for the random effect model versus the linear classical model with an overall constant; LR_{gen} tests the validity of the restrictions imposed on the general model in order to achieve the chosen specification; NO.RESTR. is the number of restrictions tested; STEPS is the number of estimation runs necessary to reduce the general model and achieve the chosen specification.

Table 4 Estimation Results: THEFT

	With AIDS		Without AIDS	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects
UNKNOWN	2.2254* (0.558)	2.7694* (0.5334)	2.3645* (0.5635)	2.7843* (0.5443)
PROBABILITY				
SEVERITY	-0.17915** (0.0724)	-0.0755 (0.062)	-0.19125* (0.0733)	-0.08047 (0.0648)
AIDS	0.03968** (0.01638)	-0.02175* (0.008		
UNEMPLOYMENT	-4.6487*** (2.392)	-8.8582* (1.729)	-6.082** (2.353)	-10.559* (1.672)
PBWORKS				
CONSUMPTION				
BENEFITS				
SERVICES				
CONSTANT	3.8050* (0.1564)	3.3727* (0.1444)	3.6281* (0.1404)	3.558* (0.1418)
$\overline{R}^2$	90.84		90.56	
$LR_{(10)}$	45.21*		44.239*	
HAUSMAN	36.37*		15.24*	
LM	317.47*		312.8*	
LR_{gen}	0.84		8.5	
NO.RESTR.	8		8	
STEPS	1		1	

Note:
Standar errors in brackets; * ** *** reject the null at 1%, 5% 10% level, respectively. $LR_{(10)}$ is a test for the significance of the trend component; HAUSMAN is a test for the orthogonality of the stochastic component with respect to the set of regressors in model (3.6); LM is the Breusch-Pagan test for the random effect model versus the linear classical model with an overall constant; LR_{gen} tests the validity of the restrictions imposed on the general model in order to achieve the chosen specification; NO.RESTR. is the number of restrictions tested; STEPS is the number of estimation runs necessary to reduce the general model and achieve the chosen specification.

CRIME RATES PER 100,000 INHABITANTS, ITALY (1991)

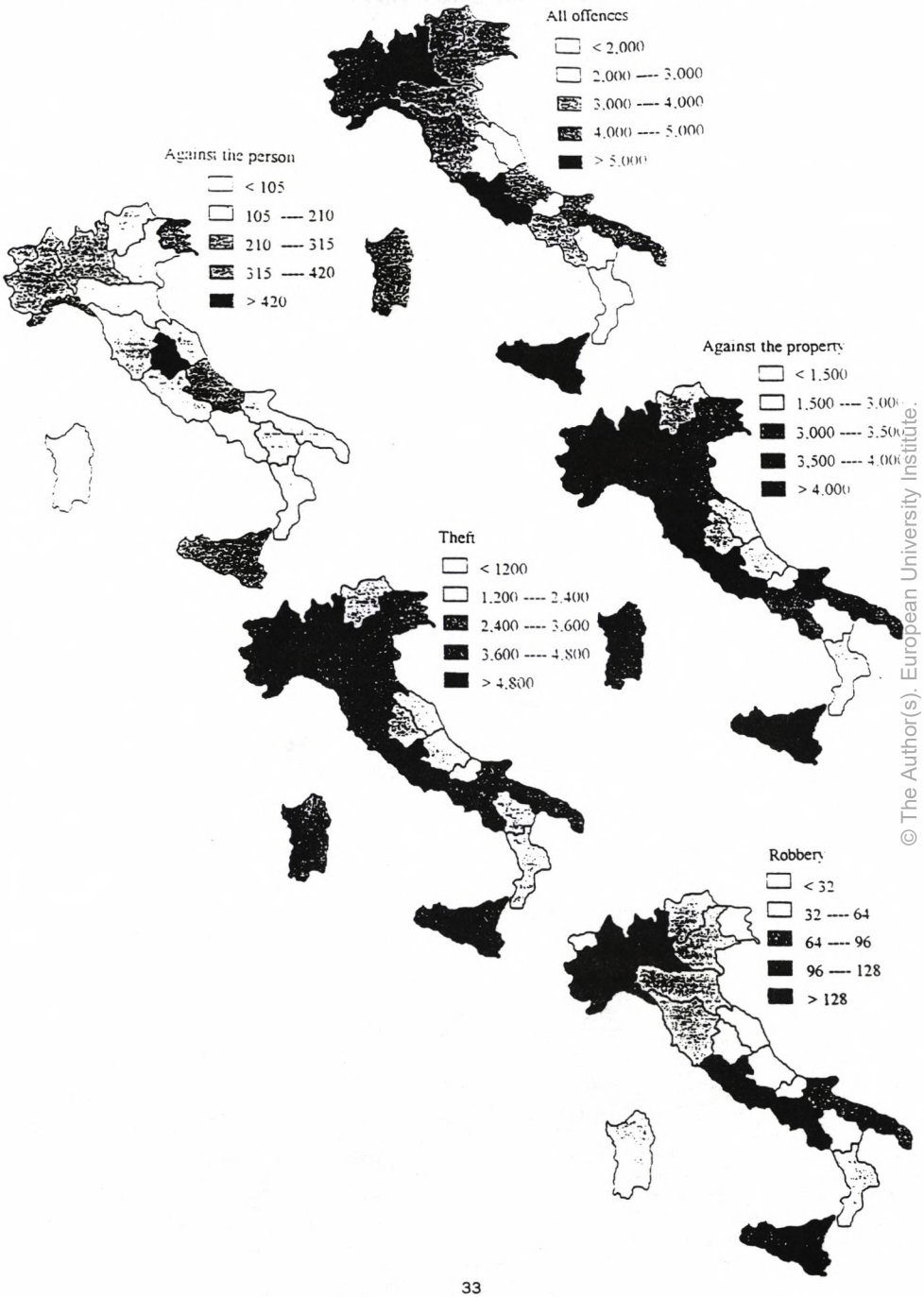
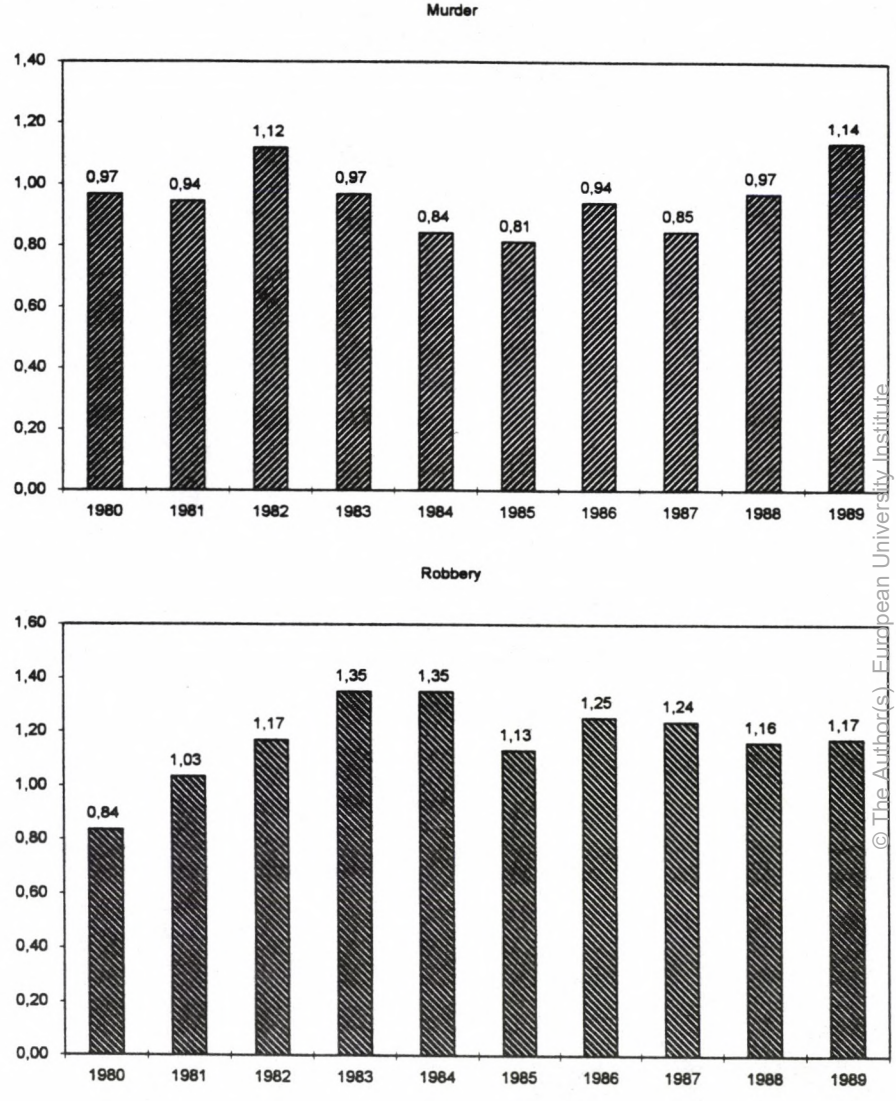


Figure 2a Reported Crimes - *coefficients of variation, 1980 - 1989*



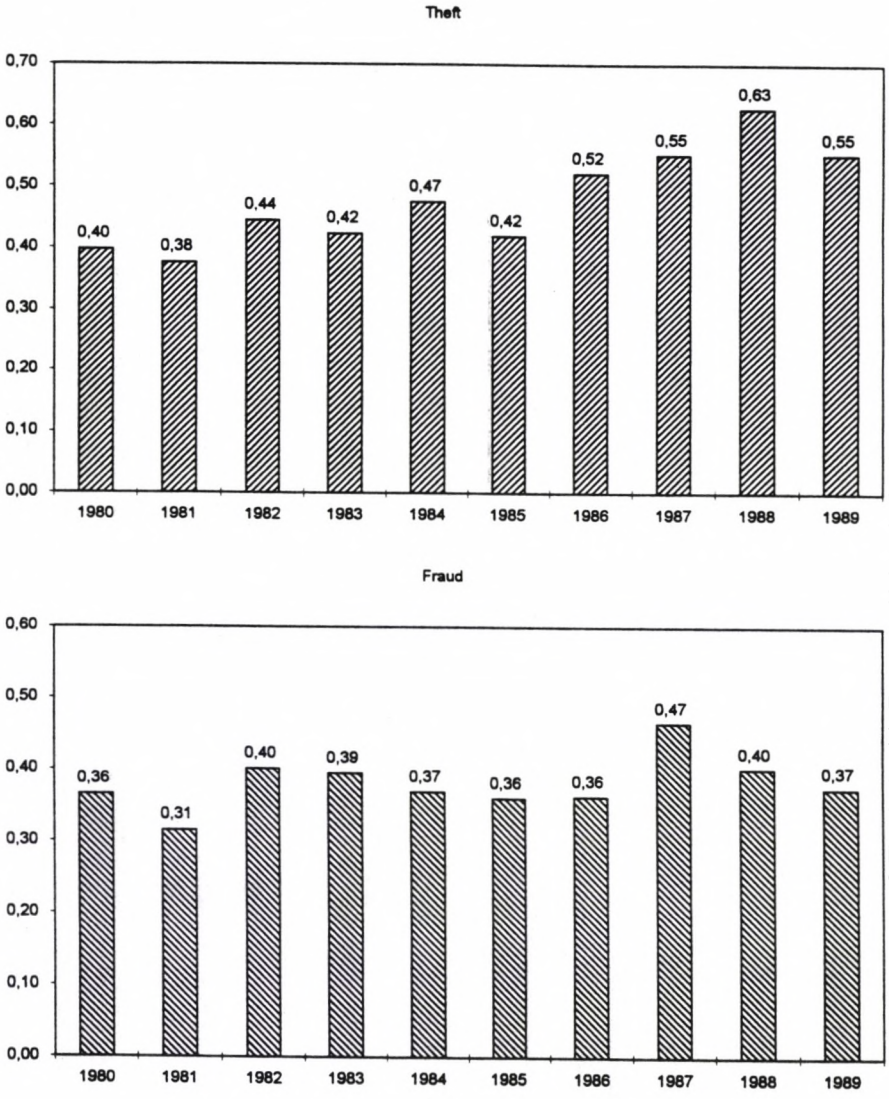


Figure 2b Reported Crimes - *coefficients of variation across regions, 1980 - 1989*

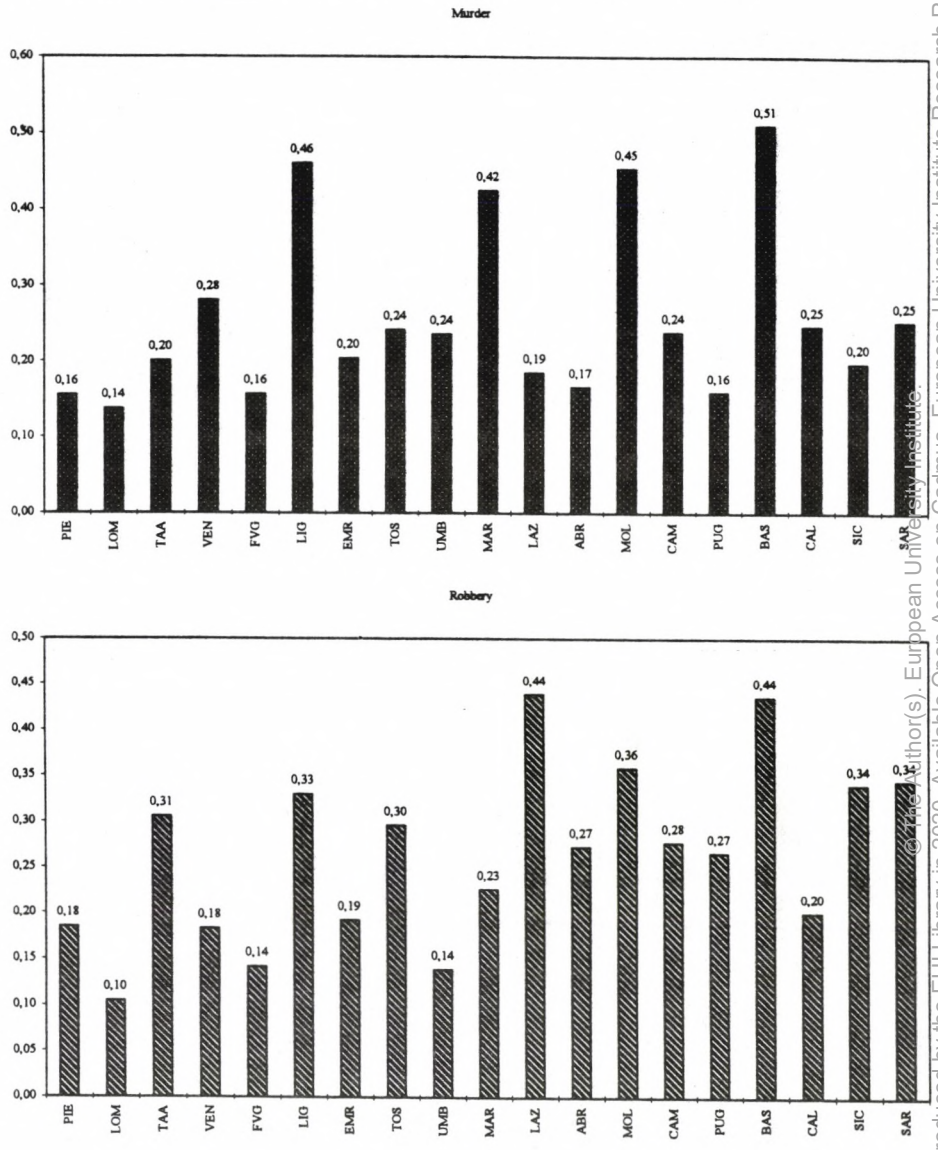
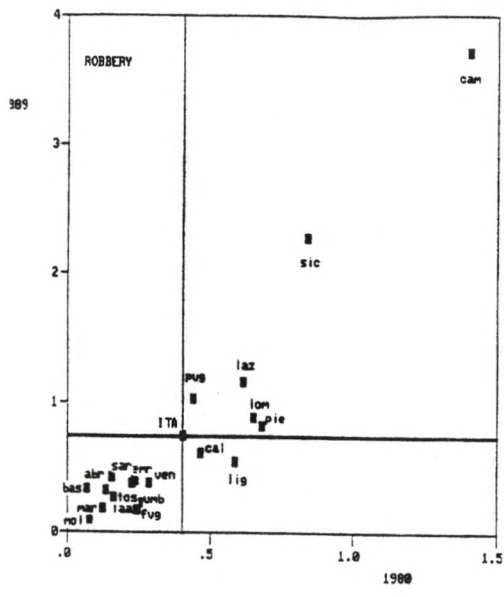
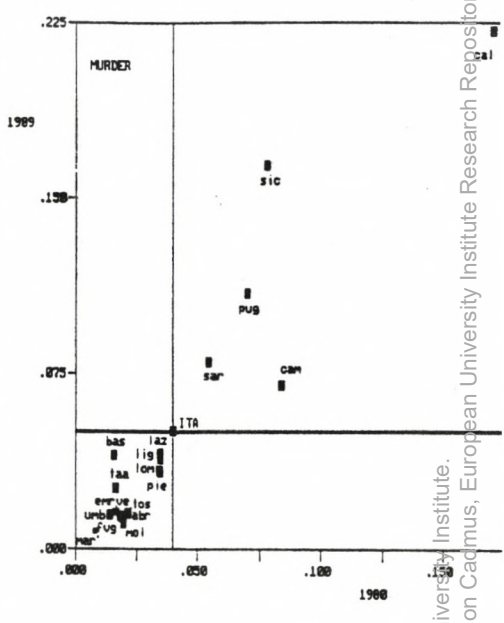
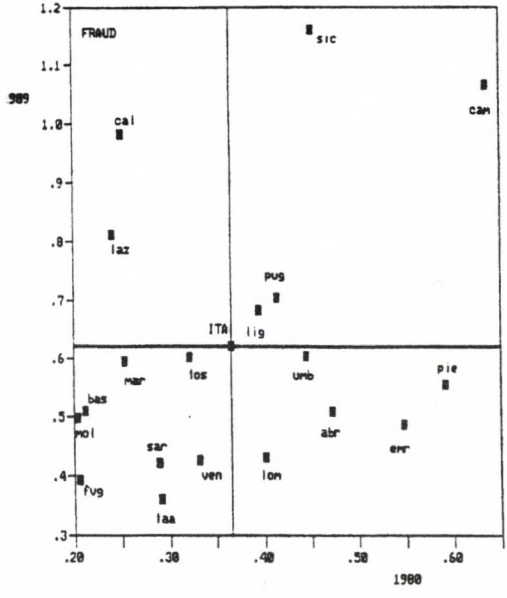


Figure 3 Changes in Crime Rates, 1980 - 1989







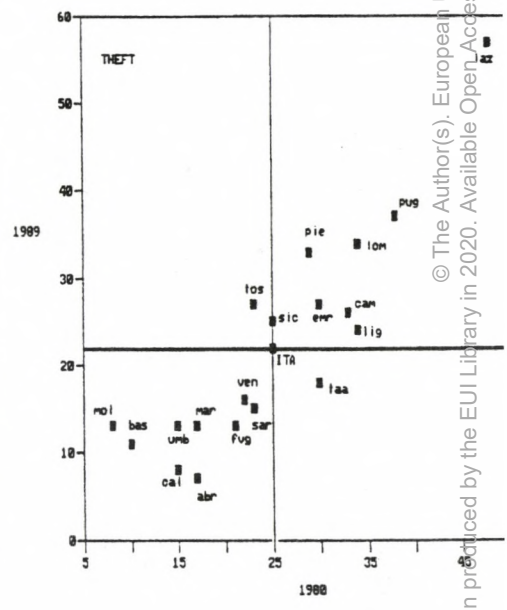
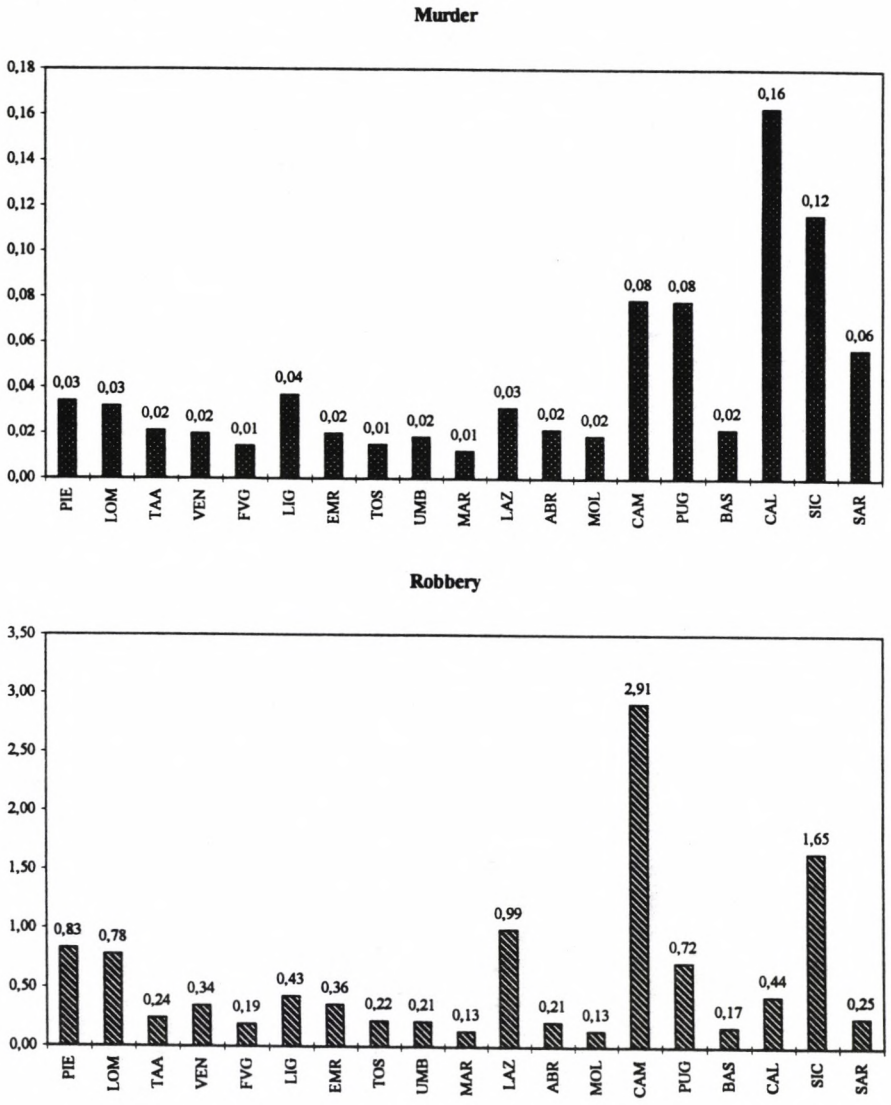
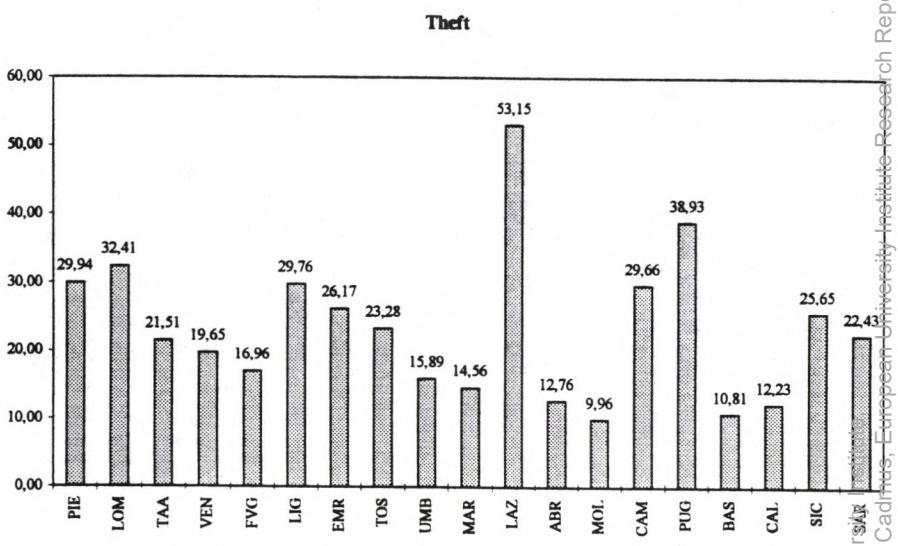


Figure 4 Reported Crimes - *mean values, 1980 - 1989*





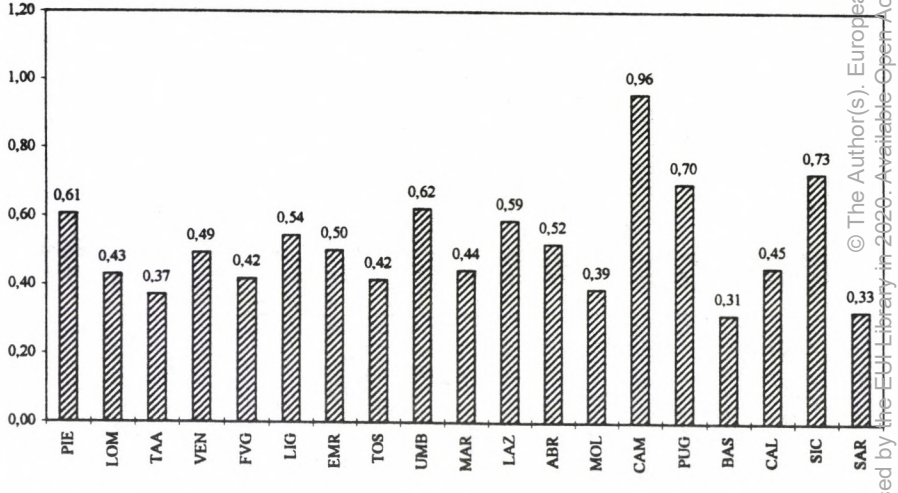


Figure 5 Coefficients of variation across time and across regions, *1980 - 1989*

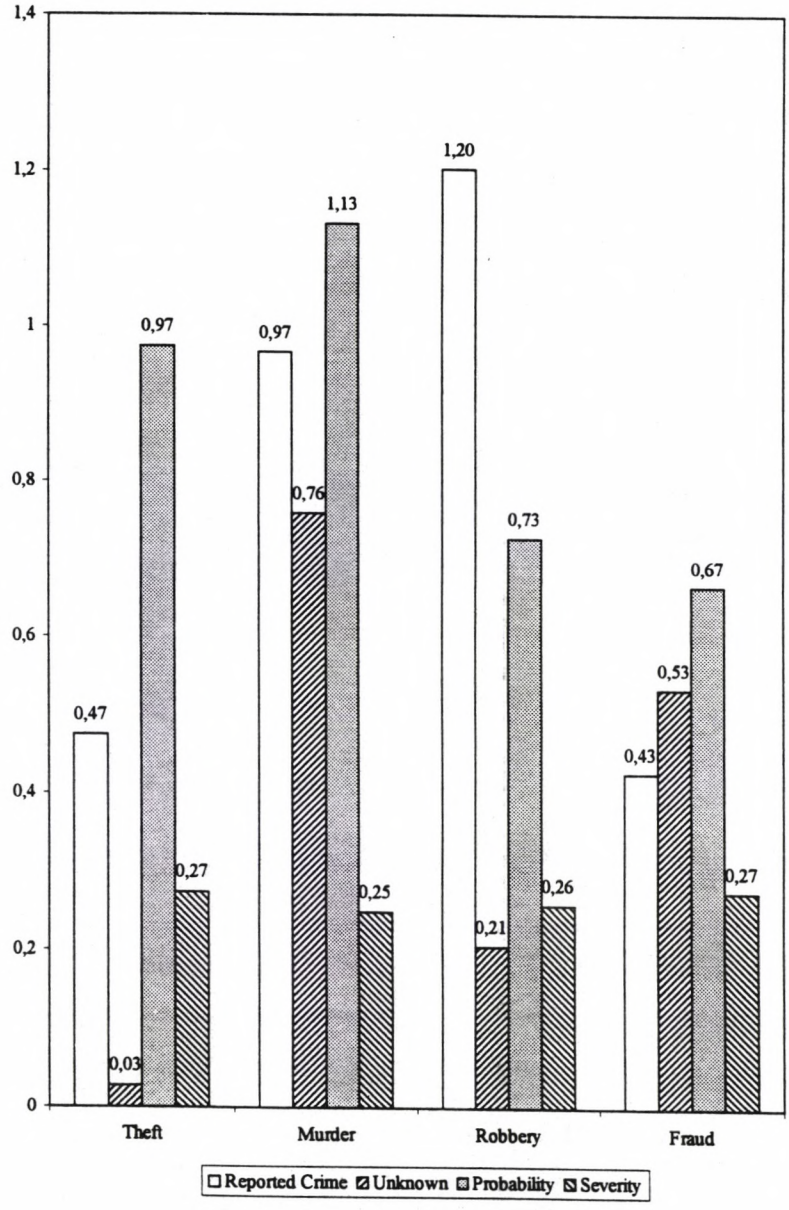


Figure 6 Coefficients of variation across time and across regions, *1980 - 1989*

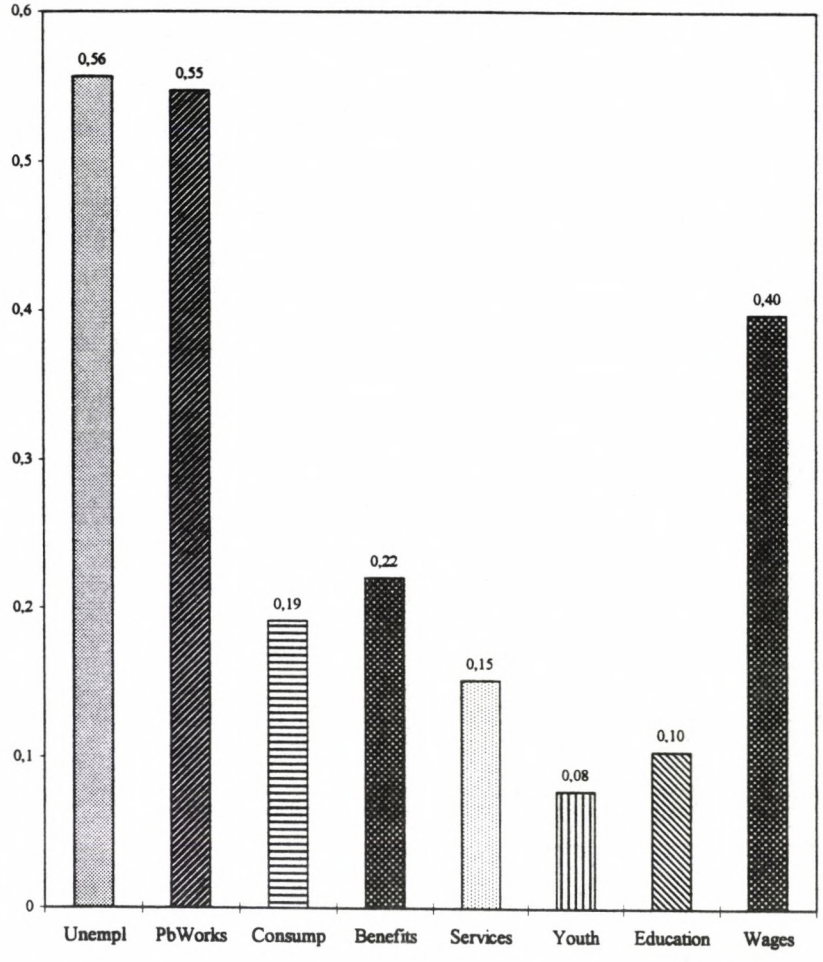
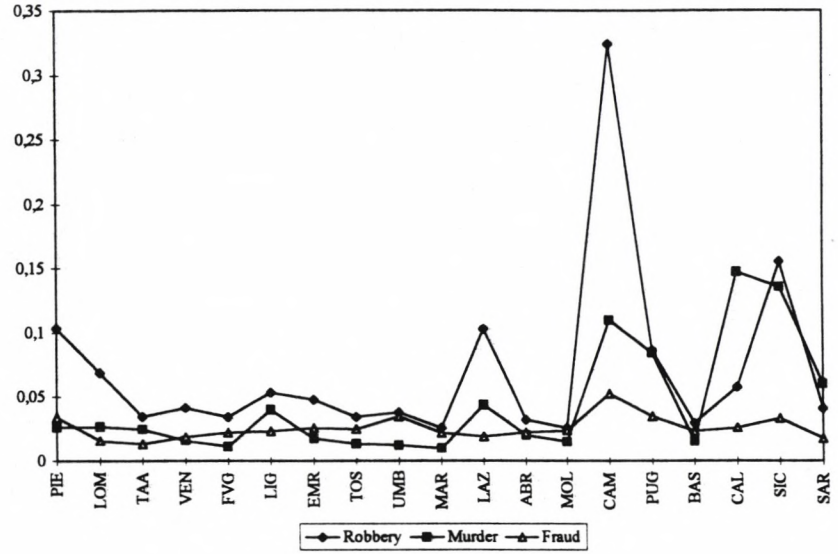


Figure 7 Regional Fixed Effects



Theft

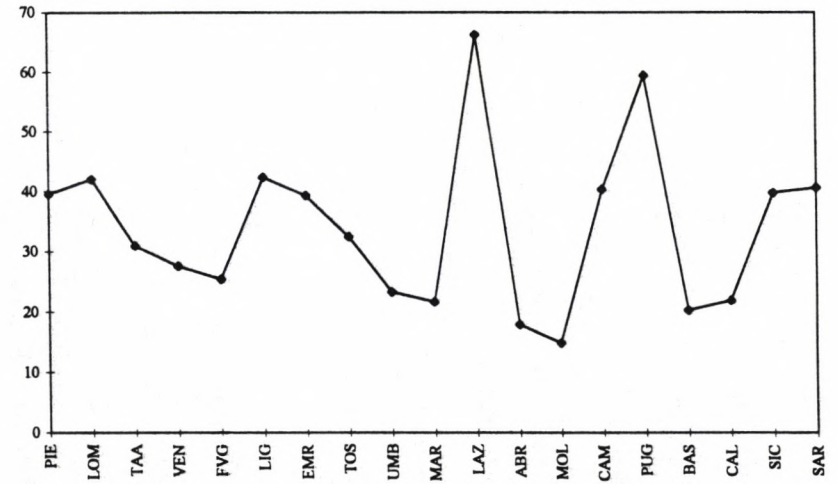
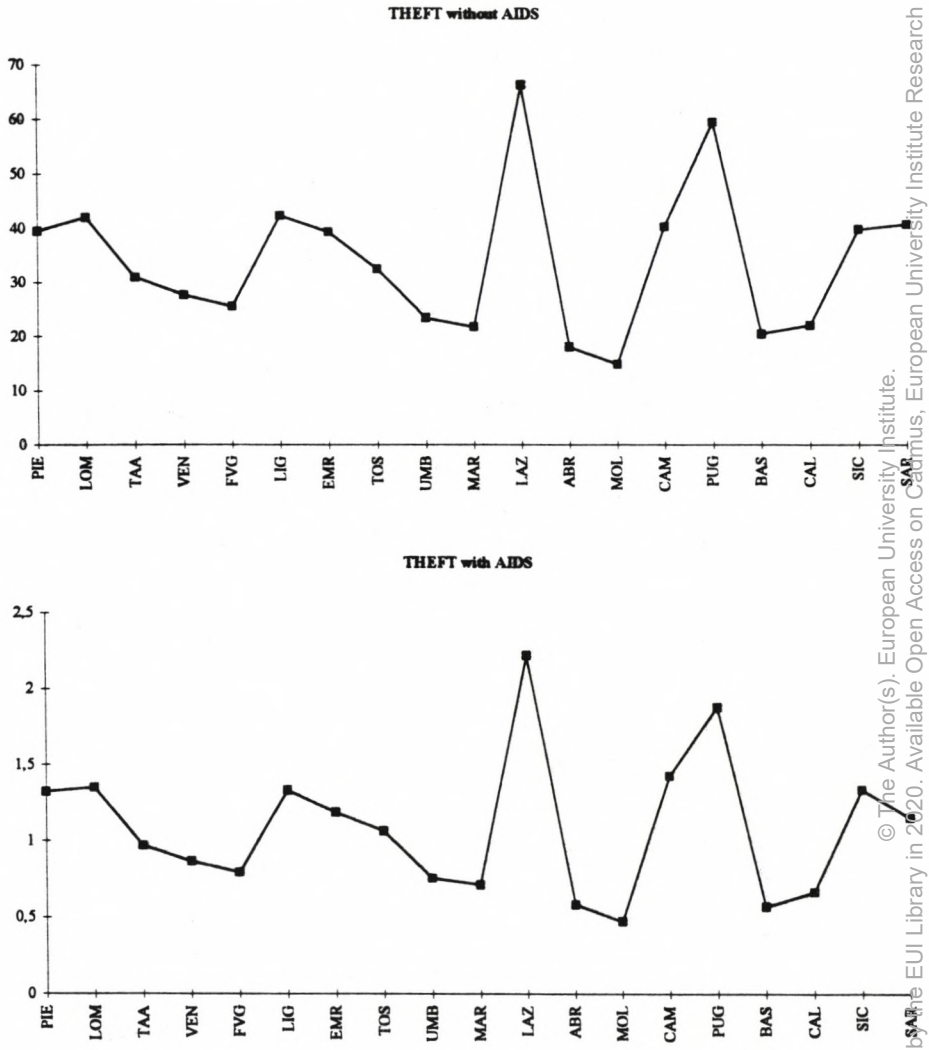


Figure 8 Regional Fixed Effects



EUI WORKING PAPERS

EUI Working Papers are published and distributed by the
European University Institute, Florence

Copies can be obtained free of charge
– depending on the availability of stocks – from:

The Publications Officer
European University Institute
Badia Fiesolana
I-50016 San Domenico di Fiesole (FI)
Italy

Please use order form overleaf

Publications of the European University Institute

To

The Publications Officer
European University Institute
Badia Fiesolana
I-50016 San Domenico di Fiesole (FI) – Italy
Telefax No: +39/55/4685 636
E-mail: publish@datacomm.iue.it

From

Name .....
Address.....
.....
.....
.....
.....

❒ Please send me a complete list of EUI Working Papers
❒ Please send me a complete list of EUI book publications
❒ Please send me the EUI brochure Academic Year 1996/97

Please send me the following EUI Working Paper(s):

No, Author .....
Title: .....
No, Author .....
Title: .....
No, Author .....
Title: .....
No, Author .....
Title: .....

Date .....

Signature .....

Working Papers of the Robert Schuman Centre

RSC No. 94/1
Fritz W. SCHARPF
Community and Autonomy Multilevel Policy-Making in the European Union *

RSC No. 94/2
Paul McALEAVEY
The Political Logic of the European Community Structural Funds Budget: Lobbying Efforts by Declining Industrial Regions

RSC No. 94/3
Toshihiro HORIUCHI
Japanese Public Policy for Cooperative Supply of Credit Guarantee to Small Firms - Its Evolution Since the Post War and Banks' Commitment

RSC No. 94/4
Thomas CHRISTIANSEN
European Integration Between Political Science and International Relations Theory: The End of Sovereignty *

RSC No. 94/5
Stefaan DE RYNCK
The Europeanization of Regional Development Policies in the Flemish Region

RSC No. 94/6
Enrique ALBEROLA ILA
Convergence Bands: A Proposal to Reform the EMS in the Transition to a Common Currency

RSC No. 94/7
Rosalyn HIGGINS
The EC and the New United Nations

RSC No. 94/8
Sidney TARROW
Social Movements in Europe: Movement Society or Europeanization of Conflict?

RSC No. 94/9
Vojin DIMITRIJEVIC
The 1974 Constitution as a Factor in the Collapse of Yugoslavia or as a Sign of Decaying Totalitarianism

RSC No. 94/10
Susan STRANGE
European Business in Japan: A Policy Crossroads?

RSC No. 94/11
Milica UVALIC
Privatization in Disintegrating East European States: The Case of Former Yugoslavia

RSC No. 94/12
Alberto CHILOSI
Property and Management Privatization in Eastern European Transition: Economic Consequences of Alternative Privatization Processes

RSC No. 94/13
Richard SINNOTT
Integration Theory, Subsidiarity and the Internationalisation of Issues: The Implications for Legitimacy *

RSC No. 94/14
Simon JOHNSON/Heidi KROLL
Complementarities, Managers and Mass Privatization Programs after Communism

RSC No. 94/15
Renzo DAVIDDI
Privatization in the Transition to a Market Economy

RSC No. 94/16
Alberto BACCINI
Industrial Organization and the Financing of Small Firms: The Case of MagneTek

RSC No. 94/17
Jonathan GOLUB
The Pivotal Role of British Sovereignty in EC Environmental Policy

RSC No. 94/18
Peter Viggo JAKOBSEN
Multilateralism Matters but How?
The Impact of Multilateralism on Great Power Policy Towards the Break-up of Yugoslavia

*out of print

RSC No. 94/19
Andrea BOSCO
A 'Federator' for Europe: Altiero Spinelli and the Constituent Role of the European Parliament

RSC No. 94/20
Johnny LAURSEN
Blueprints of Nordic Integration. Dynamics and Institutions in Nordic Cooperation, 1945-72

***

RSC No. 95/1
Giandomenico MAJONE
Mutual Trust, Credible Commitments and the Evolution of Rules for a Single European Market

RSC No. 95/2
Ute COLLIER
Electricity Privatisation and Environmental Policy in the UK: Some Lessons for the Rest of Europe

RSC No. 95/3
Giuliana GEMELLI
American Influence on European Management Education: The Role of the Ford Foundation

RSC No. 95/4
Renaud DEHOUSSE
Institutional Reform in the European Community: Are there Alternatives to the Majoritarian Avenue?

RSC No. 95/5
Vivien A. SCHMIDT
The New World Order, Incorporated: The Rise of Business and the Decline of the Nation-State

RSC No. 95/6
Liesbet HOOGHE
Subnational Mobilisation in the European Union

RSC No. 95/7
Gary MARKS/Liesbet HOOGHE/Kermit BLANK
European Integration and the State

RSC No. 95/8
Sonia LUCARELLI
The International Community and the Yugoslav Crisis: A Chronology of Events *

RSC No. 95/9
A Constitution for the European Union?
Proceedings of a Conference, 12-13 May 1994, Organized by the Robert Schuman Centre with the Patronage of the European Parliament

RSC No. 95/10
Martin RHODES
'Subversive Liberalism': Market Integration, Globalisation and the European Welfare State

RSC No. 95/11
Joseph H.H. WEILER/ Ulrich HALTERN/ Franz MAYER
European Democracy and its Critique - Five Uneasy Pieces

RSC No. 95/12
Richard ROSE/Christian HAERPFER
Democracy and Enlarging the European Union Eastward

RSC No. 95/13
Donatella DELLA PORTA
Social Movements and the State: Thoughts on the Policing of Protest

RSC No. 95/14
Patrick A. MC CARTHY/Aris ALEXOPOULOS
Theory Synthesis in IR - Problems & Possibilities

RSC No. 95/15
Denise R. OSBORN
Crime and the UK Economy

RSC No. 95/16
Jérôme HENRY/Jens WEIDMANN
The French-German Interest Rate Differential since German Unification: The Impact of the 1992-1993 EMS Crises

RSC No. 95/17
Giorgia GIOVANNETTI/Ramon MARIMON
A Monetary Union for a Heterogeneous Europe

RSC No. 95/18
Bernhard WINKLER
Towards a Strategic View on EMU - A Critical Survey

*out of print

RSC No. 95/19
Joseph H.H. WEILER
The State "über alles"
Demos, Telos and the German Maastricht Decision

RSC No. 95/20
Marc E. SMYRL
From Regional Policy Communities to European Networks: Inter-regional Divergence in the Implementation of EC Regional Policy in France

RSC No. 95/21
Claus-Dieter EHLERMANN
Increased Differentiation or Stronger Uniformity

RSC No. 95/22
Emile NOËL
La conférence intergouvernementale de 1996
Vers un nouvel ordre institutionnel

RSC No. 95/23
Jo SHAW
European Union Legal Studies in Crisis?
Towards a New Dynamic

RSC No. 95/24
Hervé BRIBOSIA
The European Court and National Courts - Doctrine and Jurisprudence: Legal Change in its Social Context
Report on Belgium

RSC No. 95/25
Juliane KOKOTT
The European Court and National Courts - Doctrine and Jurisprudence: Legal Change in its Social Context
Report on Germany

RSC No. 95/26
Monica CLAES/Bruno DE WITTE
The European Court and National Courts - Doctrine and Jurisprudence: Legal Change in its Social Context
Report on the Netherlands

RSC No. 95/27
Karen ALTER
The European Court and National Courts - Doctrine and Jurisprudence: Legal Change in its Social Context
Explaining National Court Acceptance of European Court Jurisprudence: A Critical Evaluation of Theories of Legal Integration

RSC No. 95/28
Jens PLÖTNER
The European Court and National Courts - Doctrine and Jurisprudence: Legal Change in its Social Context
Report on France

RSC No. 95/29
P.P. CRAIG
The European Court and National Courts - Doctrine and Jurisprudence: Legal Change in its Social Context
Report on the United Kingdom

RSC No. 95/30
Francesco P. RUGGERI LADERCHI
The European Court and National Courts - Doctrine and Jurisprudence: Legal Change in its Social Context
Report on Italy

RSC No. 95/31
Henri ETIENNE
The European Court and National Courts - Doctrine and Jurisprudence: Legal Change in its Social Context
Report on Luxembourg

RSC No. 95/32
Philippe A. WEBER-PANARIELLO
The Integration of Matters of Justice and Home Affairs into Title VI of the Treaty on European Union: A Step Towards more Democracy?

RSC No. 95/33
Debra MATIER
Data, Information, Evidence and Rhetoric in the Environmental Policy Process:
The Case of Solid Waste Management

RSC No. 95/34
Michael J. ARTIS
Currency Substitution in European Financial Markets

RSC No. 95/35
Christopher TAYLOR
Exchange Rate Arrangements for a Multi-Speed Europe

RSC No. 95/36
Iver B. NEUMANN
Collective Identity Formation: Self and Other in International Relations

**out of print

RSC No. 95/37
Sonia LUCARELLI
The European Response to the Yugoslav Crisis: Story of a Two-Level Constraint

RSC No. 95/38
Alec STONE SWEET
Constitutional Dialogues in the European Community

RSC No. 95/39
Thomas GEHRING
Integrating Integration Theory: Neofunctionalism and International Regimes

RSC No. 95/40
David COBHAM
The UK's Search for a Monetary Policy: In and Out of the ERM

***

RSC No. 96/1
Ute COLLIER
Implementing a Climate Change Strategy in the European Union: Obstacles and Opportunities

RSC No. 96/2
Jonathan GOLUB
Sovereignty and Subsidiarity in EU Environmental Policy

RSC No. 96/3
Jonathan GOLUB
State Power and Institutional Influence in European Integration: Lessons from the Packaging Waste Directive

RSC No. 96/4
Renaud DEHOUSSSE
Intégration ou désintégration? Cinq thèses sur l'incidence de l'intégration européenne sur les structures étatiques

RSC No. 96/5
Jens RASMUSSEN
Integrating Scientific Expertise into Regulatory Decision-Making.
Risk Management Issues - Doing Things Safely with Words: Rules and Laws

RSC No. 96/6
Olivier GODARD
Integrating Scientific Expertise into Regulatory Decision-Making.
Social Decision-Making under Conditions of Scientific Controversy, Expertise and the Precautionary Principle

RSC No. 96/7
Robert HANKIN
Integrating Scientific Expertise into Regulatory Decision-Making.
The Cases of Food and Pharmaceuticals

RSC No. 96/8
Ernesto PREVIDI
Integrating Scientific Expertise into Regulatory Decision-Making.
L'organisation des responsabilités publiques et privées dans la régulation européenne des risques: un vide institutionnel entre les deux?

RSC No. 96/9
Josef FALKE
Integrating Scientific Expertise into Regulatory Decision-Making.
The Role of Non-governmental Standardization Organizations in the Regulation of Risks to Health and the Environment

RSC No. 96/10
Christian JOERGES
Integrating Scientific Expertise into Regulatory Decision-Making.
Scientific Expertise in Social Regulation and the European Court of Justice: Legal Frameworks for Denationalized Governance Structures

RSC No. 96/11
Martin SHAPIRO
Integrating Scientific Expertise into Regulatory Decision-Making.
The Frontiers of Science Doctrine: American Experiences with the Judicial Control of Science-Based Decision-Making

RSC No. 96/12
Gianna BOERO/Giuseppe TULLIO
Currency Substitution and the Stability of the German Demand for Money Function Before and After the Fall of the Berlin Wall

*out of print

RSC No. 96/13
Riccardo MARSELLI/Marco VANNINI
Estimating the Economic Model of Crime in the Presence of Organised Crime: Evidence from Italy

*out of print