Identifying the Effect of Education on Crime. Evidence from the Italian Regions*

Paolo Buonanno†

Abstract

In this paper we develop an econometric approach aimed at estimating the impact of education on the rate of criminality for the twenty Italian regions over the period 1980-1985. Starting from a simple model in which we clearly identify the relationship between the level of education and the rate of criminality, we propose to test our theoretical model and to identify the characteristics of crime behaviour in Italy. In particular, we test which features of our theoretical model are confirmed by the econometric estimates and which features need a more careful analysis determined by the peculiarities of the Italian regions. The primary objective of our econometric estimates is to assess the existence of the relationship between crime and education. But in order to study the Italian reality we account for its peculiarities (slowness in reaching a final judgement, presence of organized crime in Italy, economic dichotomy between the North and the South of Italy).

Key words: Crime; Education;
JEL Classification: I2; J24; K42

*I would like to thank Piergiovanna Natale, Leone Leonida, Giulio Fella, Luca Stanca, Fabio Feriozzi and Daniel Montolio for extensive comments and discussions about this research. Financial support from the University of Milan-Bicocca is gratefully acknowledged.

†Università degli Studi di Milano-Bicocca, Dipartimento di Economia Politica, Piazza dell'Ateneo Nuovo 1, 20126 Milano, Italy. *Email*: p.buonanno-alumni@lse.ac.uk

1 Introduction

In this paper we develop an econometric approach aimed at estimating the impact of education on the rate of criminality for the twenty Italian regions. Starting from a simple model in which we clearly identify the relationship between the level of education and the rate of criminality, we propose to test our theoretical model and to identify the characteristics of crime behaviour in Italy. In particular, we test which features of our theoretical model are confirmed by the econometric estimates and which features need a more careful analysis determined by the peculiarities of the Italian regions.

The primary objective of our econometric estimates is to assess the existence of the relationship between crime and education. But in order to study the Italian reality we need to account for its peculiarities.

There are several distinguishing characteristics. First of all, Italian justice[1] is particularly slow and chaotic. Time needed to reach a final judgment is considerably long, implying a slow and inefficient criminal justice system. Secondly, the relevant presence of organized crime in Italy, in particular in the South, is a very important feature of the Italian situation. Finally a strong economic dichotomy exists between the North and the South of Italy. The North is one of the richest areas of Europe, while the South is affected by persistent problems: high unemployment rate, few infrastructures and low growth rate.

Crime represents a relevant social problem in Italy, in partly due to the strong presence of organized crime above all in southern regions. Despite this evidence, crime has received little attention and has been almost neglected by Italian economists.[2]

Thus, we try to fill this gap introducing a different point of view in the analysis, focusing our attention on the impact of education on crime.

In particular, we follow a similar approach to the one of Marselli and Vannini, but our work differs from Marselli and Vannini paper along different dimensions. First of all we extend the period for our analysis until 1995, while it is 1989 in Marselli and Vannini. The extension of the considered period changes radically the results obtained with respect to Marselli and Vannini. Secondly, the main purpose of our analysis is to test the implication of a theoretical model. In other words, we focus our analysis more on testing a theoretical model than on merely determining from an empirical point of view the determinants of crime in Italy. In this context, we are particularly interested in studying the effects of education in affecting the level of crime.

The remainder of the paper is structured as follows. In Section 2 we

[1] In Italy the criminal justice system is based on a codified criminal law, where the judge is not a law maker as in many common law countries, in particular anglosaxon countries, and in which the sentencing process is strictly predetermined by the penal code.

[2] Very few papers, among the others Marselli and Vannini (1997) and Scorcu and Cellini (1998) have been produced on this topic.

briefly review the literature on crime. Section 3 presents the theoretical framework, the econometric methodology and specification and the data used for our econometric analysis. Section 4 presents the results, the first part focuses on the role of education, while in the second part we discuss the results considering the particular features of southern regions. Section 5 analyze the crime dynamics, the incidence of crime appears to have inertial properties (i.e. persistence over time). Section 6 concludes.

2 Review of the Literature

During the last three decades the economics of crime has become a new field for economics investigation, in particular due to the fact that over the same period of time there has been an outstanding increase in criminal activities, as confirmed by several empirical studies.[3]

In 1968 Becker presents a paper that radically changes the way of thinking about criminal behaviour. Becker builds the first model of criminal choice, stressing that "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 model predicts that crime reduction can occur through reducing the benefits of crime, raising the probability of being caught or the costs of punishment conditional upon being caught.

Ehrlich (1973) extends the analysis made by Becker, by considering how income levels and distribution may affect criminal propensity and crime rate. He argues that payoffs to crime, especially property crime, depend primarily on the "opportunities provided by potential victims of crime".

Together with the relationship between economic conditions and crime, one of the main issues in the pioneering studies by Becker (1968) and Ehrlich (1973 and 1975) is the assessment of the effects of police presence, convictions, and the severity of punishments on the level of criminal activity.

Block and Heineke (1975) criticize Becker's and Ehrlich's work and introduce time spent in legal and illegal activities in the utility function of their model, differentiating from Becker and Ehrlich that considered time allocation only implicitly through its effects on wealth.

Since the beginning of 80s, Becker's paper opens the door to a new field of empirical research whose main purpose is to verify and study the economic and social determinants of crime. The focus of these contributions has changed from the pure testing of the deterrence hypothesis to the analysis of socioeconomic determinants like poverty,[4] social exclusion, wage and income inequality,[5] unemployment,[6] cultural and family background, level

[3] Fajnzylber et al., 2000, 2002; Freeman, 1991, 1996 and 1999; Glaeser, 1999.

[4] Huang and Laing, 2003.

[5] Chiu and Madden, 1998; Burdett et al., 1999; Kelly, 2000.

[6] Witt et al., 1998; Raphael and Winter-Ebmer, 2001; Calvo-Armengol and Zenou,

of education attained and other economic and social factors that may affect individual's propensity to commit crimes such as cultural characteristics (i.e. religion and colonial heritage),[7] age and sex (i.e. young males are said to be more prone to violence),[8] the availability of fire arms in the countries and existence of illegal drug-related activities.[9]

Recent literature[10] has emphasized the role of education as an important determinant of crime. Education has a multiple role in deterring crime: it raises skills and abilities and then improves labour market perspectives thus implying a higher opportunity cost of crime and it has a non-market effect that affects the preferences of individuals.

Becker and Ehrlich have already stressed that an increase in law-abidingness due, say, to 'education' would reduce the incentive to enter illegal activities and thus reduce the number of offenses.

Several studies have shown that criminals tend to be less educated and from poorer economic backgrounds than non criminals. Freeman (1991, 1996), Grogger (1995, 1998) and more recently Lochner and Moretti (2001) attempt to clearly identify the relationships between crime and education.

Most of the contributions on the effects of education on crime stress how education raises individuals' skills and abilities, thus increases the returns to legitimate work, raising the opportunity costs of illegal behaviour. But there exist benefits from education that are not taken in account by individuals, this implies that the social return of education is higher than its private return (Lochner and Moretti, 2001). Education has a non-market effect that affects the preferences of individuals. This effect ("civilization effect") makes criminal decision more costly in psychological terms.

Lochner (1999) uses a 2 period model to look at some simple dynamic relations between education, work and crime. In his paper, he emphasizes the role of human capital accumulation on criminal behavior and the econometric results confirm that "both high school graduation and ability directly lower criminal propensities". In a successive paper joint with Moretti (2001), Lochner estimates "the effect of education on participation in criminal activity accounting for endogeneity of schooling". The results obtained allow Lochner and Moretti (2001) to conclude that "schooling significantly reduces criminal activity".

A different approach is followed by David Usher (1997). He argues that education may also have a "civilization" effect, tending to reduce the incidence of criminal activity. In other words, "education promotes good citizenship. Education does more than teach skills to enhance one's capacity to earn income. It perpetuates the values of society, enculturates people to

2003.

[7] Fajnzylber et al., 2002.

[8] Among the others Freeman (1991) and Grogger (1998).

[9] Levitt and Venkatesh (1998).

[10] Usher, 1997; Lochner, 1999; Lochner and Moretti, 2001.

serve their communities, and promotes the virtues of hard work and honesty" (p. 368).

Thus, education has a multiple role in deterring crime. In fact, as suggested by Freeman (1994) and Lochner (1999) education may raise skills and abilities and then increasing wage level and work opportunities, but at the same time it can have a "civilization" effect, as stated by Usher (1997).

3 Model Specifications and Estimation Methods

3.1 Theoretical Framework

We present a simple economic model of education, work and crime, in order to provide some intuition on the impact of education on crime. The model does not mean to be a complete description of criminal behaviour, but it represents a useful starting point for our empirical study.

We consider a dynamic two-period model of individual behaviour in which individuals decide how to allocate their disposable time among education, work and crime. Individual disposable time sum up to unity ($l_t + s_t + d_t = 1$ and $l_t, s_t, d_t \geq 0$) where l_t, d_t and s_t are respectively the fraction of time devoted to work, crime and education; subscript t denotes time (either 1 or 2). During their lives agents optimally choose whether to be engaged or not in criminal activities and their level of education in period 1. For simplicity in period 2 $s_2 = 0$; namely individuals can choose only between work and crime. Denote with w_t the wage rate; then, income from legitimate activities is $y_t = w_t h_t l_t$, where h_t represents the level of ability, defined as $h_t = h_t(s_{t-1})$. Individual ability is increasing at a decreasing rate in the level of education acquired in the previous period, we assume that $h_1(s_0)$ is given.

If an agent is engaged in criminal activity she obtains a return $R(d_t, h_t)$ with probability $(1 - \pi_a)$, where π_a represents the probability of being apprehended and punished. The function $R(.)$ depends on the time devoted to crime activities and on individual ability. Returns from crime are supposed to be increasing at a decreasing rate in individual ability and in time devoted to crime itself and $\dfrac{\partial}{\partial h_t}\dfrac{\partial R(d_t, h_t)}{\partial d_t} > 0$.

The punishment is represented by $P(d_t)$ and measured in consumption terms. Individuals consume their income from legal work and crime, and receive a utility $u(c_t)$. Given the wage rate in the first and in the second period (w_1 and w_2) and the initial level of ability ($h_1(s_0)$), the individual's maximization problem is:

$$\max_{s_1, d_1, d_2} c_1 + \rho^{-1} c_2 \tag{1}$$

under

$$c_1 = w_1 h_1(s_0)(1 - s_1 - d_1) + (1 - \pi_a)R(d_1, h_1(s_0)) - \pi_a P(d_1)$$

and

$$c_2 = w_2 h_2(s_1)(1 - d_2) + (1 - \pi_a)R(d_2, h_2(s_1)) - \pi_a P(d_2)$$

The FOCs with respect to s_1, $d_1$and d_2 for an interior solution are:

$$d_1 : w_1 h_1(s_0) = (1 - \pi_a)R_{d_1}(d_1, h_1(s_0)) - \pi_a P_{d_1}(d_1) \tag{2}$$

$$s_1 : w_1 h_1(s_0) = \rho^{-1}\left[w_2 h_2'(s_1)(1 - d_2) + (1 - \pi_a)R_{h_2} h_2(s_1)\right] \tag{3}$$

$$d_2 : w_2 h_2(s_1) = (1 - \pi_a)R_d(d_2, h_2(s_1)) - \pi_a P_{d_2}(d_2) \tag{4}$$

Equations (2) and (4) suggest two channels through which education can affect criminal decisions. First, education increases individual returns from work, thereby increasing the opportunity costs of crime.[11] Second, education may affect the net marginal returns to crime. Equation (3) allows us to study the costs and returns of education. On one hand, a higher level of education implies higher returns both from work and crime. On the other hand, an individual with a high level of education if apprehended and convicted experiences greater losses in earnings and then it is likely that she will be more crime adverse than a less educated individual.

More time invested in education in the first period implies higher expected returns in the legal sector in the second period, increasing the opportunity cost of crime, viceversa more time spent in criminal activities during the first period, reducing the time spent for schooling, implies lower expected returns in the legal sector in the second period and this leads to a higher level of crime.

An increase in the wage rate has a negative effect on crime, but we need to distinguish between adolescents and adults. In adulthood an increase of wage unambiguously reduces time spent in criminal activities, while during adolescence this implies that education is costly in terms of foregone income, then individuals will prefer to allocate more time to legal work than to education. Then, it may be that higher wages during adolescence could increase the level of crime in adulthood.

Finally, prevention and effective law enforcement policies will allow to reduce the overall crime rates, an increase in the probability of apprehension (π_a) reduces the level of time spent in committing crime. Increasing the probability of apprehension corresponds to a reduction of the expected return from illegal activities.

Our analysis suggests that a correct mix of enforcement and education investment reduces crime. Increases in enforcement and in education are likely to considerably affect the level of crime and to be important components of an effective crime-fighting strategy.

[11] As long as education increases the marginal return to work more than crime $\left(w_t h_t' > \dfrac{\partial^2 R(d_t, h_t)}{\partial h_t \partial d_t}\right)$, crime is decreasing in education. We argue that for property crimes, education is likely to have little effect on their returns.

3.2 Data: Source and Description

Our data set comprises annual observations from the twenty Italian regions over the period 1980-1995. Crime data, that represent the dependent variable, are taken from CRENoS.[12] We utilize the number of total crimes, the number of total crimes against property and against the person normalized by population, taken from ISTAT. The explanatory variables are separated into three groups: education, deterrence variables and socioeconomic variables.

Education (EDU), taken from ISTAT, is defined as the ratio between students enrolled in high-school and in university and the total population of each region. Deterrence variables, taken from CRENoS, are: quickness of conclusion of Istruttoria (IST) and Appello (APP) obtained as inverse of average length of judicial process respectively for Istruttoria and Primo Grado[13] and for Appello and Cassazione[14]; the percentage of crimes committed by unknown offender (UNK), that we use to proxy the probability of apprehension, obtained as the ratio of crimes committed by unknown offender to all recorded crimes in each category and police force[15] (POL) normalized by population.

We complete the data set by adding a set of socioeconomic variables taken from ISTAT. In particular, we have constructed an index representing the rate of employment (EMP) defined as the ratio between the number of employed and the population for each region, an index of labour productivity (PRO) at 1990 constant prices, an index of the rate of growth of real added value (GRO), an index of average regional wages (WAG) at 1990 constant price, and finally an index of the presence of public sector (PUB) obtained as the ratio between overall consumption of public administration and the added value of each region, both at 1990 constant prices.

In Figure 1 we present the behaviour of property crimes per 1.000 inhabitants over the period 1980-1995. In order to facilitate the analysis we have aggregated the twenty Italian regions in northern regions, central regions and southern regions. As it clearly appears from Figure 1 property crimes present an upward trend over the considered period. From 1980 to 1990 they have substantially remained stable, but after 1990 they peaked again. The trend is similar for all Italian regions.

Total crimes (Figure 2) per capita present a behaviour similar to that of property crimes. Both for total crimes and property crimes the trend is overall increasing in Italy, even if over the period 1977-1990 southern regions have experienced a reduction, while central and northern regions

[12] Centre for North South Economic Research.

[13] Istruttoria and Primo grado represents the first stage of the entire judicial proceeding.

[14] Appello and Cassazione represent respectively the second and the third stage of judicial proceeding.

[15] Italian police force is composed by Carabinieri, Polizia and Guardia di Finanza. All these three bodies of the Italian police force operate at national level.

have experienced a slight increase. Starting from 1991 a sharp increase has affected all Italian regions.

The picture drastically changes by considering crimes against the person and murders (Figure 3 and Figure 4). They have experienced a constant reduction until 1990. After 1990 crimes against the person have more than doubled in five years. Northern regions have a level of crimes against the person constantly higher than the national average, while central regions are on average even if they present a great variability.

Within the category of crime against the person, murders present a constant and stable growth with a peak in 1991. In less than 30 years murders per capita are more than doubled. The situation is very different across Italy, and in particular, southern regions present a level of murders per capita considerably higher (3-4 times) than central and northern regions.

Figure (5) presents the rate of education (high school and university) defined as the number of high school and university students normalized by regional population. Education sharply increase until 1990. After this year there is a consistent reduction that affects northern and central regions, while it remains stable in southern regions.

3.3 Econometric Methodology and Specification

The theoretical model we want to test is basically an individual's choice model between education, work and crime. For this reason in the first part of our analysis we consider the simplest version of the model, in which we test the relationship between crime and education, while in the following parts of the present work we will test more complex models in which we use two different set of control variables .

In particular, in the second model we not only test the relationship between crime and education, but also the role of the criminal justice and police force by adding a set of control variables regarding the justice and police system as *UNK*, *POL, IST* and *APP* In the third model we introduce the economic variables (*PRO, EMP*, *WAG*, *GRO* and *PUB*) and finally in the fourth model, presented in section 5, we analyse the dichotomy existing between the North and the South of Italy and the presence of organized crime in southern regions.

The first equation we test is very simple and relates crime to education:

$$crim_i = \alpha + \beta_1 edu_i + \varepsilon_i \tag{5}$$

where edu_i represents the level of education in region i as defined in the previous section, crim_i the number of crimes recorded in region i.

Our work aims at identifying if it exists a clear relationship between education and crime, in particular in our analysis we focus on property crimes, as we discussed above those type of crimes are more likely to depend on economic motivations than violent crime (i.e. murder, assault, rape, etc.).

We test (**??**) thrice. In a first model, crim_i represents the total number of crimes recorded in region i; in a second model it identifies the number of property crimes recorded in region i and finally it represents the number of crimes against the person recorded in region i.

We expect an inverse relationship between education and crime, when crim_i is respectively the total number of crimes and the number of property crimes, while we expect no relationship when crim_i represents the number of crimes against the person.

There are several reasons to guess that an increase in the level of education will imply a reduction in the level of crime (total and property crimes).

Education may influence the decision to engage in criminal activities in several ways and there are several reasons to believe that education may reduce crime rate. First, higher levels of educational attainment are associated with a higher wage rate: higher wage rates raises the opportunity cost of criminal behaviour and may reduce crime participation. Second, education (or schooling) may alter personal preferences in an indirect way, which may affect decisions to engage in crime. In particular, education may have a sort of "civilization" effect[16] and then could represent a valid policy in preventing crime.

Hence, education appears to be an important variable in determining crime rate both for its direct economic implications and for its "civilization" effect.[17]

As written above, we present a second model in which a new set of variables concerning police force, criminal justice and probability of apprehension is added and tested. This second model can be represented as:

$$crim_i = \alpha + \beta_1 edu_i + \sum_{j=2}^{5} \beta_j x_{ji} + \varepsilon_i \tag{6}$$

where x_{2i} is police force in region i (POL), x_{3i} represents the quickness of conclusion of Istruttoria (IST), x_{4i} represents the quickness of conclusion of Appello (APP) and x_{5i} is the percentage of crimes committed by unknown offender as the ratio of crimes committed by unknown offender to all recorded crimes in each category (UNK).

We expect a negative sign for variables x_{2i}, x_{3i}, x_{4i} and a positive one for x_{5i}. These variables capture the efficiency of police force and the quickness and efficiency of criminal justice; in other words, the quicker is the

[16] See Usher (1997) and Fajnzylber et al. (2002).

[17] Some studies have stressed how a positive correlation between crime and education may exist. In particular, a higher level of education may increase the returns in the illegal sector more than the returns in the legal sector (Ehrlich, 1975). Even if, the effect of education could be *a priori* ambiguos, it is reasonable to think, on the basis of the previous considerations, that the effect of education on crime is negative and then the sign of β_1 is negative.

criminal justice, the lower will be the number of crimes; in the same way, more policemen increase the probability of apprehension and this leads to a reduction in the number of crimes. While, the bigger is the probability of not being apprehend the bigger will be the number of crimes.

Finally, we enrich the model represented by equation (6) including a second set of control variables containing the economic variables. Then we have a third model to test:

$$crim_i = \alpha + \beta_1 edu_i + \sum_{j=2}^{5} \beta_j x_{ji} + \sum_{j=6}^{10} \beta_j x_{ji} + \varepsilon_i \tag{7}$$

where x_{6i} is the rate of regional employment, x_{7i} and x_{8i} are respectively labour productivity and regional growth rate, x_{9i} is average wage in the legal sector, and finally x_{10i} represents the ratio between overall consumption of public administration and the added value of each region.

Then, we expect a negative sign for x_{8i} and x_{9i}. In facts, it appears widely recognized that an increase in the growth rate and a higher level of legal wage is related to a reduction in the level of crime.

We expect a positive sign for x_{10i}. Previous studies have stressed the fact that a pervasive and broad public sector may have distortionary effects on private incentives. Furthermore, a too extensive public sector may lead to a misallocation of public resources and may generate criminal behaviours.[18]

Contrary to common intuition it is not straightforward to establish the effect of employment x_{6i} and labour productivity x_{7i} on crime. In fact, as confirmed by several econometric studies, unemployment *per se* is not a relevant and significant determinant of crime rate and this relationship between crime and unemployment appears to be very sensitive to econometric specification.

According to us, a very similar analysis can be used for labour productivity. In fact, if on one hand, it is reasonable to guess that an increase in labour productivity implies a lower level of crime because of the higher wages, on the other hand it is likely that the number of crimes, and in particular property crimes, will be higher where people are richer. *A priori*, we cannot guess which one of these two effects will be bigger.

We estimate our models (5-7) by using 5 different techniques: i) OLS estimator; ii) Fixed Effects (FE) estimator; iii) Random Effects (RE) estimator; iv) Fixed Effects estimator with time effects and finally v) Random Effects estimator with time effects.

We estimate the model by using all the above described techniques, among which we will choose the best technique by using the Poolability test (OLS vs FEM), the Lagrange Multiplier test by Breusch and Pagan (1980) to test if a Panel Data Model (FEM/REM) has to be preferred to

[18] Costabile and Giannola, 1996.

an OLS estimation. and in order to choose between FEM and REM we use the Hausman test, whose null hypothesis is that the unobserved explanatory variables is orthogonal to the regressor. Finally, we test the significance of time effects, in order to choose the best specification form for our analysis.

4 Results

4.1 Crime and Italy

In this section we present the results of the regressions on total crimes, property crimes and crimes against the person without considering the dichotomy between northern and southern regions. Our basic equation includes only education as explanatory variable. Then we add two different sets of control variables: deterrence variables (probability of apprehension, police force, quickness of proceedings) and socioeconomic variables (employment rate, growth rate, wage rate, weight of public sector and labour productivity). These additional regressions are designed to test both the robustness of our 'core' results and the relevance of other potentially important crime determinants.

Table 3 presents static fixed-effect estimations with individual and time effects, as Table 1 reveals that this is the preferred specification form for our analysis according to the statistical tests conducted. Table 4 shows a second set of estimations, in which we have used only the significant regressors from the previous set of estimations.

As Tables 3 and 4 show, education is significantly and negatively correlated with total and property crimes, while, as expected, the coefficient of education for crimes against the person is not significant. This result is robust to heteroskedasticity and is not affected by adding the two different sets of control variables aimed at detecting the effect of deterrence and socioeconomic variables.

When we pass to consider the effect of deterrence variables, model denoted by (b) in Tables 3 and 4, we get a more puzzled picture. In fact, on one hand IST presents the expected (negative) sign and is significant and robust to heteroskedasticity for total crimes and property crimes, while is not significant for crimes against the person. On the other hand, APP is significant only for crime against the person.

The fraction of crimes committed by unknown offender, used to proxy the probability of apprehension, is significant and with the expected sign in the case of property crime and crime against the person, even if it is not robust to heteroskedasticity in the first case, while is not significant in the case of total crimes.

Police force, contrary to what one would expect is positively correlated with the number of crimes for every typology of crimes, albeit in some cases is not significant. This result, at first sight contradictory and counterintuitive,

can be justified observing that it may exist a relationship of reverse causality between the level of crime and police force. In other words, government spends more for police force where the number of crimes is higher.

It is worth to notice that, in models denoted by (b), some of the variables used, even if presenting the expected sign, are not statistically significant. The non significance of some of the considered variables, in our opinion, may be due to the type of crime analyzed. As we widely discussed in this and in the previous sections, our study focuses on property crimes. The theoretical and econometric models confirm our intuition on the existence of a relationship among education, the other control variables and property crimes, but we are not able to extend our analysis and considerations to other typologies of crimes. Little can be said about the determinants of crimes against the person, that in most cases are determined by unpredictable reasons.

It is important to stress that the set of deterrence variables is statistically significant. In other words, our basic model denoted by (a) is less explanatory than model denoted by (b). We have tested the significance of the regressors (Table (2)) and we can unequivocally conclude that the addition of this set of control variables better off the forecasting capacity of our models.

Education and deterrence variables are able to offer a good explanation of criminal behaviour in Italy during the period 1980-1995. R^2 are found to be higher than 80% for total and property crimes and 60% for crimes against the person.

Then, we extend our analysis adding a second set of control variables. This second set aims at analyzing the role of socioeconomic variables as determinants of crime behaviour. Also in this case the set of economic variables is statistically significant. In other words, models denoted by (a) and (b) are less explanatory than model including socioeconomic variables, denoted by (c).

The regression results indicate that wage rate in the legal sector is negatively correlated with every category of crimes, as expected. This result confirms the predictions of our theoretical model; a higher wage in the legal sector is associated to a higher cost of committing crime and consequently it implies a lower rate of crime. Growth rate, even though has the expected (negative) sign, is not significant for every category of crimes. Employment rate and labour productivity are positively correlated with every types of crimes and are strongly significant also by considering for heteroskedasticity. The positive effect of labour productivity can be due to the existence of two opposite effects on crime rate. On one hand, it is reasonable to expect that an increase in labour productivity leads to a lower level of crime because of the higher wages; on the other hand, it is likely that the number of crimes, and in particular property crimes, will be higher where people are richer, we can suppose that the second effect is bigger. It is worth to

notice that the relationship existing between crime and unemployment is not clear and unambiguous, and appears to be very sensitive to econometric specification (Freeman, 1994 and Masciandaro, 1999). Finally, public sector is positively correlated with every category of crimes rate, as expected. This result confirms what obtained by Marselli and Vannini (1997) and Costabile and Giannola (1996) that a pervasive and broad public sector may have distortionary effects on private incentives, may lead to a misallocation of public resources and may generate criminal behaviours, as corruption.

4.2 Crime and South

In this section we account for the economic and social differences existing between southern regions and the rest of Italy. South of Italy is affected by chronic problems, in particular a pervasive and strong presence of organized crime and a structural backwardness. By using dummy variables for southern regions we aim at obtaining more robust and less contradictory results.

In order to catch these and other effects, we test the following econometric model:

$$crim_{it} = \mu_i + \eta_t + \beta_1 edu_{it} + \sum_{j=2}^{5} \beta_j x_{jit} + \sum_{j=6}^{10} \beta_j x_{jit} + DS \times \left(\sum_{j=2}^{5} \beta_j x_{jit} + \sum_{j=6}^{10} \beta_j x_{jit} \right) + \varepsilon_{it} \quad (8)$$

where DS is a slope dummy variable whose value is 1 for southern regions (Campania, Calabria, Puglia, Basilicata, Sardinia and Sicily) and 0 otherwise. In other words in model (8) it has been used a number of slope dummy variables exactly equal to the number of explanatory variables in model (7). Table (5) reports the results of regression analyses based on equation (8).

The results are considerably affected by considering the distinguishing characteristics of southern regions. The effect of the set of deterrence variables is considerably less evident in southern regions. IST and APP are not significant for every category of crimes and UNK is significant only in the case of total crimes. Police force, even presenting a negative sign, results to be not significant in southern regions. Overall "justice" variables appears to be not significant, with some exceptions, and this is in contrast with the results obtained for the rest of Italy. The non significance of deterrence variables can be interpreted as a consequence of the presence of organized crime. In other words, organized crime considerably affects the efficiency of criminal justice and effectiveness of police force.

The analysis of the socioeconomic variables gives the opportunity to clearly perceive the strong dichotomy existing between northern and southern regions. All the socioeconomic variables present an opposite sign respect to estimations for Italy as a whole. Employment and labour productivity are negatively correlated to crime rate for every category of crimes, but are significant only for total crimes. Growth rate is positively and significantly correlated to crime rate for every category of crime, this results is robust to control for heteroskedasticity. Wage rate is negatively and significantly correlated with total and property crimes.

These results should be considered together with the positive sign of education for southern regions. In fact, it is likely that the high level of high school and university enrollment in southern regions may be due to the high level of unemployment. In other words, high schools and universities represent a valid alternative to unemployment. Adolescent choose to go on with their studies in order to avoid the high probability of being unemployed and the related psychological costs. In this sense education does not represent a way in which acquiring higher skills to be used in the labour market, but simply a way in which postponing unemployment problems.

Finally, public sector is not significant for every category of crime. This may be due to the fact that the pervasiveness of the public sector more than affecting crime behaviour is related to corruption attitudes and behaviours that are not taken in account in our analysis.

Concluding we can state that the economic and social context considerably affects crime rate. The use of dummy variables try to capture the presence of organized crime and economic underdevelopment of southern regions, but it is difficult to distinguish between these two effects for their probable correlation. Organized crime considerably reduces the efficiency of criminal justice and effectiveness of police force.

The Italian situation varies considerably across regions and the existence of a striking socioeconomic dichotomy between the North and the South of Italy affects crime rate in Italian regions. The distinguishing characteristics and peculiarities existing between northern and southern regions have to be taken in account in order to properly identify the determinants of crime across Italy.

5 Crime Dynamics

Individual's past experience in criminal activities is an important underlying variable that affects in several ways the decision to commit a crime. First, criminals can learn-by-doing, which means that acquiring the adequate criminal know-how and abilities the costs of carrying out criminal acts may decrease over time.[19] Second, criminals who have been arrested tend to be

[19] Case and Katz, 1991.

stigmatized in the legal labour market, then they will have less employment opportunities and expected wage.[20] Third, a sort of peer or network effect, individuals who have joined the crime industry and work with criminals tend to have a reduced moral threshold. This effect is opposite to the positive effect of education and regard the "moral" sphere.

Thus, the incidence of crime appears to have inertial properties (i.e. persistence) that are noted in the theoretical literature and documented in the micro and macro empirical work.[21]

These arguments strongly suggest the possibility of criminal inertia; in other words present crime incidence is explained to some extent by its past incidence. Our model shows that the bigger the amount of time spent in criminal activities in the first period, the lower the expected returns in the legal sector in the second period because of the reduction of the time spent for schooling; this, in turn, leads to a higher level of crime in the second period.

We test a partial adjustment model of the form:

$$(CRIME_{i,t} - CRIME_{i,t-1}) = \lambda(CRIME^*_{i,t} - CRIME_{i,t-1}) \qquad (9)$$

where:

$$CRIME^*_{i,t} = \Phi(EDU_{i,t}, POL_{i,t}, WAG_{i,t}) \qquad (10)$$

that yields:

$$CRIME_{i,t} = \gamma CRIME_{i,t-1} + \Phi[EDU_{i,t}, POL_{i,t}, WAG_{i,t}] + \eta_i + \eta_t + \varepsilon_{i,t} \quad (11)$$

where $\gamma = 1 - \lambda$, Φ allows for lags in explanatory regressors, η_i and η_t represent region-specific and time-specific effects respectively and the subscripts i and t represent region and time period.

We use a Within Group estimator to estimate eq. (11). The Within Group estimator eliminates the OLS bias by transforming the equation to wipe out the individual effect components, as original observations are expressed as deviations from the individual means. For panels where the number of the time periods is small relative to the cross sectional dimension, this transformation may cause a non-negligible correlation between the transformed lagged dependent variable and the transformed error leading to biased and inconsistent estimated parameters. This correlation remains as the number of individuals in the sample increase; however, in the case of large T panels this correlation vanishes and the Within Group estimator leads to consistent estimates, provided that tests for serial correlation are satisfied.

Table 6 presents our empirical results. The first column reports results obtained when we use property crimes as a proxy for $CRIME$; the second

[20] Grogger, 1995.

[21] Glaeser et al., 1996; Fajnzylber et al., 1998.

column reports parameters estimated when the total number of crimes is instead used.

Our model fits well the data. R^2 are found to be higher than 60%. Our results are robust to heterosckedasticity; moreover, the tests for first and second order serial correlation are satisfied, confirming the validity of the assumption of serially uncorrelated errors. The coefficients associated with the variables object of this paper, $CRIME_{i,t-1}$ and EDU are strongly significant; signs are consistent with our theoretical predictions. In particular, $CRIME_{i,t-1}$ is positive, implying that criminal activities display an inertial behavior; adjustment coefficients range between 50 and 60%. The coefficients associated with $EDU_{i,t}$ and $EDU_{i,t-1}$ are negative, suggesting that both present and past education has a negative impact on property crimes.

As expected, police force displays a negative effect on both property and total crime; however their effect is small, and the estimated parameters are statistically not significant. Finally, the effect of WAG on crime is ambiguous. Current wage is positively correlated with crime, while past wage display a negative effect. If on the one hand, it is reasonable to guess that an increase in wage implies a lower level of crime because it raises the opportunity cost of criminal behaviour, on the other hand it is likely that the number of crimes, and in particular property crimes, will be higher where people are richer. *A priori*, we cannot guess which one of these two effects will be bigger.

6 Conclusions

Our empirical analysis, both static and dynamic, confirms the existence of a relationship between the level of crime and education.

For what it concerns the static analysis the relationship between crime and education is stronger for property crimes than for total crimes or crimes against the person, in fact, as previously asserted, property crimes are more likely to depend on economic motivations than other types of crimes. The empirical investigation has confirmed the prediction of our theoretical model. Education and wages are negatively correlated with the level of crime and the proxy used for the probability of apprehension behaves accordingly to our analysis. Our results are robust to autocorrelation and heteroskedasticity and are not affected by adding two different sets of control variables aimed at detecting the effect of justice (probability of apprehension, number of police force, quickness of proceedings) and economic situation (employment rate, growth rate, wage, weight of public sector and labour productivity).

The picture changes when we consider the socioeconomic differences existing between southern regions and the rest of Italy. South Italy is affected by chronic problems, in particular a pervasive and strong presence of organized crime and a structural backwardness. By using dummy variables

for southern regions we obtain more robust and less contradictory results. The Italian situation varies considerably across regions and the existence of a striking socioeconomic dichotomy between the North and the South of Italy affects crime rate in Italian regions. The distinguishing characteristics and peculiarities existing between northern and southern regions have to be taken in account in order to properly identify the determinants of crime across Italy.

Finally, the dynamic estimation confirms the theoretical predictions of our model. Property and total crimes exhibit a persistence over time, implying that the incidence of crime appears to have inertial properties. Education, both present and past, has a negative effect on crime. Then the negative impact of education on crime is confirmed also in a dynamic context, showing how educational effects persist over time.

References

[1] Alvarez, J. and M. Arellano (1998). "The time series ond cross-section asymptotics of dynamic panel data estimators", *mimeo*, CEMFI, Madrid.

[2] Anderson, T.W. and C. Hsiao (1982). "Formulation and Estimation of Dynamic Models Using Panel Data", *Journal of Econometrics*, **18**, pp. 47-82.

[3] Baltagi, B.H., (2001). Econometric Analysis of Panel Data, 2^{nd} edition. John Wiley and Sons, LTD.

[4] Becker, G.S., (1968). "Crime and Punishment: An Economic Approach", *Journal of Political Economy*, **76** (2), pp. 169-217.

[5] Block, M. and J. Heineke (1975). "A Labor Theoretic Analysis of Criminal Choice", *American Economic Review*, **65** (3), pp. 314-325.

[6] Bound, J. and R.B. Freeman (1991). "What Went Wrong? The Erosion of Relative Earnings and Employment Among Young Black Men in the 1980's", *Quarterly Journal of Economics*, **107** (1), pp. 201-232.

[7] Breush, T. and A. Pagan (1980). "The Lagrange Multiplier Test and Its Application to Model Specification in Econometrics", *Review of Economic Studies*, **47**, pp. 239-253.

[8] Burdett, K., Lagos, R. and R. Wright, (1999). "Inequality, Unemployment and Crime", forthcoming in *American Economic Review.*

[9] Calvo-Armengol, A. and Y. Zenou (2003). "Does Crime Affect Unemployment? The Role of Social Network", *mimeo.*

[10] Case, A.C. and L.F. Katz (1991). "The Company You Keep: The Effects of Family and Neighborhood on Disadvantaged Youth", NBER Working Paper no. 3705.

[11] Huang, C. and D. Laing, Crime and Poverty: A Search-Theoretic Approach, *mimeo.*

[12] Chiu, W.H. and P. Madden, P. (1998). "Burglary and income inequality", *Journal of Public Economics*, **69**, pp. 123-141.

[13] Costabile, L. and A. Giannola (1996). "Norme Sociali e Distribuzione dei Posti di Lavoro. Una Parabola della Corruzione nell'Italia Meridionale" in Istituzioni e sviluppo economico nel Mezzogiorno a cura di L. Costabile, Il Mulino, Bologna, pp.171-208.

[14] Ehrlich, I., (1975). "On the Relation between Education and Crime", in Juster, F.T. (Ed.), Education, Income and Human Behavior. New York: McGraw-Hill, pp. 313-337.

[15] Ehrlich, I., (1973). "Participation in Illegitimate Activities: A Theoretical and Empirical Investigation", *Journal of Political Economy*, **81** (3), pp. 521-565.

[16] Fajnzylber, P., Lederman, D. and N. Loayza (2002). "What Causes Violent Crime?", *European Economic Review*, **46** (2), pp.1323-1357.

[17] Fajnzylber, P., Lederman, D. and N. Loayza (2000). "Crime and Victimization: An Economic Perspective", *mimeo.*

[18] Freeman, R.B., (1996). "Why Do So Many Young American Men Commit Crimes and What Might We Do About It?", *Journal of Economic Perspectives*, **10** (1), pp. 25-42.

[19] Freeman, R.B., (1994). "Crime and the Job Market", in Wilson, J. Q. and J. Petersilia (Eds.), Crime. San Francisco: ICS Press.

[20] Freeman, R.B., (1991). "Crime and the Employment of Disadvantaged Youths", NBER Working Paper no. 3875.

[21] Glaeser, E.L. and B. Sacerdote (1999). "Why is there more crime in cities?", *Journal of Political Economy*, **107** (6), pp. S225-S228.

[22] Glaeser, E.L., Sacerdote, B. and J.A. Scheinkman (1996). "Crime and Social Interactions", *Quarterly Journal of Economics*, **111**, pp. 507-548.

[23] Greene, W.H., (2000). Econometric Analysis, 4^{th} edition. Prentice Hall International, Inc.

[24] Grogger, J., (1998). "Market Wages and Youth Crime", *Journal of Labor Economics*, **16**, pp. 756-91.

[25] Grogger, J., (1995). "The Effect of Arrest on the Employment and Earnings of Young Men", *Quarterly Journal of Economics*, **110** (1), pp. 51-72.

[26] Grogger, J., (1991), "Certainty vs. Severity of Punishment", *Economic Inquiry*, **29**, pp. 297-309.

[27] Hausman, J., (1978). "Specification Tests in Econometrics", *Econometrica*, **46**, pp. 69-85.

[28] Imrohoroglu, A., Merlo, A. and P. Rupert (2001). "What Accounts for the Decline in Crime?", Federal Reserve Bank of Cleveland, wp 0008.

[29] Imrohoroglu, A., Merlo, A. and P. Rupert (2000). "On the political economy of income redistribution and crime", *International Economic Review*, **41** (1) pp. 1-25.

[30] Kelly, M., (2000). "Inequality and Crime", *The Review of Economics and Statistics*, **82** (4), pp. 530-539.

[31] Levitt, S.D. and S.A. Venkatesh (1998). "An economic analysis of a drug-selling gang's finance", *Quarterly Journal of Economics*, **115** (3), pp. 755-789.

[32] Lochner, L., (1999). "Education, Work and Crime: Theory and Evidence", Working Paper No. 465, Center for Economic Research (RCER) - University of Rochester.

[33] Lochner, L. and E. Moretti (2001). "The effect of education on crime: evidence from prison inmates, arrests, and self-reports", NBER Working Paper no. 8605.

[34] Marselli, R. and M. Vannini (1997). "Estimating a Crime Equation in the Presence of Organized Crime: Evidence from Italy", *International Review of Law and Economics*, **17** (1), pp. 89-113.

[35] Raphael, S. and R. Winter-Ebmer (2001). "Identifying the effect of unemployment on crime", *Journal of Law and Economics*, **44**, pp. 259-283.

[36] Sah, R.K., (1991)."Social Osmosis and Patterns of Crime", *Journal of Political Economy*, **99** (6), pp. 1271-1295.

[37] Scorcu, A. E. and R. Cellini (1998). "Economic Activity and Crime in the Long Run: An Empirical Investigation on Aggregate Data from Italy, 1951–1994", *International Review of Law and Economics,* **18**, pp. 279–292.

[38] Tauchen, H., Witte, A.D. and H. Griesinger (1994). "Criminal deterrence: revisiting the issue with a birth cohort", *Review of Economics and Statistics*, **76** (3), pp. 399-412.

[39] Usher, D., (1997). "Education as Deterrent to Crime", *Canadian Journal of Economics*, **30** (2), pp. 367-84.

[40] White, H., (1980). "A heterosckedasticity-consistent convariance matrix estimator and a direct test for heteroskedasticity", *Econometrica*, **48**, pp. 817-838.

[41] Wilson, J.Q. and R. Herrnstein (1985). Crime and Human Nature. New York: Simon and Schuster.

[42] Witt, R., Clarke, A. and N. Fielding (1998). "Crime, earnings inequality and unemployment in England and Wales", *Applied Economics Letters*, **5**, pp. 265-67.

[43] Witte, A.D., (1980). "Estimating the economic model of crime with individual data", *Quarterly Journal of Economics*, **94** (1), pp. 57-84.

[44] Witte, A.D. and H. Tauchen (1994). "Work and Crime: An Exploration Using Panel Data", *Public Finance*, **49**, pp. 155-167.

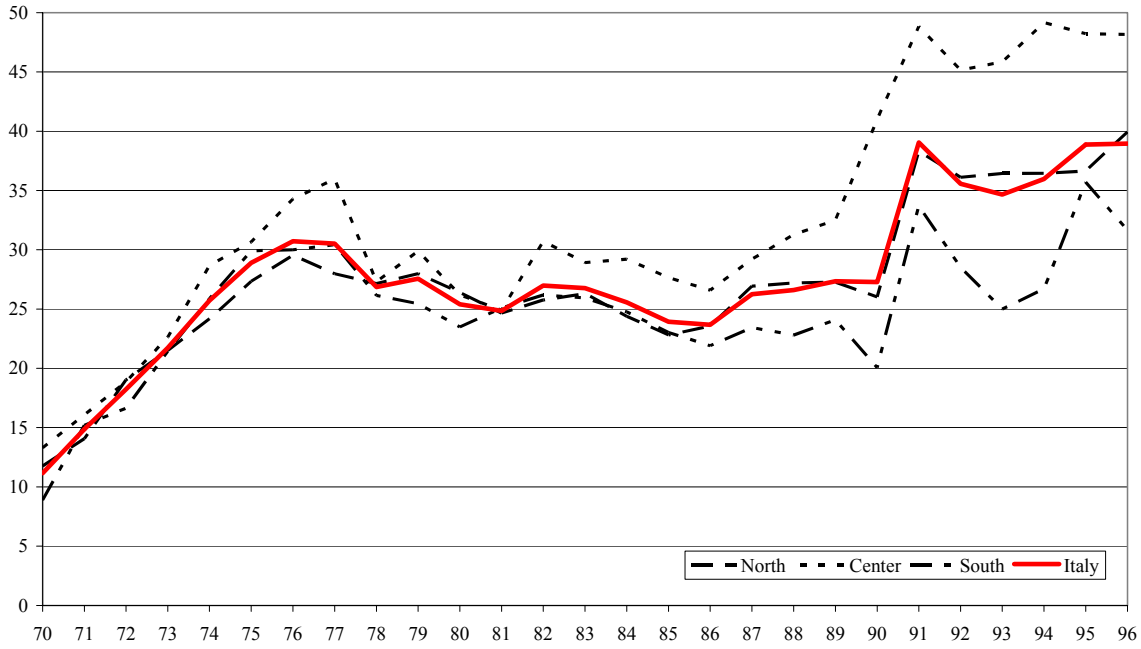

Figure 1: Property Crimes per 1.000 inhabitants

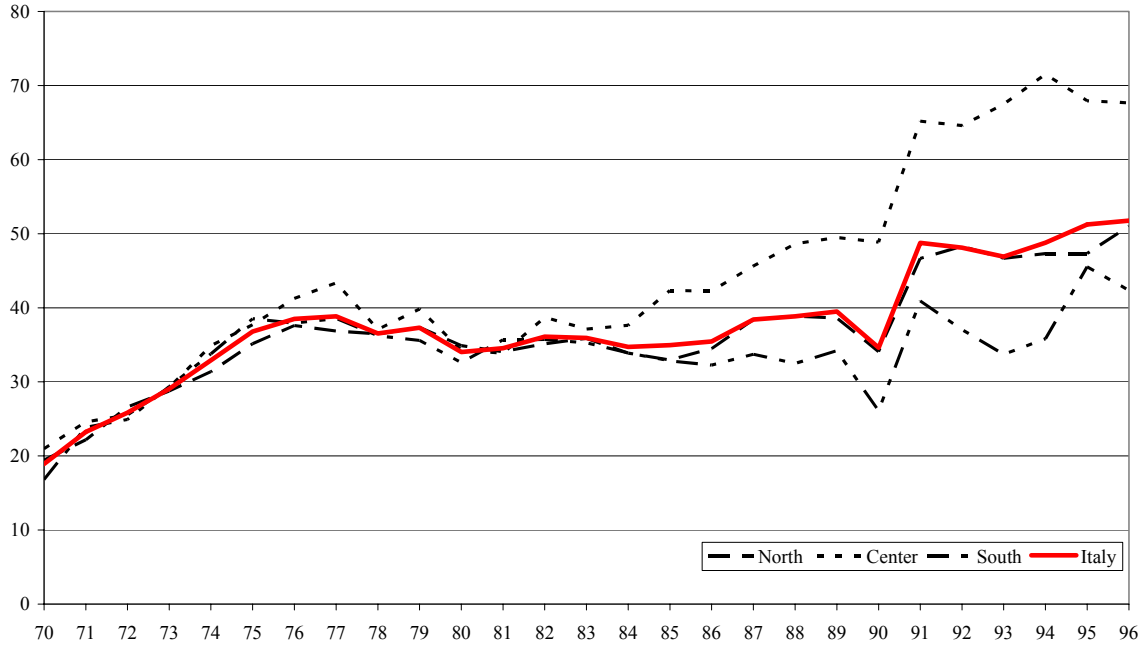

Figure 2: Total Crimes per 1.000 inhabitants

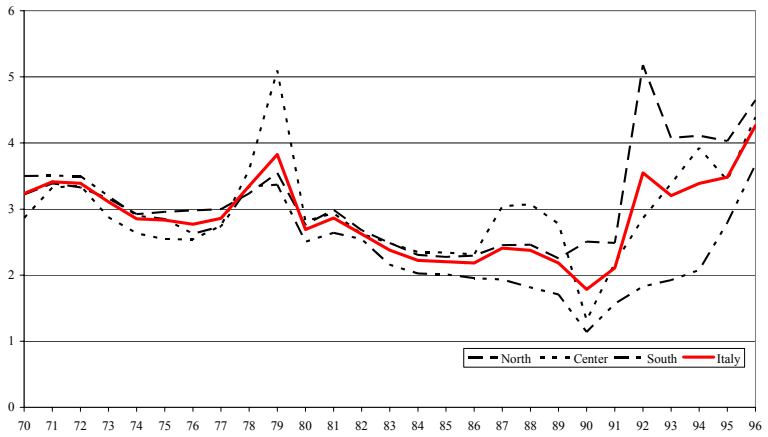

Figure 3: Crimes against the person per 1.000 inhabitants

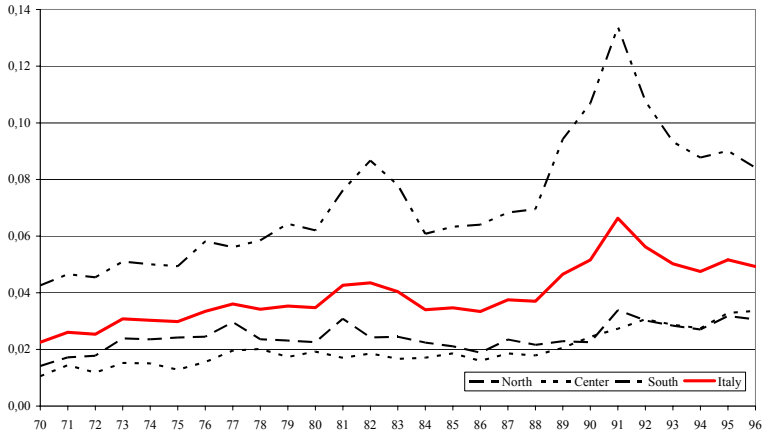

Figure 4: Murders per 1.000 inhabitants

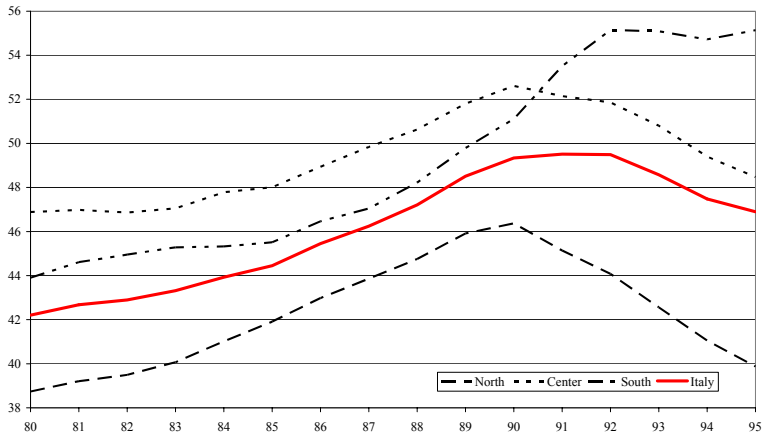

Figure 5: Students enrolled in high school and university per 1.000 inhabitants

Table 1
Test for the choiche of the model

	Total Crimes			*Property Crimes*			*Crimes against person*		
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
*Test for Poolability**	981,6	293,1	220,8	347,4	215,9	192,5	175,9	199,7	186,4
	Fixed and Random Effects Model without time dummies								
*Lagrange Multiplier Test***	981,6	606,4	145,7	974,4	256,8	107,2	366,8	416,4	346,4
*Hausmann Test****	1,6	11,2	75,3	1,6	25,9	70,0	0,1	12,1	14,2
	Fixed and Random Effects Model with time dummies								
Lagrange Multiplier Test	993,6	609,1	145,7	997,9	256,8	109,4	376,4	417,1	346,9
Hausmann Test	29,7	22,7	20,6	24,2	124,6	100,5	1,3	5,7	14,7
*Test for time effects*****	180,5	106,9	54,8	215,4	129,8	62,1	66,4	40,7	67,0

* Pooled model vs. FEM, high values of Poolability test favor FEM over Pooled model, ** Pooled model vs. FEM/REM, high values of LM favor FEM/REM over Pooled model, *** Fixed vs. Random Effects, high (low) values of Hausmann test favor FEM (REM), **** High values of test for time effects favor the introduction of time effects in the model

Table 2
"Nested" tests for the choiche of the model

	Nested Tests for model choice								
Test joint significance of the regressors	4,3	36,0	39,0	5,9	39,7	41,5	1,2	12,2	12,7
Model (a) vs Model (b)		21,9			24,3			28,6	
Model (a) vs Model (c)			46,9			51,6			39,7
Model (b) vs Model (c)			22,6			19,7			22,7

Table 3

Effects of economic and social variables on crimes

	Total Crimes			*Property Crimes*			*Crimes against person*		
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
EDU	-1,097	-1,201	-0,585	-0,904	-0,894	-0,454	-0,074	-0,025	0,037
	(-6.16)***	(-6.90)***	(-3,16)***	(-6.59)***	(-6.54)***	(-3.09)***	(-3.05)***	(-1.04)	(1.43)
	[-2.06]**	[-2.39]**	[-1.93]*	[-2.42]**	[-2.32]**	[-2.02]**	[-1.08]	[-0.38]	[0.67]
POL		0,017	0,030		0,007	0,017		0,001	0,003
		(2.37)**	(4.13)***		(1.20)	(2.92)***		(0.96)	(2.79)***
		[1.17]	[2.32]**		[0.61]	[1.90]*		[0.56]	[1.98]**
IST		-5,5E-04	-5,1E-04		-3,6E-04	-3,1E-04		-3,4E-05	-1,8E-05
		(-4.05)***	(-3.92)***		(-3.36)***	(-3.04)***		(-1.90)*	(-1.03)
		[-2.24]**	[-2.19]**		[-1.92]*	[-1.65]*		[-1.28]	[-0.75]
APP		4,1E-09	4,0E-07		-5,4E-08	2,4E-07		-4,5E-07	-4,3E-07
		(0.00)	(0.26)		(-0.043)	(-0.20)		(-2.10)**	(-2.14)**
		[0.00]	[0.54]		[-0.39]	[-0.53]		[-2.85]***	[-3.08]**
UNK		-0,095	-0,052		0,322	0,330		0,042	0,042
		(-1.13)	(-0.66)		(2.23)**	(2.42)**		(6.85)***	(-7.29)***
		[-0.38]	[-0.29]		[1.34]	[1.94]*		[2.82]***	[-3.29]***
EMP			0,340			2,357			0,269
			(5.23)***			(4.59)***			(3.08)***
			[2.92]***			[2.99]***			[1.76]*
PRO			0,032			0,024			0,004
			(6.09)***			(5.75)***			(5.58)***
			[5.09]***			[4.49]***			[5.06]***
GRO			-0,154			-0,077			-0,004
			(-0.77)			(-0.48)			(-0.14)
			[-0.83]			[-0.67]			[-0.14]
WAG			-0,028			-0,022			-0,003
			(-2.36)**			(-2.35)**			(-2.07)**
			[-1.83]*			[-1.84]*			[-1.56]
PUB			0,337			2,672			0,601
			(3.27)***			(3.27)***			(4.34)***
			[2.47]**			[2.45]**			[3.00]***
R^2	0,82	0,84	0,87	0,84	0,85	0,88	0,57	0,64	0,68
$\bar{R}^2$	0,80	0,82	0,85	0,82	0,83	0,85	0,51	0,59	0,63

Notes:

Standard errors are reported in parentheses. Standard errors robust to heteroscedasticity are reported in square brackets. ***, ** and * indicate coefficient significant at the 1%, 5% and 10% levels, respectively.

Table 4
Effects of economic and social variables on crimes (reduced form)

	Total Crimes			*Property Crimes*			*Crimes against person*		
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
EDU	-1,097	-1,178	-0,587	-0,904	-0,867	-0,463			
	(-6.16)***	(-6.84)***	(-3.24)***	(-6.59)***	(-6.44)***	(-3.19)***			
	[-2.06]**	[-2.39]**	[-2.00]**	[-2.42]**	[-2.42]**	[-2.07]**			
POL		0,017	0,031			0,017			0,003
		(-2.39)**	(4.24)***			(2.97)***			(3.31)***
		[-2.10]**	[2.24]**			[1.91]*			[2.42]**
IST		-5,6E-04	-5,1E-04		-3,9E-04	-3,1E-04		-3,8E-05	
		(-4.12)***	(-3.96)***		(-3.70)***	(-3.04)***		(-2.18)**	
		[-2.17]**	[-2.08]**		[-1.87]*	[-1.79]*		[-1.80]*	
APP								-4,7E-07	-4,2E-07
								(-2.21)**	(-2.07)**
								[-2.91]***	[-3.07]**
UNK				0,321	0,322			0,044	0,039
				(2.23)**	(2.38)**			(7.83)***	(7.14)***
				[1.97]*	[1.85]*			[3.06]***	[2.90]***
EMP			0,335			2,314			0,234
			(5.27)***			(4.58)***			(2.86)***
			[2.75]***			[2.91]***			[1.75]*
PRO			0,031			0,023			0,004
			(6.08)***			(5.74)***			(5.82)***
			[5.04]***			[4.39]***			[3.28]**
GRO									
WAG			-0,028			-0,022			-0,003
			(-2.46)**			(-2.36)**			(-2.08)**
			[-1.76]*			[-1.83]*			[-1.76]*
PUB			0,348			2,718			0,575
			(3.42)***			(3.37)***			(4.46)***
			[2.73]***			[2.61]**			[2.55]**
R^2	0,82	0,84	0,87	0,84	0,86	0,88		0,64	0,68
$\bar{R}^2$	0,80	0,82	0,85	0,82	0,84	0,86		0,59	0,63

Notes:

Standard errors are reported in parentheses. Standard errors robust to heteroscedasticity are reported in square brackets. ***, ** and * indicate coefficient significant at the 1%, 5% and 10% levels, respectively.

Table 5
Effects of economic and social variables on crimes (South)

	Total Crimes		*Property Crimes*		*Crimes against person*	
	X_j	$Ds * X_j$	X_j	$Ds * X_j$	X_j	$Ds * X_j$
EDU	-0,646	1,259	-0,682	0,811	0,006	0,173
	(-2.19)**	(2.23)**	(-2.87)***	(1.86)*	(0.16)	(2.32)**
	[-1.85]*	[1.86]*	[-2.33]**	[1.44]	[0.14]	[2.13]**
POL	0,024	-0,024	0,016	-0,025	0,002	-0,001
	(2.87)***	(-1.04)	(2.48)**	(-1.34)	(2.21)**	(-0.36)
	[2.08]**	[-1.29]	[-1.83]*	[-1.60]	[2.31]**	[-0.38]
IST	-6,7E-04	5,2E-04	-4,1E-04	2,9E-04	2,4E-07	-1,5E-05
	(-4.21)***	(2.52)**	(-3.23)***	(1.78)*	(0.01)	(-0.60)
	[-2.72]***	[2.45]**	[-1.93]*	[1.52]	[0.01]	[-0.49]
APP	4,4E-07	-2,4E-06	3,9E-07	-4,0E-06	-4,4E-07	-4,0E-08
	(0.30)	(-0.53)	(0.33)	(-1.07)	(-2.22)**	(-0.06)
	[0.59]	[-0.54]	[0.97]	[-1.17]	[-3.02]***	[-0.05]
UNK	-0,036	0,356	0,381	0,233	0,046	-0,014
	(-0.41)	(2.21)**	(2.32)**	(0.80)	(7.44)***	(-1.14)
	(-0.18)	[1.90]*	[1.60]***	[0.75]	(3.40)***	[-0.84]
EMP	2,719	-3,234	2,158	-1,413	0,163	-0,154
	(3.44)***	(-2.73)***	(3.42)***	(-1.58)	(1.53)	(-1.00)
	[1.86]*	[-2.22]**	[2.10]**	[-1.20]	(0.89)	[-1.25]
PRO	0,029	-0,024	0,022	-0,008	0,004	-0,002
	(5.13)***	(-3.25)***	(4.86)***	(-1.52)	(5.02)***	(-1.90)*
	[4.51]***	[-3.40]***	[4.51]***	[-1.63]	[5.37]***	[-1.54]
GRO	-0,770	1,369	-0,384	0,660	-0,082	0,144
	(-2.60)***	(3.53)***	(-1.62)	(2.15)**	(-2.04)**	(2.76)***
	[-2.28]**	[3.63]***	(-1.80)*	[2.61]**	[-1.44]	[2.36]**
WAG	-0,049	0,065	-0,030	0,040	-0,005	0,004
	(-3.17)***	(2.74)**	(-2.45)**	(2.07)**	(-2.30)**	(1.16)
	[-2.91]***	[2.69]**	[-2.41]**	[2.07]**	[-2.52]**	[1.42]**
PUB	1,419	1,216	1,925	0,542	0,478	0,105
	(0.93)	(0.95)	(1.59)	(0.53)	(2.30)**	(0.62)
	[0.54]	[0.54]	[0.99]	[0.33]	[1.43]	[0.44]
R^2		0,88		0,88		0,71
$\bar{R}^2$		0,85		0,86		0,65

Notes:

Standard errors are reported in parentheses. Standard errors robust to heteroscedasticity are reported in square brackets. ***, ** and * indicate coefficient significant at the 1%, 5% and 10% levels, respectively.

Table 6
Estimation Results of Dynamic Panel Data

	A	B
$CRIME_{i,t-1}$	0.425	0.588
	(4.13)***	(4.62)***
$EDU_{i,t}$	-0.269	-0.209
	(-2.10)**	(-1.82)*
$EDU_{i,t-1}$	-0.245	-0.188
	(-2.07)**	(-1.80)*
$POL_{i,t}$	-0.010	-0.004
	(-0.94)	(-0.37)
$POL_{i,t-1}$	-0.011	-0.005
	(-0.99)	(-0.45)
$WAG_{i,t}$	0.002	0.002
	(2.12)**	(1.46)
$WAG_{i,t-1}$	-0.003	-0,003
	(-2.47)**	(-1.92)*
Serial Correlation (p-values)		
First-order	0.107	0.069
Second-order	0.523	0.348
$\bar{R}^2$	0.608	0.608

Notes:

In model A the dependent variable is the number of property crimes recorded in region i at time t; in model B the dependent variable is the number of total crimes recorded in region i at time t. Both variables are normalised by the size of the population. Time dummies are included in all models. Standard errors robust to heteroscedasticity are reported in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10% levels respectively.