# Criminal Choices and their Economic Consequences

Submitted by

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## Declaration of Authorship

I, Andreina Naddeo, hereby declare that this thesis and the work presented in it is entirely my own. Where I have consulted the work of others, this is always clearly stated.

Signed:

Date:

# Abstract

This thesis addresses questions in the Economics of Crime regarding the effect of crime on GDP per capita and its growth rate, and criminal choices. The first part of the thesis presents evidence concerning the effect of crime on economic outcomes in Italy. Using an Instrumental Variables (IV) strategy and a system GMM approach, the empirical exercise identifies the effect of different crimes on GDP per capita and its growth rate in Italian regions. Results indicate that crime related to organised crime has a substantial negative effect on the economic performance of Italian regions, with the southern regions of Italy driving the outcome.

The second part of this thesis sheds further light on the understanding of criminal choices using a dynamic discrete choice model able to replicate trends observed in the National Longitudinal Survey of Youth 1997 (NLSY97). The model offers a unifying framework of the literature, presented in economics of crime, studying the factors leading to criminal success. Its development accounts for criminal and/or human capital accumulation and its impact on legal and illegal earnings. Estimation of the parameters of the model is accomplished by the simulated method of moments. Results show a strong role for social criminal capital in defining successful criminal activity. In addition, the estimated returns to experience in illegal activities are larger compared to legal ones, but the percentage of young men committing offences decreases when the opportunity cost of crime increases. The counterfactual policy exercise suggests that policies aimed at increasing human capital for previous offenders can have a significant effect over short and long-term.

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# 1 Introduction

The first attempt to study crime using an economic point of view is provided by Gary Becker, 1968. Following Becker's seminal work, the development of models analysing criminal choices identified features enabling researchers to explain illegal behaviour, not only within a static framework but also in a dynamic one. This helped shed further light on the mechanism leading to criminal success and to a career in the illicit sector. Along with theoretical work, the contributions to the economics of crime literature use empirical evidence to understand illegal behaviour and its impact on important economic dimensions, such as GDP per capita and its growth rate. Recently developed panel estimation techniques allow for better understanding of the impact of endogenous factors on economic performance. This thesis makes use of the latter procedures in chapter two to answer the important question: What is the relation between economic outcomes and crime? The exploitation of external variation overcomes important issues that arise when exploring the above relation, such as endogeneity, and leads to obtaining an adequate response.

Using data from the Italian National Institute for Statistics (ISTAT), the effect of crime on the economy is analysed using Italy as a case study. The considerable disparities among its regions, in terms of economic outcomes and crime rates, make the country ideal for an empirical exercise with the aim of understanding the potential effect of crime on regional economic performance. The analysis addresses possible endogeneity issues through an instrumental variable approach and system GMM estimators, with an external source of variation found in effective abortion rate (Donohue and Levitt, 2000). Findings suggest that crime related to organised crime has a large and negative effect on the economy of Italian regions, especially in Southern Italy.

In order to reduce the costs that crime imposes on society, it is fundamental to answer the following two questions: What determines criminal choices? Why do individuals repeatedly commit offences? These questions are fully explored in this thesis, and an answer is provided in chapter three using an extensive dynamic discrete choice model, which is able to repeat trends observed in the National Longitudinal Survey of Youth 1997 (NLSY97). The model offers a framework able to unify empirical evidence and theories produced in the economics of crime literature studying criminal capital. Its development accounts for the formation of skills that can be used in legal and illegal markets and the effect of their accumulation on the possible rewards in each sector. Estimation of the parameters included in the model is conducted through the simulated method of moments, with results indicating a strong role of social criminal capital in defining successful criminal activity. Similarly, the estimated returns to experience in the illegal sector show a larger premium for criminal activity compared to legal one. However, the percentage of young men committing offences decreases when the opportunity cost of crime increases. Counterfactual policy exercise, obtained for the model at the estimated parameters, suggests that policies aimed at augmenting human capital for previous offenders can have an important effect over short and long-term.

# 2 How crime affects the economy: evidence from Italy

## 2.1 Introduction

Data from ISTAT (Italian National Institute for Statistics) indicate that GDP per capita is substantially different between the Italian average and the regions comprising Southern Italy. During the period 1995-2011, this discrepancy amounted to almost €7,200 and reached circa €9,700 when calculated as difference between the average GDP per capita of the Northern-Center macro-area and Mezzogiorno[1].

Economists have widely investigated convergence in GDP growth rate across Italian regions. Previous studies show that convergence has not generally occurred[2], except in the 1960s when the investments carried out through Cassa per il Mezzogiorno [3] led to the convergence.

Two factors that may explain the lack of convergence and the Italian economic disparities are the large presence of crime and organised crime in Italy. Since the 1960s economists have tried to understand why people commit crime from an economic perspective. This line of research started with the work of Gary Becker, which assumes that a person commits an offence if the expected utility from crime exceeds the utility that could be obtained using time and other resources in legitimate activities. An extensive literature explaining the effect of crime on the economy is missing. The aim of this paper is to show how crime contributes to the differences in the economic performances of Italian regions. In fact, the large presence of crime in an area may lead to a loss in opportunities for development and the Italian case may be one of the best examples of this.

The economic literature has shown several channels through which crime could have affected Italian development. The large presence of organised crime in the

[1] The term Mezzogiorno refers to the regions comprising the southern part of Italy.

[2] The results are based on analysis of both GDP per capita and productivity.

[3] Cassa del Mezzogiorno was a fund, established in 1950 and dissolved in 1984, used by the Italian government to stimulate economic growth and development in Southern Italy.

South of the country discourages corporate investment, including foreign direct investment (FDI). Using data on Italian provinces, Daniele and Mariani (2008) estimate the impact of crime on the FDI inflow. The results of their analysis show that the correlation between organised crime and FDI inflows is substantially negative and statistically significant. Another factor that could affect the Italian economic performance is the misallocation of public funding, with the Mafia attracting and absorbing public funding, as suggested by Barone and Narcisio (2013). Accordingly, a higher incidence of crime, especially offences related to organised crime, can lead to higher interest rates and reduced access to credit (Bonaccorsi di Patti, 2009).

This work contributes to the literature by explicitly addressing potential endogeneity issues, such as simultaneous causality between GDP per capita and crime, using a Two Stage Least Square (2SLS) estimator with an instrumental variable that has its roots in the economics of crime literature. The obtained estimates indicate that crime usually associated with organised crime substantially affects the economic performance of Italian regions, especially in Southern Italy. The literature investigating this issue is not extensive, and the approaches adopted by researchers are varied.

Carmeci and Mauro (2007) use Pooled Mean Group (PMG) estimators to explore the link between crime, unemployment and economic activity using Italian regional data. They found that crime and unemployment have long-run effects on the level of Italian regional income, but no long-run growth effects. Meanwhile, Pinotti (2015) uses policy evaluation methods to study the economic effects of organised crime in two Italian regions (Apulia and Basilicata) recently exposed to the presence of criminal associations of the Mafia type (since the 1970s). The comparison of actual and counterfactual development shows that as the number of murders increases, the presence of organised crime lowers the economic growth path. Furthermore, a lower GDP reflects a net loss in economic activity because less productive public capital substitutes private capital. Using difference GMM and system GMM estimators, Rana and Neanidis (2013) explore the joint effect of organised crime and corruption on the economic growth of Italian regions between 1983 and 2009. Their analysis shows that both corruption and organised crime inhibit growth, but if both phenomena are present together in the area, the joint effect is less severe due to organization in corruption leading to better coordination in the bureaucrat's rent-seeking behavior.

In this chapter, an external instrument for crime is used to solve possible endogeneity issues. The chosen instrument is the 'effective abortion rate' used by Donohue and Levitt (2000) to explain the decrease in crime rate in the US during the 1990s. The authors claim that the link between abortion and crime is causal, thus possibly satisfying the condition of relevance of the instrument. Following the argument proposed by Donohue and Levitt, effective abortion rate can have an indirect positive effect on GDP per capita through its effects on crime. The latter is a consequence of a possible decrease in the number of potential criminals due to a cohort size effect and/or possible lower rates of criminality for children born after the introduction of the abortion legislation. The instrumental variable is used to construct the two stage least square and system GMM estimators of the effect of crime on the economic performance of Italian regions. The results produced from the aforementioned empirical strategy indicate that crime related to organised crime activity has a substantial negative impact on GDP per capita and its growth rate, especially in Mezzogiorno.

This chapter is structured as follows: the next section describes the data and the importance of the research question. In Section 2.3, the theoretical motivations are presented. Section 2.4 outlines the empirical methodology and discusses the instrument for crime. Section 2.5 presents the results. Robustness checks are explored in

Section 2.6. Section 2.7 provides the conclusion.

## 2.2 Data and preliminary analysis

Using data from ISTAT, this study utilises a panel of nineteen Italian regions[4], during the period 1995-2011, to determine the impact of crime on the economy.

The economic performance of Italian regions is measured by GDP per capita (base year 2005). Homicide rate (attempted and committed) per 100,000 inhabitants is the offence of interest in this work because of its strong correlation with homicides related to the Mafia (as shown in Appendix A.1), thus representing a possible good proxy for organised crime. Further, data on other types of crime, especially those related to organised crime (such as extortions), are subject to under-reporting and under-recording bias, whereas these problems are negligible for homicides.

Figure 2.1 illustrates the variation across Italian regions in terms of GDP per capita and homicide rate. Calabria stands out as having the lowest level of GDP per capita and the highest level of homicide rate. The homicide rate is generally higher in the Southern part of Italy, which also presents lower levels of GDP per capita. This may be due to reverse causality: GDP per capita may be lower because of the presence of crime and organised crime, and their presence may be a consequence of the economic situation of these regions. As shown in Figure 2.2, there is a strong negative correlation between GDP per capita and homicide rate (figure 2.2 also displays OLS fitted values).

Because of possible reverse causality, an instrumental variables approach is adopted in this work. The approach involves the choice of an appropriate instrument that is, for this case, the 'effective abortion rate'. Additional variables included in the analysis and used as control variables are: the ratio of investment to GDP, the ratio of regional government spending in construction and regional planning to total

[4] The analysis excludes Aosta Valley.

regional government spending, the dropout rate after one year of high school, population density, an index for social capital, and the rate of firms creation (difference between number of firms created and companies that ended their activity in a year, divided by the number of firms existing the year before in the region).

The selection of control variables is suggested by the economic growth and economics of crime literatures. Investments are a primary source of growth, while government spending in construction plays a role in defining GDP and it is also correlated with crime. Further, to control for possible youth preferences for crime over employment opportunities, the drop-out rate from high school is preferred to the level of human capital.

As suggested by the literature, social capital is likely to have a positive impact on economic activity, and be negatively correlated with crime. The definition of a social capital index follows the work of Putnam (2000), which considers trust and social participation as the most general forms of social capital, with volunteering activity being part of the latter category. Putnam argues that participation in voluntary organisations and social associations promotes, among members, collective norms and trust, which is fundamental for the production and the maintenance of the community's well-being. Thus, the use of the ratio of people, aged at least 14, engaged in volunteering activities to the total population, of the same age, should partially capture the level of social capital in the region. The set of independent variables is used in natural logarithm term, except for population density.

Figure 2.1: HETEROGENEITY ACROSS ITALIAN REGIONS IN TERMS OF GDP PER CAPITA AND HOMICIDE RATE (PER 100,000 INHABITANTS), AVERAGE 1995-2011

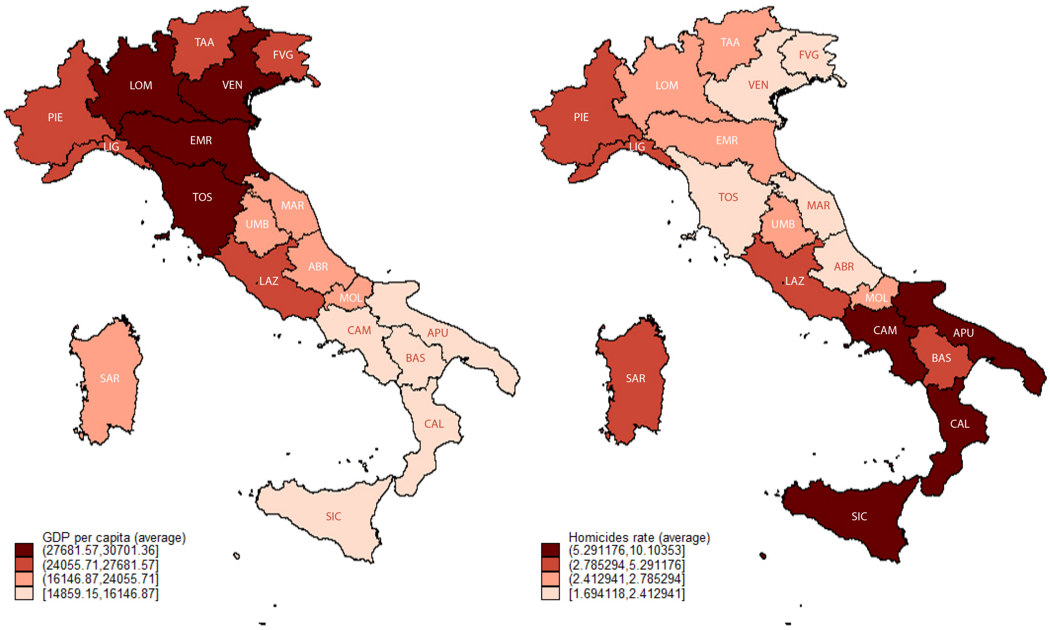



Table 2.1 presents descriptive statistics for the aforementioned variables for Italian regions and the subsample 'South' comprised of Campania, Apulia, Basilicata, Calabria and Sicily. Descriptive statistics indicate that the average of the GDP per capita for the full sample is almost €7,200 higher than the South subsample, while the mean for the homicide rate almost doubles if considering only the southern regions - the difference between the two means increases when considering only Northern-Central regions. In particular, Calabria has the lowest level of GDP per capita (1995) and the highest homicide rate (in 1996). Lombardy has the highest GDP per capita (in 2007), while the lowest growth rate is in Piedmont (in 2009).

Data pattern suggests the urgency of understanding and providing an answer to the Italian dualism.

Hereafter, the term South always denotes the macro-area formed by Campania, Apulia, Basilicata, Calabria and Sicily.

Figure 2.2: GDP PER CAPITA AND HOMICIDE RATE

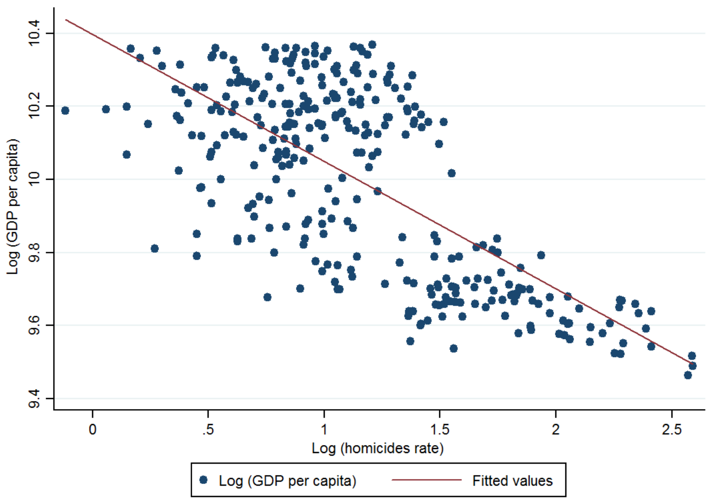



Table 2.1: SUMMARY STATISTICS

| VARIABLES | ITALY Mean | St. Dev. | Min. | Max. | SOUTH Mean | St. Dev. | Min. | Max. |
|---|---|---|---|---|---|---|---|---|
| GDP per capita | 22,659 | 5,668 | 12,892 | 31,848 | 15,478 | 969.0 | 12,892 | 17,417 |
| Homicide rate | 3.682 | 2.267 | 0.89 | 13.35 | 6.403 | 2.563 | 2.720 | 13.35 |
| Growth rate (%) | 0.439 | 2.390 | -9.132 | 5.315 | 0.689 | 2.35 | -5.88 | 5.31 |
| I/GDP | 0.213 | 0.0276 | 0.152 | 0.304 | 0.220 | 0.0186 | 0.178 | 0.263 |
| Construction/Government spending | 0.021 | 0.003 | 0.010 | 0.028 | 0.0205 | 0.005 | 0.012 | 0.028 |
| Dropout rate (%) | 7.40 | 2.25 | 1.6 | 15.1 | 8.658 | 1.858 | 4.700 | 12.60 |
| Population density | 197.3 | 107.2 | 58.70 | 434.5 | 207.1 | 123.8 | 58.70 | 434.5 |
| Rate of firms creation (%) | 1.38 | 1.075 | -2.67 | 6.29 | 1.673 | 1.235 | -1.200 | 4.300 |
| Social capital (%) | 11.08 | 4.854 | 4.421 | 27.70 | 6.973 | 1.526 | 4.421 | 12.10 |

## 2.3 Theoretical motivation

This section defines the mechanism through which a high presence of crime can have an impact on economic performance.

Region $i$ at time $t$ obtains its output using the following production function with labour-augmenting technological progress:

$$Y_{it} = F(K_{it}, A_{it}(Cr_{it})L_{it}) \tag{2.1}$$

where $Y_{it}$ is a function of capital, $K_{it}$ -that depreciates at rate $\delta$-, technological progress, $A_{it}$ -which grows at rate $g$-, and labour, $L_{it}$ -that increases at rate $n$. A fraction of the output is consumed, $cY_{it}$ -with 0<c<1-, while the emerging saved share, $s$ , is used for investments that lead to an increase in capital, $\dot{K_{it}} = I_{it} - \delta K_{it}$. In contrast with the Solow growth model (1957), the term $A_{it}$ depends on crime and its level decreases for any increase in crime, with $\frac{\partial A_{it}}{\partial Cr_{it}} < 0$, while the key assumptions remain the same as Solow's model.

Given constant returns to scale, the output is rewritten in terms of output per efficiency unit of labour as:

$$y_{it} = \frac{Y_{it}}{A_{it}(Cr_{it})L_{it}} = \frac{1}{A_{it}(Cr_{it})L_{it}} F(K_{it}, A_{it}(Cr_{it})L_{it}) = f(k_{it}) \qquad (2.2)$$

where $k_{it} = \frac{K_{it}}{A_{it}(Cr_{it})L_{it}}$. This form underlines the strong dependence of output on the level of capital per efficiency unit.

Crime also has to be taken into account in the resource constraint. In fact, resources are used for protection and prevention while investments are discouraged if crime is widely present in the region, thus causing wasted resources. Further, the presence of criminal organisations in the region can lead to a flow of money out of the legal economy through pizzo[5]. This leads to a resource constraint, in intensive form, for the economy given by:

$$c_{it} + i_{it} + (wastedresources)_{it} = y_{it} = f(k_{it}) \qquad (2.3)$$

where, following Peri (2004), the wasted resources are funded through a tax whose amount depends on the level of crime in the region, $wastedresources_{it} = \tau(Cr_{it})y_{it}$.

The investment equation has to account for the presence of the tax, $I_{it} = S_{it} =$

[5]"Pizzo" is an Italian word derived from the Sicilian word "pizzu" that means extortion. It indicates the money paid by business to Mafia for protection.

$(1-\tau(Cr_{it}))sY_{it}$, and the low of motion for capital can be rewritten as in (2.4):

$$\dot{K_{it}} = (1-\tau(Cr_{it}))sY_{it} - \delta K_{it} \tag{2.4}$$

which leads to the fundamental equation of motion:

$$\dot{k_{it}} = (1-\tau(Cr_{it}))sf(k_{it}) - k_{it}(\delta + g + n) \tag{2.5}$$

From equation (2.5) it emerges that a higher tax implies a lower level of capital accumulation, and, as consequence, a lower level of output.

This work does not attempt to estimate the equations presented in this section, but some of their elements can be found in the empirical part of the study, e.g. investment and population density as a proxy for population growth.

## 2.4 Empirical methodology

The empirical model, which has GDP per capita as dependent variable, is:

$$Y_{it} = \alpha_i + \beta_1 t + \beta_2 Crime_{it} + \gamma X_{it} + \delta_1 DU_{i2008} + \delta_2 DU_{i2009} + \varepsilon_{it} \tag{2.6}$$

where $Y_{it}$ is the natural logarithm of GDP per capita in region $i$ in period $t$, $t$ is a time trend, $Crime_{it}$ is the natural logarithm of the homicide rate, $X$ is a vector of control variables comprising the ratio of investment to GDP, the ratio of regional government spending in construction and regional planning to total regional government spending, the drop out rate after one year of high school, population density and an index of social capital, and the rate of firms creation. $DU_{i2008}$ and $DU_{i2009}$ are two binary variables being equal to 1 if in year 2008 and 2009, respectively, and used to account for the impact of the beginning of the economic crisis in Italy. $\alpha_i$ is a time-invariant region specific effect, while $\varepsilon_{it}$ is the error term. Control variables are in logarithm terms except for population density. The empirical model accounts for the time factor using a linear trend, and considers the Italian economic crisis using two yearly binary variables, corresponding to the start of the economic crisis in Italy.

The empirical model that uses growth rate as dependent variable is:

$$Y_{it} - Y_{it-1} = \theta_1 Y_{it-1} + \theta_2 Crime_{it} + \rho X_{it} + \sigma_1 DU_{i2008} + \sigma_2 DU_{i2009} + u_{it} \qquad (2.7)$$

with $Y_{it-1}$ potentially correlated with the error term and thus potentially endogenous [6]. The model does not present a trend since the use of first differences eliminates it.

Equation (2.6) is estimated using the two stage least square in order to obtain a consistent estimator for $\beta_2$, while the System GMM estimator [7] developed by Arellano-Bond (1991), Arellano-Bover (1995) and Blundell-Bond (1998)[8] is used to achieve consistent estimates for equation (2.7).

A difficulty associated with the chosen estimation strategies relates to the choice of the external instrument and of the number of lags to use for the construction of the internal ones. In estimating equation (2.7), a lag of two to a maximum of four is used and the instruments are collapsed[9].

The next section explains the choice of the external instrumental variable.

[6]The specification does not include a trend since $Y_t$ is trend stationary. Using first difference eliminates the trend.

[7]The use of the system GMM estimators allows to wipe out the region fixed effects.

[8]System-GMM estimation treats the model as a system of equations in first-differences and in levels. It uses the lags of the potential endogenous variables in order to obtain internal instruments that will be used in this work in addition to the external instrument used in the 2SLS estimation.

[9]Collapsing instruments allows to reduce the number of instruments through the creation of one instrument for each variable and lag distance, instead of one instrument for each year, variable, and lag distance. In addition, the limitation of the number of lags helps in achieving the goal of having a number of instruments smaller than the number of entities composing the panel.

### 2.4.1 The instrument for crime

Donohue and Levitt (2000) argue that a decline in crime rates in the U.S. during the 1990s followed from the abortion legalization. Their claim is that the link between abortion and crime is causal, and it is based on the following consideration: legalized abortion may lead to reduced crime rates through either a cohort size effect and/or possible lower rates of criminality for children born after the introduction of the abortion legislation.

The cohort size effect relies on the fact that when the cohort reaches the criminal age, there will be fewer people in their highest-propensity crime years, and thus less crime. The second possible explanation follows from the consideration that women's ability for child care may vary with age, education and income; consequently, abortion may be used to optimize the timing of child-bearing.[10].

In Italy, legislation introduced abortion in 1978 through Law 194/1978. This law allows a woman to stop her pregnancy during the first ninety days of childbearing in a health care institution, such as a hospital. Data on abortion rates for 1,000 women are available from 1979, the first entire year that the law came to effect, while data on GDP per capita and crime are available from 1995 to 2011. This allows to construct a variable that follows Levitt's aforementioned considerations.

The following equation shows the construction of the external instrument:

$$EffectiveAbortion_{it} = \sum_{a} Ab_{it-a} \tag{2.8}$$

The effective abortion rate for region $i$ at time $t$ is given by the sum of the abortion rate in the region at time $t$ - $a$, where $a$ is the age of the cohort. Data on abortion cover the period from 1979 to 1995. Hence, for the year 1995, the effective

[10]Unfortunately, there is not a good amount of information about women who choose abortion in Italy during the time period of interest. The available information reveals that at least 27% of women choosing abortion are not married (the percentage increases with time) and that an increase in the level of schooling corresponds to a decrease in abortion.

abortion rate is the abortion rate in 1979 (with a cohort age of sixteen). For 1996, the effective abortion rate is the abortion rate in 1979 plus abortion rate in 1980 (cohort ages are 16 and 17). The operation is repeated until 2011, where the abortion rates from 1995 are used to construct the effective abortion rate of the period.

The proposed instrument is different from the effective abortion rate used by Donohue and Levitt (2000). This is due to the different aims of the two works. In this study, effective abortion rate represents an instrument for crime and the focus is on determining whether the instrument is relevant and exogenous or not.

Levitt's arguments justify a potential relevance of the instrument. The considerations for exogeneity attempt to identify a non-direct link between effective abortion rate and GDP per capita and its growth rate. The exogeneity condition is explored using a different dataset, available from CRENOS. Using data on GDP per capita and abortion rate for 1,000 women, for the period 1979-1995, the estimated correlation coefficient between the two variables is small and statistically insignificant even when considering a lagged effect of abortion on GDP per capita (see Appendix A.2). This indicates that the productivity shock, potentially faced by a woman choosing abortion, is not transmitted to the GDP per capita. Instead, the effect of effective abortion rate on the economic performance from 1995 to 2011 is positive and significant (table 2.3), indicating a possible impact of effective abortion on GDP through its effect on crime.

The following reduced form equation is used to obtain the Two Stage Least Square (2SLS) estimator:

$$Crime_{it} = \alpha_i + \beta_1 t + \pi_1 EffectiveAbortion_{it} + \gamma X_{it} + \delta_1 DU_{i2008} + \delta_2 DU_{i2009} + v_{it} \tag{2.9}$$

with results presented and discussed in section 2.5.

## 2.5 Results

This section presents estimation results for equation (2.6). Different specifications of the model are presented to allow for a comparison of the results. If the hypothesis that crime is one of the factors explaining the Italian economic disparities is correct, the results of the regression model should show a negative effect of homicide rate on the GDP per capita. Using homicide rate as a crime variable enables to capture part of the effect that organised crime has on the economy, especially in Southern Italy.

Table 2.2 shows Pooled Ordinary Least Square (POLS) and fixed effects estimator results. The two approaches present different negative magnitudes of the estimated effect of crime, but the latter is highly statistically significant in almost all specifications. In particular, the estimations show a decreasing magnitude (in absolute value) as the number of covariates increases. This suggests the possibility of omitted variable bias for the estimations with only homicide rate as regressor.

Furthermore, fixed effects estimation results present a smaller coefficient (in absolute value) in all specifications, meaning that it is important to control for time-invariant region characteristics. They also suggest the presence of a potential additional source of endogeneity: measurement error. Murder rate may capture organised crime presence with error, and this helps to explain the large difference in magnitudes for the coefficients observed in table 2.2 obtained with the two estimation strategies. Moreover, as previously argued, the possible endogeneity issue, due to reverse causality between GDP per capita and crime, may further invalidate the results obtained with the two methods.

Table 2.2: POLS AND FIXED EFFECTS ESTIMATION OF EQUATION (2.6)

| | POLS | | | | FIXED EFFECTS | | | |
|---|---|---|---|---|---|---|---|---|
| ln(Homicide rate) | -0.310*** | -0.310*** | -0.117*** | -0.127*** | -0.042** | -0.038*** | -0.029 | -0.028*** |
| | (0.019) | (0.018) | (0.016) | (0.014) | (0.018) | (0.011) | (0.021) | (0.011) |
| Control variables | no | no | yes | yes | no | no | yes | yes |
| Time specification | no | yes | no | yes | no | yes | no | yes |
| Observations | 323 | 323 | 289 | 289 | 323 | 323 | 289 | 289 |
| $R^2$ | 0.394 | 0.414 | 0.791 | 0.812 | 0.04 | 0.705 | 0.398 | 0.755 |
| Adj. $R^2$ | 0.393 | 0.407 | 0.786 | 0.805 | 0.037 | 0.701 | 0.383 | 0.746 |

Note: * p<0.1; ** p<0.05; *** p<0.01, standard errors in parenthesis

The 2SLS estimators, proposed in table 2.4, capture the effect of crime for the sample, comprising nineteen Italian regions, and a sub-sample of five of them (South in the tables): Apulia, Calabria, Campania, Basilicata and Sicily. In this way, it is possible to compare the results for the two samples in order to understand which part of the effect belongs to the South[11]. Instead, table 2.3 presents the estimated effect of the effective abortion rate on GDP per capita (both in natural logarithm terms). The results in table 2.3 support the claim that the instrument has a positive effect on the economic performance through its effect on crime. The latter result arises from a possible reduction in crime rate due to effective abortion rate (shown in table 2.4). Reduced form regression results presented in Table 2.4 allow to explore the determinants of homicide rate in the two samples. It is worth noting the large difference in magnitude and direction of the estimated effect of regional government spending for housing on homicide rate in the samples. The cited difference may capture a possible distortion in the allocation of government spending in Southern Italy due to the presence of organised crime in the territory. Social capital produces the expected effect for both groups (consistently with the results obtained in the literature on social capital and crime), and the same is true for population

[11]The results for South should be read with caution due to the small subsample size.

density.

Table 2.3: ESTIMATION OF THE EFFECT OF ABORTION RATE ON GDP PER CAPITA

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dependent variable: ln(GDP per capita$_{it}$) | | ITALY | | | SOUTH | |
| ln(Effective abortion rate) | 0.032*** | 0.029*** | 0.020*** | 0.036*** | 0.037*** | 0.023*** |
| | (0.006) | (0.006) | (0.004) | (0.007) | (0.008) | (0.006) |
| Control variables | no | yes | yes | no | yes | yes |
| Time specification | no | no | yes | no | no | yes |

NOTE: * p<0.1; ** p<0.05; *** p<0.01, standard errors in parenthesis

Furthermore, the results for the reduced form equation indicate that effective abortion rate has a negative impact on crime (as argued by Levitt, 2000) and is highly significant in all specified models. Additionally, the estimated impact is larger for the restricted sample of the southern regions. The reported statistics show that effective abortion rate is not a weak instrument for five out of six model specifications. Only in column two, an F-statistic slightly lower than ten is observed. The endogenous regressor is also not underidentified, as denoted by the reported Sanderson-Windmeijer statistics (S.W.).

Table 2.5 displays the 2SLS results for equation (2.6). The results suggest that a 1% increase in homicide rate leads to a decrease in GDP per capita by circa 0.32% (column (3)). Restricting the sample to Southern regions, the corresponding decrease is almost 0.26% (column (6)). A comparison of the estimated coefficients of crime for the two samples suggests that Mezzogiorno is driving the results. Furthermore, the estimation results for the control variables indicate that government spending has a large positive effect in defining the GDP per capita of the southern area, with a magnitude that is larger than the one presented for the private investments. Consequently, this may indicate the deficiency of the southern area in cap-

Table 2.4: REDUCED FORM RESULTS

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Dependent variable: | | | | | | |
| ln(Homicide rate$_{it}$) | | ITALY | | | SOUTH | |
| Effective abortion rate | -0.054*** | -0.058*** | -0.064*** | -0.131*** | -0.112*** | -0.092*** |
| | (0.015) | (0.018) | (0.019) | (0.031) | (0.021) | (0.020) |
| Social Capital | | -0.276*** | -0.256*** | | -0.190 | -0.164 |
| | | (0.071) | (0.074) | | (0.125) | (0.110) |
| Drop out rate | | 0.098 | 0.127* | | 0.195** | 0.173* |
| | | (0.069) | (0.072) | | (0.095) | (0.089) |
| Construction/Government spending | | 0.311 | 0.310 | | 2.287*** | 2.548*** |
| | | (0.222) | (0.220) | | (0.466) | (0.564) |
| Investment/GDP | | 0.393* | 0.285 | | 0.322 | 0.399 |
| | | (0.225) | (0.223) | | (0.339) | (0.407) |
| Firms creation rate | | -0.013 | -0.015 | | 0.060** | 0.069* |
| | | (0.016) | (0.014) | | (0.029) | (0.038) |
| Population density | | 0.005* | 0.005* | | 0.029** | 0.042** |
| | | (0.003) | (0.003) | | (0.013) | (0.017) |
| Trend | | | 0.005 | | | -0.011** |
| | | | (0.004) | | | (0.005) |
| $Du_{i2008}$ | | | 0.035 | | | -0.084 |
| | | | (0.038) | | | (0.089) |
| $DU_{i2009}$ | | | -0.008 | | | -0.267** |
| | | | (0.033) | | | (0.107) |
| F-statistic of excluded instrument | 13.43 | 9.80 | 11.89 | 17.87 | 27.70 | 20.86 |
| S.W. chi squared | 14.26 | 10.64 | 13.05 | 18.99 | 31.99 | 25.19 |

NOTE: * p<0.1; ** p<0.05; *** p<0.01, standard errors robust to heteroskedasticity, serial correlation and common disturbances in parenthesis turing the benefits of private investments and a large dependence on public funding (as in Pinotti, 2015).

Comparing tables 2.2 and 2.5, the effect of crime on GDP per capita is upward biased when estimated with POLS and in fixed effects specifications, with the bias increasing its magnitude in the second specification. The bias is partially corrected by including variables that are positively correlated with crime and have a positive impact on GDP, such as government spending and population density, or adding variables that are correlated with crime and GDP in a negative manner. The IV strategy allows to further capture the upward bias, which may be the consequence of the unobserved corruption, whose effects are mitigate when the phenomenon is present along with organised crime (Neandis and Rana, 2013). But the results emerging from the comparison of the two tables strongly suggest that the bias is not only due to omitted variables. In fact, adding controls reduces the estimates magnitude in tables 2.2 and 2.5, but the IV estimation presents a much higher coefficient (in absolute value) in all specifications. This can be due to the fact that the IV strategy allows to address the endogeneity issue, previously discussed, arising from reverse causality. An additional explanation is that homicide rate is measuring the presence of organised crime in the territory with error, and the IV strategy is addressing also this potential source of endogeneity.

### 2.5.1 The effect of crime on economic growth

Estimating the effect of crime on growth rate, using a dynamic panel model, leads to two potentially endogenous regressors. The estimation strategy adopted to control for the potential endogeneity problem is the system GMM (Arellano-Bond, 1991; Arellano-Bover, 1995; Blundell-Bond, 1998). In contrast to the Difference GMM, the system GMM estimator uses lags of potential endogenous variables in level and first differences for the construction of internal instruments. In addition, the external

Table 2.5: 2SLS RESULTS FOR EQUATION (2.6)

| Dependent variable: | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| ln(GDP per capita$_{it}$) | | ITALY | | | SOUTH | |
| Homicide rate | -0.595*** | -0.515*** | -0.315*** | -0.280*** | -0.334*** | -0.256*** |
| | (0.205) | (0.171) | (0.067) | (0.060) | (0.028) | (0.023) |
| Social Capital | | -0.137** | -0.054 | | -0.054* | -0.048* |
| | | (0.066) | (0.041) | | (0.031) | (0.029) |
| Drop out rate | | 0.011 | 0.034 | | 0.018 | 0.018 |
| | | (0.043) | (0.022) | | (0.033) | (0.025) |
| Construction/Government spending | | 0.189* | 0.117** | | 0.947*** | 0.728*** |
| | | (0.103) | (0.060) | | (0.182) | (0.139) |
| Investment/GDP | | 0.293*** | 0.036 | | 0.276*** | 0.079 |
| | | (0.077) | (0.062) | | (0.104) | (0.101) |
| Firms creation rate | | -0.001 | -0.001 | | 0.026* | 0.018* |
| | | (0.012) | (0.004) | | (0.015) | (0.011) |
| Population density | | 0.001 | 0.0001 | | 0.012*** | 0.006 |
| | | (0.001) | (0.001) | | (0.005) | (0.004) |
| Trend | | | 0.009*** | | | 0.006*** |
| | | | (0.001) | | | (0.001) |
| $Du_{i2008}$ | | | 0.089*** | | | 0.085*** |
| | | | (0.012) | | | (0.017) |
| $DU_{i2009}$ | | | 0.015* | | | -0.022 |
| | | | (0.009) | | | (0.021) |

NOTE: * p<0.1; ** p<0.05; *** p<0.01, standard errors robust to heteroskedasticity, serial correlation and common disturbances in brackets instrument already used in the 2SLS estimation (the effective abortion rate) can be used along with the internal ones.

Estimation results for equation (2.7), using the system GMM estimator, are in table 2.6. Column (2) shows that crime produces a negative effect on growth rate. An increase of 1% in the homicide rate leads to a decrease in the growth rate by 0.04%. These small magnitudes are still important considering that Italy has experienced low growth rates and periods of recession for the past 20 years.

Table 2.6: ESTIMATION OF THE EFFECT OF CRIME ON ECONOMIC GROWTH

| Dependent variable: $\triangle \ln(\text{GDP per capita}_{it})$ | (1) | (2) |
|---|---|---|
| GDP per capita$_{it-1}$ | 0.003 | -0.025 |
| | (0.002) | (0.014) |
| Homicide rate | -0.02 | -0.045** |
| | (0.017) | (0.019) |
| Social capital | | -0.009 |
| | | (0.009) |
| Dropout rate | | 0.026** |
| | | (0.012) |
| Construction/Government spending | | -0.063* |
| | | (0.033) |
| Investment/GDP | | -0.023 |
| | | (0.026) |
| Firms creation rate | | 0.002 |
| | | (0.003) |
| Population density | | -0.000 |
| | | (0.000) |
| $DU_{i2008}$ | | -0.031*** |
| | | (0.008) |
| $DU_{i2009}$ | | -0.068*** |
| | | (0.007) |
| Observations | 304 | 272 |
| No. of instruments | 7 | 15 |
| Arellano-Bond test for AR(2) in first differences, | -2.88 | -0.70 |
| p-value | 0.004 | 0.484 |
| Hansen test, | 7.64 | 9.10 |
| p-value | 0.177 | 0.105 |

Note: * p<0.1; ** p<0.05; *** p<0.01, standard errors in brackets

To verify the validity of the instruments two tests are conducted. The first test is the Arellano-Bond test for AR(2) in first differences, with the null hypothesis being the absence of auto-correlation in the residuals using a lag length of two. It is not possible to reject the null hypothesis, and consequently the internal instruments, with at least a lag of two, are not endogenous. The Hansen test controls the validity of the instruments using the null hypothesis that the covariance among the instruments and the error term is zero. The associated p-value of 0.105 indicates that null hypothesis of exogeneity of the entire set of instruments cannot be rejected.

The results presented in this section suggest that crime has a statistically significant and negative impact on economic performances of Italian regions, especially in the South subsample. Given the higher level of homicide - typically associated with organised crime associations - in Southern Italy, results indicate that crimes related to criminal organisations can partially explain the lack of convergence across regions in Italy and the Italian dualism.

## 2.6 Robustness checks

Robustness checks try to further assess the exogeneity of the instrument using internal instruments in addition to effective abortion rate. This allows the use of the Hansen test to check for the validity of the entire set of instruments. In fact, it is not possible to judge whether an instrument is exogenous in a just identified model, but in the presence of more instruments the Hansen test can help in deciding on the validity of the instruments.

Table 2.7: ESTIMATION OF EQUATION (2.6) VIA SYSTEM GMM

| Dependent variable: ln(GDP per capita$_{it}$) | (1) | (2) | (3) |
|---|---|---|---|
| Homicide rate | -0.484*** | -0.378*** | -0.230* |
| | (0.100) | (0.081) | (0.119) |
| Trend | | 0.009*** | 0.011*** |
| | | (0.002) | (0.004) |
| $DU_{i2008}$ | | 0.090*** | 0.086** |
| | | (0.017) | (0.038) |
| $DU_{i2009}$ | | 0.002 | -0.021 |
| | | (0.019) | (0.028) |
| Social Capital | | | 0.323*** |
| | | | (0.098) |
| Drop Out rate | | | -0.002 |
| | | | (0.068) |
| Construction/Government spending | | | -0.018 |
| | | | (0.120) |
| Investment/GDP | | | -0.329* |
| | | | (0.178) |
| Firms creation rate | | | 0.008 |
| | | | (0.010) |
| Population Density | | | 0.000* |
| | | | (0.000) |
| Constant | 10.555*** | 10.374*** | 8.770*** |
| | (0.120) | (0.104) | (0.491) |
| Observations | 323 | 323 | 289 |
| No. of instruments | 5 | 8 | 14 |
| Arellano-Bond test for AR(2) in first differences, | 0.01 | 0.63 | 0.28 |
| p-value | 0.991 | 0.527 | 0.776 |
| Hansen test, | 1.69 | 2.45 | 4.06 |
| p-value | 0.64 | 0.484 | 0.256 |

NOTE: * p<0.1; ** p<0.05; *** p<0.01, standard errors in brackets

The results in table 2.7 are similar in magnitude to the ones obtained in section 2.5 with different specifications of the model. In contrast to the previous section, the number of instruments here is greater than one. In addition to effective abortion rate, the internal instruments are used to obtain a consistent estimator of the effect of crime. AR(2) test results indicate that it is possible to use internal instruments starting from a lag of two for the specifications of column (2) and (3), while the set of instruments is exogenous for the three models.

In the following, an attempt to assess whether crime related to organised crime is the one with the larger negative effect on the economy is conducted. If organised crime is one of the factors explaining the Italian dualism, using types of crime not strictly related to Mafia type associations - and whose distribution is more homogeneous among Italian regions - to estimate the effect of crime on the economy should lead to different results from what obtained in section 2.5. Bank robberies (per 100,000 inhabitants) and bag-snatching (per 100,000 inhabitants) are used to determine whether other kinds of crime, not necessarily associated with criminal organisations of the Mafia type, have a smaller impact on the economy compared to homicide rate.

Figure 2.3 furnishes a qualitative analysis of data on bank robberies and bag-snatching. The figure shows that the level of bag-snatching is almost uniform across the regions, while bank robbery rate tends to be higher for regions with a higher level of GDP per capita.

Equations (2.6) and (2.7) are re-estimated using the natural logarithm of bank robberies and bag-snatching as crime variable. The results of the 2SLS estimators are presented in Table 2.8, while system GMM results can be found in Table 2.9.

In Table 2.8, the results of the reduced form for both variables are reported in columns (1) and (2), while columns (3) and (4) report second stage regression results. Bank robberies and bag-snatching have a negative and statistically significant effect on GDP per capita, but are smaller in magnitude compared to murder rate. F and SW statistics indicate that the instrument is not weak in all regression models, and the potential endogenous regressor is not under-identified. Moreover, the magnitude of effective abortion rate coefficient, in both cases, is larger than the one found in table 2.4.

Table 2.9 presents the estimated effect of bank robberies and bag-snatching on

Figure 2.3: Bank robberies and bag-snatching in Italian regions

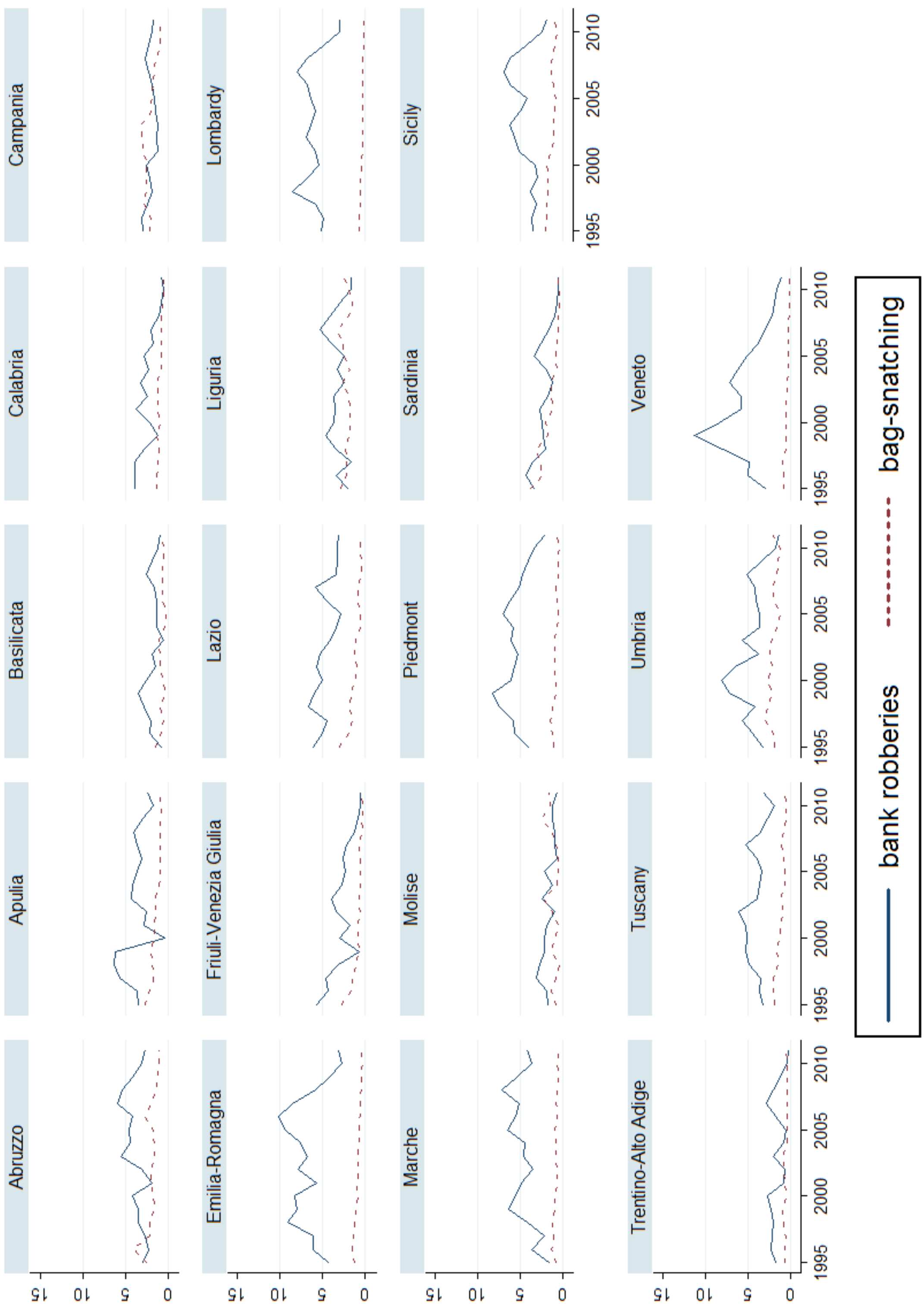


Table 2.8: THE EFFECT OF BANK ROBBERIES AND BAG-SNATCHING ON GDP PER CAPITA

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | REDUCED FORM RESULTS | | SECOND STAGE RESULTS | |
| | ln(Bank robberies$_{it}$) | ln(Bag-snatching$_{it}$) | ln(GDP per capita$_{it}$) | ln(GDP per capita$_{it}$) |
| Effective abortion rate | -0.145*** | -0.206*** | | |
| | (0.035) | (0.049) | | |
| Bank robberies | | | -0.139*** | |
| | | | (0.034) | |
| Bag-snatching | | | | -0.098*** |
| | | | | (0.016) |
| Social Capital | 0.051 | -0.147 | 0.033 | 0.012 |
| | (0.228) | (0.100) | (0.034) | (0.021) |
| Dropout rate | 0.135 | 0.159 | 0.013 | 0.010 |
| | (0.143) | (0.147) | (0.021) | (0.014) |
| Construction/Government spending | 0.505 | 0.456** | 0.087 | 0.064*** |
| | (0.358) | (0.228) | (0.055) | (0.020) |
| Investment/GDP | -1.000** | -0.630** | -0.196** | -0.115*** |
| | (0.468) | (0.288) | (0.081) | (0.033) |
| Firms creation rate | 0.136*** | 0.043*** | 0.023*** | 0.008* |
| | (0.041) | (0.017) | (0.008) | (0.004) |
| Population density | -0.004 | -0.006 | -0.002** | -0.002*** |
| | (0.006) | (0.006) | (0.001) | (0.000) |
| Time specification | yes | yes | yes | yes |
| Observations | 285 | 289 | 285 | 289 |
| F statistic of excluded instrument | 16.99 | 17.52 | | |
| S.W. chi squared | 17.66 | 19.22 | | |

NOTE: * p<0.1; ** p<0.05; *** p<0.01, standard errors robust to heteroskedasticity, serial correlation and common disturbances in brackets

Italian regional economic growth. Results for bank robberies are in column (1), while results for bag-snatching can be found in column (2). Bank robberies and bag-snatching have a positive but insignificant effect on economic growth. The tests for the validity of the instruments reported in Table 2.9 reveal that the null hypothesis of absence of covariance among the instruments and the error term can be rejected at a 10% significance level for the model in column (1), while it cannot be reject for the model in column (2) .

This section proved the exogeneity of the external instrument and how crimes that may not be related to organised crime have a smaller effect on the economic performance of Italian regions if compared to homicides (usually related to mafia associations).

Table 2.9: THE EFFECT OF BANK ROBBERIES AND BAG-SNATCHING ON THE ECONOMIC GROWTH OF ITALIAN REGIONS

| Dependent variable: $\triangle$GDP per capita$_{it}$ | (1) | (2) |
|---|---|---|
| GDP per capita$_{it-1}$ | -0.009 | -0.004 |
| | (0.015) | (0.011) |
| Bank robberies | 0.012 | |
| | (0.009) | |
| Bag-snatching | | 0.007 |
| | | (0.009) |
| Social capital | -0.004 | -0.007 |
| | (0.015) | (0.009) |
| Dropout rate | 0.001 | -0.004 |
| | (0.009) | (0.009) |
| Construction/Government spending | -0.013 | -0.006 |
| | (0.025) | (0.029) |
| Investment/GDP | -0.028 | -0.021 |
| | (0.043) | (0.024) |
| Firms creation rate | -0.001 | 0.001 |
| | (0.003) | (0.002) |
| Population density | -0.000 | -0.000 |
| | (0.000) | (0.000) |
| $Du_{i2008}$ | -0.030*** | -0.030*** |
| | (0.008) | (0.005) |
| $DU_{i2009}$ | -0.058*** | -0.063*** |
| | (0.012) | (0.008) |
| Observations | 268 | 272 |
| No. of instruments | 17 | 17 |
| Arellano-Bond test for AR(2) in first differences, | -0.68 | -0.57 |
| p-value | 0.495 | 0.562 |
| Hansen test, | 13.46 | 9.80 |
| p-value | 0.06 | 0.200 |

NOTE: * p<0.1; ** p<0.05; *** p<0.01, standard errors in brackets

## 2.7 Conclusions

This study provides consistent estimates of the effect of homicide rate on the economic performances of Italian regions. The choice of homicide rate as a regressor is due to its strong correlation with murder rate associated to the Mafia, thus providing a valid proxy for organised crime. Moreover, data on other crimes are not reliable due to under-reporting and under-recording bias, especially those related to Mafia type associations.

The estimation strategy addresses potential endogeneity issues by using effective abortion rate as an instrument for homicide rate. The chosen instrument has its roots in the economics of crime literature and the statistics presented in the work show its validity. The empirical exercises indicate that crime may play an important role in determining the Italian regional economic disparities, since it inhibits the growth path and has a large effect on the level of GDP per capita.

Robustness checks show how other types of crime, which do not require an organised crime association of the Mafia type and whose distribution is more homogeneous among Italian regions, have smaller effects on GDP per capita and negligible impact on growth rate.

The findings of this study suggest several aspects on which policy makers should focus to fight crime and its consequences. For example, as showed by the reduced form results, dropout rate from high school has a positive and statistically significant impact on murder rate in Southern Italy. This means that policy makers should pay more attention to territories characterized by high youth unemployment rate, and provide opportunities to develop skills to use in the legal sector in order to decrease the number of potential affiliates in criminal organisations. The results section also showed that a greater effort in increasing social capital can lead to a reduction in crime, which would be beneficial for the economy through a boost in trust among citizens.

If the effect of illicit activities on the economy is neglected, the potential benefits of policies aimed to improve economic performance in Italy would be wiped out by crime. This is particularly important for a country like Italy which has not been able to achieve high growth rates for twenty years.

Further research is needed to understand the complex relation between crime and economic outcomes. A longer time period could be used to understand when and through which channels crime and organised crime started to affect the economy of Italy and its Southern regions.

# 3 Does crime pay? Criminal Versus Human Capital

## 3.1 Introduction

Crime imposes enormous costs on society. In 2014, there were an estimated 8,277,829 property crime offences in the U.S. with an equivalent estimated losses of $14.3 billion. During the period 2010-2014, property crimes exhibit a lower decrease compared to violent crimes, with data on arrests for 2014 showing that individuals under the age of 25 accounted for 43% of the arrestees for the former crime category. The latter figure provides some evidence of crime trends during life cycle. Crime rates typically increase with age during adolescence, but decline in early adulthood. Lochner (2004) explained this pattern using a human capital approach where the opportunity cost of crime increases with human capital. Machin et al. (2011) provide further evidence of the deterrent effect of education on crime, while Campaniello, Gray and Mastrobuoni (2016) estimate positive returns to education for professional criminals.

But, why do individuals repeatedly commit offences? What happens during the adolescent years and the early adulthood? In order to comprehend criminal choices, it is crucial to understand the factors defining criminal success, and this is what the present study attempts to do.

This chapter contributes to the literature by presenting a dynamic discrete choice model for young men, which proposes a mechanism underlying criminal choices. It reveals the channels leading to criminal and human capital accumulation. These channels constitute the basis to obtain a unifying framework of theories and empirical evidence produced in the criminal capital literature. Consistently with empirical evidence produced in previous studies, this work emphasises the importance of social criminal capital. The latter is critical in identifying important factors associated to criminal choices, such as illegal earnings and probability of apprehension.

Results indicate that there are important wage premiums in the illegal sector for individuals interacting with delinquents, thus capturing the importance of a ‘school of crime’ effect in criminal choices determination.

Criminal capital represents a type of human capital that can facilitate successful criminal activity (McCarty & Hogan, 1995) and it is measured using experience in crime and criminal embeddedness. The first measure refers to the accumulation of experience through criminal decisions and, as a consequence, criminal capital via a learning by doing process. The second one refers to potential of criminal capital accumulation through interaction with delinquent peers. Differently from legal human capital, formal schools of crime to facilitate the acquisition of criminal skills or knowledge do not exist. It is not possible to attend a ’school of crime.’ However, ongoing social relations with criminals can play a fundamental role in transferring relevant skills and in providing informal criminal training.

Although criminal capital may be fundamental in identifying criminal choices, only few studies take into account its formation. Mocan et al. (2005) are the first to present a dynamic model of criminal activity where individuals are endowed with two types of human capital: legal human capital and criminal human capital. They underline the importance of the dynamics for the study of criminal activity and identify prison as a potential source of criminal human capital.

A dynamic model for juvenile crime is proposed in Merlo and Wolpin (2009). Their work focuses on the decisions of black young men and fits the data observed in the National Longitudinal Survey of Youth 1997 (NLSY97), but it does not explicitly account for accumulation of criminal capital and the effect that time spent in prison can have on future criminal activity. Empirical evidence of the positive effect of time spent in prison on criminal capital accumulation is provided by Bayer et al. (2005), while Loughran et al. (2013) show that there are important illegal wage premiums associated with investments in criminal capital. Munyo (2015) develops a model that includes the aforementioned empirical evidence and manages to explain the recent increase in the juvenile crime trends in Uruguay, with calibration techniques delivering the parameters of his model.

On the contrary, Mancino et al. (2015) use data on serious offenders to identify the roles of state dependence, returns to experience, and heterogeneity in determining crime and school decisions of youth. Their findings reveal that the choice between crime and school enrolment is largely affected by state dependence and heterogeneity. However, their work is not useful to study the choice of becoming a serious offender due to the nature of their dataset.

The cited studies fail to account for the importance of social criminal capital, not acquired in correction facilities, when modelling illegal capital formation. In contrast, empirical evidence suggests that early exposure to neighbourhood crime has a positive effect on subsequent criminal behaviour of youths (Damm and Dustmann, 2014). Moreover, an increase in the probability of arrest, for the homeless, is associated with an increase in the share of criminal friends in the group, Corno (2012) -with the probability of arrest used as an imperfect proxy for criminal behaviour.

In order to provide a theoretical framework able to expand previous theories and include the aforementioned empirical findings, a dynamic discrete choice model is used to understand the choices of young men, employing data from the NLSY97. Data from NLSY97 offer a rich set of information on each respondent's criminal activity and criminal justice history. The set of available information also includes data on criminal organisations in respondent's neighbourhoods (gangs), and data on whether someone close to the respondent is part of such organisations. Furthermore, it contains data on enrolment status in education, number of hours worked and income from legal and illegal sources.

Using NLSY97, the model matches the actual data well at the estimated parameters, being able to repeat trends in crime, school and work. Results from the DCDP are consistent with empirical evidence produced in the criminal capital literature. Legal and 'illegal schooling' have a positive and large effect for both criminal and legal wages, meaning that schooling plays a key role in the determination of illegal and legal rewards. The estimate of the returns to crime shows a larger premium for criminal activity compared to work experience. In fact, as opposed to labour market employment, experience in crime can lead to a potentially more profitable, albeit riskier, activity.

The model is also used for policy simulations aimed at decreasing juvenile crime. In particular, a decrease of 10% in the probability of having a delinquent peer is associated with a decrease in crime of 1.6%, while an increase in the opportunity cost of crime can decrease the proportion of people choosing illegal behaviour by 3% and recidivism by 23%.

This chapter is structured as follows: Section 3.2 presents the data, while Section 3.3 shows the mechanism of the model. In Section 3.4 results for estimations are reported along with model fit. Section 3.5 presents policy simulations and Section 3.6 concludes.

## 3.2 Data

Data used in this work are from the National Longitudinal Survey of Youth 1997 (NLSY97). NLSY97 is a longitudinal project that follows 9000 young Americans born between 1980 and 1984, making them 12-17 years of age when first interviewed in 1997. Males constitute approximately half of the sample. The survey is conducted every year and it provides information about several aspects of the youths' lives, such as school enrolment, worked hours, wages, family income, parents' education, criminal activity and exposure to the criminal justice system. Questions on criminal activity explore the types of crimes committed, the number of times -since the last interview- the youth was involved in a particular crime, and illegal income from criminal activity. Information on illegal behaviour is available for the whole sample until 2005, and only for respondents with criminal justice history in subsequent rounds.

This work uses a sub-sample of the NLSY97 composed of males who were 14 years old in 1997 or in 1998 and follows them until the age of 22. Each youth was recorded as working during the decision period if he spent more than 780 hours[12] in employment (as in Merlo and Wolpin, 2009), while he was registered as attending school if reported as enrolled during the year. Event history data are not available for illegal activity. During each survey round, crime related questions are asked to determine the number of times a youth committed a crime since the date of the last interview –types of crime used in the work are: stealing something worth 50 dollars or more, other property crimes (e.g. fencing stolen property), and selling drugs. The strategy adopted by Merlo and Wolpin (2009) to deal with the absence of event history data is also used in this work. In addition to the data on criminal activity, the answer to a specific question on whether a brother/sister or a friend is part of a gang is used to identify social criminal capital (later defined as $Soc_a$). Data on arrest and incarceration status are collected monthly and used to construct the arrest and imprisonment history of an individual during each time period. Lastly, if the individual reports that he is not enrolled in education, nor is he employed, and has not committed a crime, he is registered as being at home.

Table 3.1 presents the choice distribution by age. It shows that 88% of individuals aged 14 choose school over the other alternatives, and that an additional 10% choose school in combination with either crime or work, thus leading to a vast majority of individuals in education at age 14. This number decreases over-time and, as expected, presents the biggest drop at age 18 -normal high school graduation age. The opposite pattern can be observed for the working alternative. From table

[12]This threshold is useful to potentially exclude youth employed only during summer.

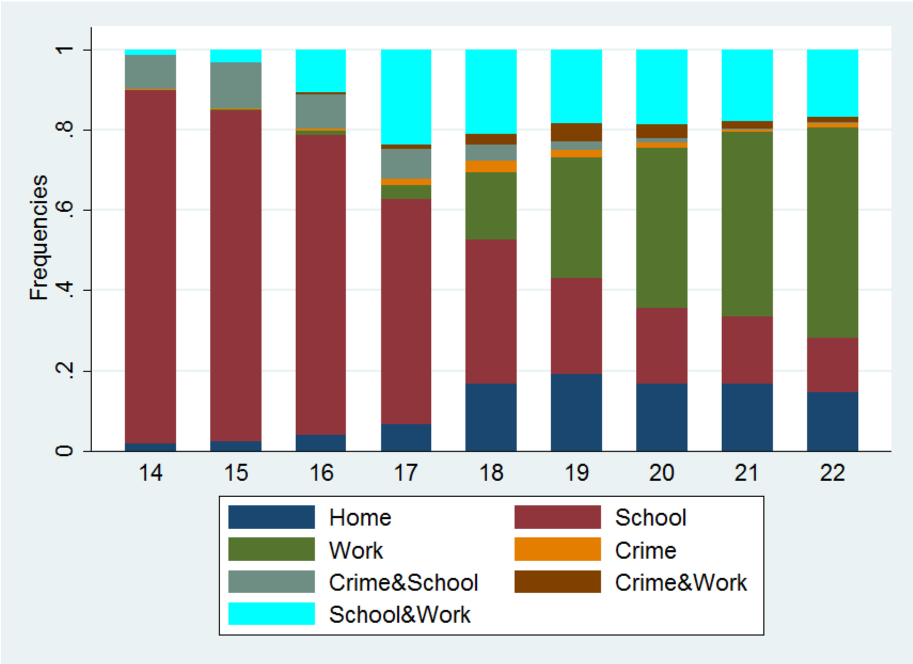
3.1, it appears that some individuals switched from school and crime to work and crime between age 17-18 and 18-19. Given the previously stated residual definition of home, it may be that the youths classified as being at home worked for less than 780 hours during the calendar year, or his time spent at school was not enough to classify him as at school for the period. A jump in the home choice is registered at age 18, when there may be a transitional period from school to work.

Table 3.1: CHOICE DISTRIBUTION: YOUNG MEN AGED 14-22

| Age | Home | School | Work | Crime | Crime and School | Crime and Work | School and Work | Total |
|---|---|---|---|---|---|---|---|---|
| 14 | 1.9 | 87.79 | 0.06 | 0.28 | 8.47 | 0 | 1.51 | *1794* |
| 15 | 2.34 | 82.33 | 0.23 | 0.47 | 11.23 | 0.06 | 3.34 | *1709* |
| 16 | 3.99 | 74.55 | 1.09 | 0.6 | 8.59 | 0.3 | 10.88 | *1654* |
| 17 | 6.47 | 56.16 | 3.45 | 1.6 | 7.57 | 0.86 | 23.89 | *1624* |
| 18 | 16.65 | 35.99 | 16.71 | 2.76 | 4.02 | 2.64 | 21.23 | *1592* |
| 19 | 19.16 | 23.74 | 30.02 | 2.03 | 2.16 | 4.51 | 18.38 | *1529* |
| 20 | 16.79 | 18.69 | 40.04 | 1.36 | 0.88 | 3.54 | 18.69 | *1471* |
| 21 | 16.64 | 16.79 | 46 | 0.57 | 0.21 | 1.93 | 17.86 | *1400* |
| 22 | 14.69 | 13.53 | 52.36 | 0.87 | 0.36 | 1.38 | 16.8 | *1375* |
| Total | 10.5 | 47.77 | 19.49 | 1.16 | 5.14 | 1.62 | 14.33 | *14148* |

NOTES: Figures are row percentages. Total number of observations is reported in column Total.

Figure 3.1: CHOICE DISTRIBUTION: YOUNG MEN AGED 14-22




The described patterns become evident when looking at Figure 3.1. It shows the jump in home and work alternatives at age 18, and perfectly displays the decreasing trend of schooling choices and the increasing one for work. The switch from crime and school to crime and work can also be easily identified.

Table 3.2 reports the transition matrix for the seven alternatives, with the figure in each cell representing the percentage of transitions from origin to destination. The school choice presents high persistence, as shown in Table 3.2 where about 72% of the time a youth chooses to stay in school if previously enrolled. This is not surprising given the age of the sample.

Table 3.2: ONE-YEAR ALTERNATIVES TRANSITION MATRIX

| | Choice (*a*) | | | | | | |
|---|---|---|---|---|---|---|---|
| Choice(*a-1*) | Home | School | Work | Crime | Crime and School | Crime and Work | School and Work |
| Home | 47.8 | 11.7 | 30.4 | 31.0 | 0.8 | 2.04 | 4.08 |
| School | 6.22 | 71.8 | 4.3 | 0.6 | 51.5 | 0.28 | 11.6 |
| Work | 10.2 | 16.9 | 77.34 | 0.54 | 0.11 | 3.32 | 6.81 |
| Crime | 40.91 | 6.1 | 15.15 | 18.18 | 6.1 | 9.85 | 3.79 |
| Crime and School | 7.26 | 41.53 | 3.09 | 4.03 | 28.76 | 3.23 | 12.1 |
| Crime and Work | 9.95 | 2.09 | 51.31 | 3.14 | 1.57 | 25.65 | 6.28 |
| School and Work | 5.58 | 18.02 | 24.06 | 0.35 | 1.41 | 1.88 | 48.71 |

NOTES: Figures are row percentages.

A similar figure emerges for the work alternative, where 77% of individuals choosing work repeat their choice the next period. State dependence can also be found for the home alternative and the combined choice of school and work. The alternatives concerning illegal behaviour present low state dependence, respectively 18% for crime, 28% crime and school, 26% crime and work. In particular, data show that a person choosing crime at *a-1* is more likely to stay at home at age *a*. The latter pattern may be a consequence of an efficient police force and justice system. Table 3.3 reports data on arrest and imprisonment for the sub-sample of youth choosing a crime-related alternative. The pattern presented in Table 3.3 displays that 73% of youth committing a crime managed to avoid arrest and incarceration, while 27% were arrested and not incarcerated. Further, 12% of arrested individuals were then incarcerated.

Table 3.3: ARREST AND INCARCERATION TWO-WAY FREQUENCY TABLE

| Incarceration Status | Arrest No | Arrest Yes |
|---|---|---|
| Not in Jail | 73.1 | 26.87 |
| | | *87.8* |
| In Jail | | *12.2* |

NOTES: Figures are row percentages and column percentages (italic).

In Table 3.4 reduced form results, obtained using OLS method, are reported for legal and illegal wages, while table 3.5 presents the estimates of a logit model for the binary variable $Arrest_a$, equal to 1 if the youth is arrested at age $a$, and 0 otherwise. It is assumed that schooling and experience determine real legal wage and real criminal wage (both in 2003$) as in a Mincer equation (Mincer, 1974). Schooling is defined by high school completion for the legal sector, while social criminal capital describes schooling in the illegal one.

Table 3.4: REDUCED FORM RESULTS FOR LEGAL AND ILLEGAL WAGE

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | Log(real wage) | | | Log(real criminal wage) | |
| High school graduate | 0.117*** | 0.116*** | 0.109** | | | |
| | (0.043) | (0.044) | (0.045) | | | |
| Social Criminal Capital | | | | 0.579*** | 0.572** | 0.588*** |
| | | | | (0.223) | (0.223) | (0.226) |
| $X_a$ | 0.279*** | 0.279*** | 0.248*** | 0.606** | 0.545** | 0.539** |
| | (0.043) | (0.043) | (0.046) | (0.249) | (0.249) | (0.249) |
| $X_a^2$ | -0.017*** | -0.017*** | -0.014** | -0.038 | -0.030 | -0.035 |
| | (0.005) | (0.005) | (0.006) | (0.037) | (0.037) | (0.038) |
| $Jail_a$ | | -0.010 | -0.010 | | 0.568*** | 0.547*** |
| | | (0.047) | (0.047) | | (0.207) | (0.210) |
| $I(age_{19-22})$ | | | 0.151*** | | | 0.278 |
| | | | (0.054) | | | (0.320) |
| Constant | 8.905*** | 8.907*** | 8.853*** | 5.010*** | 4.879*** | 4.884*** |
| | (0.089) | (0.089) | (0.087) | (0.330) | (0.336) | (0.336) |
| R-squared | 0.151 | 0.151 | 0.157 | 0.085 | 0.107 | 0.109 |
| Adj.R-Squared | 0.149 | 0.149 | 0.154 | 0.076 | 0.095 | 0.094 |
| F_stat | 72.59 | 54.73 | 49.16 | 11.409 | 9.734 | 7.814 |

NOTES: robust standard errors in brackets.
* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Results in columns (1) and (2) of table 3.4 show the importance of schooling in determining youth wages, with people graduating from high school earning around 12% more compared to individuals that do not have a high school qualification. The estimate is statistically significant at 1%. Experience plays a major role in determining wages for youth, being associated to an increase of 28% of wage for an additional year of work. Considering that the estimates are for the age range 14-22, it seems a plausible result since youth may move quickly from one job to another and decide to increase/decrease the number of hours spent working during the year. Column(3) reports the results of the regression model with an additional regressor, $I(age_{19-22})$, indicating whether the youth is in the age range 19-22. The effect of experience on wages decreases using the additional independent variable. In addition, the effect of having spent time in jail is explored, resulting in a negative and statistically insignificant effect on legal wage but in a positive and statistically significant effect on criminal wage. Column (4), (5) and (6) explore the determinants of criminal wage. Social criminal capital has a large significant impact on illegal wage, the returns in the illegal sectors are around 58% higher for individuals that can benefit from the 'school of crime'. The effect of criminal experience has a large and significant impact on illegal wage, while its squared functional form is negative but insignificant. However, conducting an F-test on joint significance of experience coefficients, the assumption of a non-quadratic relation between illegal earnings and experience can be rejected. Table 3.5 shows the results for a logit model and a logit model with random effects of the probability of arrest given criminal experience and social criminal capital. Column(1) reports a positive effect of criminal experience and 'illegal schooling' on the probability of apprehension in a logit model, whereas squared experience can have a negative impact. Although none of the coefficients is statistically significant (except for the constant), the Chi squared statistics indicate that a rejection of the null hypothesis stating the insignificance of the model is possible. In Column(2) the outcomes obtained through the random effects model are reported. The sign of the effect remains the same, while estimated crime experience effect becomes positive at 10% significance level. The random effects estimation strategy is preferred since the results obtained with the fixed effects estimator indicate a possible correlation between the unobserved time-invariant characteristics of an individual and the independent variables, invalidating the latter estimation strategy. The assumption of the fixed effects method is unlikely to hold in the proposed model for criminal wage and arrest probability.

Table 3.5: REDUCED FORM RESULTS FOR ARREST PROBABILITY

| | (1) | (2) |
|---|---|---|
| $X_a$ | 0.479 | 0.610* |
| | (0.335) | (0.368) |
| $X_a^2$ | -0.018 | -0.034 |
| | (0.052) | (0.054) |
| Social criminal capital | 0.389 | 0.433 |
| | (0.267) | (0.303) |
| Constant | -1.823*** | -2.082*** |
| | (0.472) | (0.563) |
| Wald Chi2 | 13.38 | 15.68 |
| Pseudo $R^2$ | 0.044 | |

NOTES: Standard errors in brackets.
* P<0.1; ** P<0.05; *** P<0.01

## 3.3 Model

### 3.3.1 Model structure

The model considers a finite decision horizon, with the start of decision period being age 14 and the end being 22. At each age $a$, an individual can choose between human and/or criminal capital and none. Each period the youth faces seven alternatives: school, $d_{1,a} = \{0,1\}$, work, $d_{2,a} = \{0,1\}$, crime, $d_{3,a} = \{0,1\}$, home, $d_{4,a} = \{0,1\}$ or a combination of work and school, $d_{5,a} = \{0,1\}$, school and crime, $d_{6,a} = \{0,1\}$ ,or work and crime, $d_{7,a} = \{0,1\}$; with $d_{r,a}$equal to 1 if alternative $r$ is chosen and 0 otherwise, with r=1,...,7. The individual increases his human capital choosing school and work or a combination with them, while criminal capital is accumulated by choosing crime or a combination of crime and school or crime and work.

Unobserved heterogeneity is one of the determinants of individual's choices[13]. It is possible to account for unobserved heterogeneity by assuming that there are

[13]The importance of heterogeneity in determining criminal choices has also be emphasised in previous work, e.g. Lochner(2004), Merlo and Wolpin (2009).

a finite number of types. There are two types of individuals in the model. Each type probability depends on some important characteristics that may induce the young man to choose one of the alternatives. In particular, parents' higher education contributes to determine the probability that the individual is type1, and more keen to choose legal opportunities. Type2 probability is constructed using information on low expectation of arrest at age 13 if a crime is committed, thus helping to identify high able criminal.

Following Keane & Wolpin (1997), a system of rewards, containing the benefits for each alternative, is presented. If an individual at age $a$ decides to work, the reward for this choice is the wage, $w_a^l$, presented in equation (3.1):

$$R_{e,a} = w_a^l = exp(\beta_0 + \beta_1 S_a + \beta_2 X_a + \beta_3 X_a^2 + \beta_4 type1 + \varepsilon_{1,a}) \tag{3.1}$$

Wage is a function of schooling, work experience and a productivity shock at age $a$, $\varepsilon_{1,a}$, with experience at $a$, $X_a$, presenting a quadratic term, as in a Mincer equation. Given the focus on young men, and the terminal decision period at age 22, the specification uses a dichotomous variable, which indicates whether the individual completed high school or not at age $a$, $S_a$.

Work experience is set equal to zero as initial condition and evolves over time as in (3.2):

$$X_a = X_{a-1} + d_{2,a} + d_{5,a} + d_{7,a} \tag{3.2}$$

To determine whether an individual has a delinquent peer the following logistic function is used:

$$Pr(Soc_a|A_a) = \frac{exp(\phi_0 + \phi_1 A_a)}{1 + exp(\phi_0 + \phi_1 A_a)}$$

where the local social iteration variable depends on the presence of criminal groups in the area each period ($A_a$) and a constant.

If an individual decides to engage in criminal activity, the reward accompanying his choice is the illegal wage, $w_a^c$, given by:

$$R_{c,a} = w_a^c = exp(\delta_0 + \delta_1 Soc_a + \delta_2 Z_a + \delta_3 Z_a^2 + \delta_4 type2 + \varepsilon_{2,a}) \tag{3.3}$$

with $\varepsilon_{2,a}$ being the crime related productivity shock. The illegal earnings function presents a quadratic term for experience in illegal activity, $Z_a$, while $Soc_a$ accounts for the effect of local social interactions with delinquents on illegal rewards.

As for work, initial criminal experience is assumed to be zero, and its law of motion is:

$$Z_a = Z_{a-1} + d_{3,a} + d_{6,a} + d_{7,a} \tag{3.4}$$

If crime is chosen, criminal capital, $H_a^c$, increases following equation (3.5):

$$H_a^c = H_{a-1}^c + d_{3,a} + d_{6,a} + d_{7,a} + \delta_5 Soc_a \tag{3.5}$$

Furthermore, if the youth commits a felony, he encounters a probability of being arrested that depends on criminal capital and the type of individual as in (3.6),

$$Pr(Arrest_a | H_a^c, type_2) = \frac{exp(\gamma_0 + \gamma_1 H_a^c + \gamma_2 H_a^{c^2} \gamma_3 type_2)}{1 + exp(\gamma_0 + \gamma_1 H_a^c + \gamma_2 H_a^{c^2} + \gamma_3 type_2)} \tag{3.6}$$

Equation (3.6) reflects the cost of spending time in the illegal sector, resulting in a higher probability of being arrested, which reduces when the youth becomes a more able criminal, with $\gamma_2 < 0$.

Arrest may lead to incarceration and time spent in prison can increase the level of criminal capital. Furthermore, imprisonment has a negative effect on human capital through depreciation and/or stigma effect. Individuals can again choose among the seven alternatives when the sentence is over.

In addition to single choices, the youth can choose to combine two alternatives. This leads to a reduction of the time available to each choice and, consequently, of the rewards. An individual working in both the legal and illegal sectors faces the reward presented in (3.7)

$$R_{ec,a} = f(w_a^l, w_a^c, \rho_1, \rho_2) \tag{3.7}$$

The youth sacrifices a part of his wage (depending on $\rho_1$) in order to spend part of his time committing crimes. He also loses a portion of his illegal earnings (depending on $\rho_2$). An individual can commit offences while at work; but, sacrificing working time to crime leads to a shift in productivity and, consequently, wage.

The non-working alternative school has implications for earnings and increases skills endowment and consequently, human capital, $H_a^l$. Possible rewards for schooling,$w_a^p$, can be formalized as follows:

$$R_{s,a} = w_a^p = exp(\tau_0 - \tau_1 S_a + \tau_2 type1 + \varepsilon_{3a}) \tag{3.8}$$

with $\varepsilon_{3,a}$as shock. Schooling rewards differ among individuals according to their type and whether they are enrolled at university or not (to account for the tuition cost).

Furthermore, the youth can decide to combine the last alternative with work or crime. If the individual decides to work and enrol in education, then he faces the reward function (3.9):

$$R_{sw,a} = f(w_a^l, w_a^p, \rho_3, \rho_4) \tag{3.9}$$

The youth has to split his time between the two activities and, as a consequence, his wage is lower compared to full time employment (depending on $\rho_3$). In addition, the alternative source of income reduces schooling reward (depending on $\rho_4$).

School can also be combined with crime. And, as for the previous cases, the reward accounts for the lack of full engagement in one of the two choices. Equation (3.10) represents the reward for the alternative school and crime:

$$R_{sc,a} = f(w_a^p, w_a^c, \rho_5, \rho_6) \tag{3.10}$$

Lastly, an individual that chooses home can engage in home production and leisure. Home productions implies that $Y_a$ goods with a fixed price, *p,* will be produced together with leisure,$\Gamma_a$. The reward for this alternative is:

$$R_{h,a} = pY_a + \eta\Gamma_a + \varepsilon_{4,a} \tag{3.11}$$

where $\eta$ is a weight for Leisure at age *a*, and $\varepsilon_{4,a}$is the shock for the home alternative.

The joint distribution of shocks is $(\varepsilon_{1,a}, \varepsilon_{2,a}, \varepsilon_{3,a}, \varepsilon_{4,a}) \sim N(0,\Sigma)$, with the variance-covariance matrix given by $\Sigma = LL^T$ where $L$ is a lower triangular matrix representing the Cholesky factor. $L$ specification allows for non-zero covariances and it is presented below:

$$L = \begin{bmatrix} l_{11} & 0 & 0 & 0 \\ 0 & l_{22} & 0 & 0 \\ 0 & l_{32} & l_{33} & 0 \\ 0 & l_{42} & l_{43} & l_{44} \end{bmatrix}$$

The structure of the model is used to determine through which choices young men maximize remaining expected rewards.

The maximization process accounts for the mechanisms of the model, which show the importance of dynamics given the influence of today's decisions on tomorrow's outcomes. An individual choosing a non-combined crime alternative over legal opportunities accumulates criminal capital, and has few incentives to switch to a legal career path. However, he can accumulate human capital along with criminal one if he decides to combine crime with schooling or work and giving up part of his legal rewards. This produces future higher legal earnings and an important increase in salary after school completion. Illegal alternatives, even if combined with legal ones, can lead to apprehension and incarceration. Time spent in correction facilities depreciates human capital and decreases salaries in the legal sectors, while working as an additional source of criminal capital. Given the cost associated with crime, such as apprehension and incarceration, the decision making process has to consider not only the benefits associated to offences but also the costs.

### 3.3.2 Solution

An individual's goal is to maximize his lifetime expected rewards, while his maximum expected present discount value of lifetime rewards at age $a$, taken over all possible future choices and given the state space and the discount factor, can be written as in equation (3.12):

$$V_a(\Omega_a) = max_{d_{r,t}} E \left\{ \sum_{t=a}^{A} \delta^{t-a} \left[ \sum_{r=1}^{7} R_{r,a} d_{r,a} \right] |\Omega_a \right\} \tag{3.12}$$

where $\Omega_a$ represents the state space for the youth at age $a$. The state space for each age includes $X_a$, $Z_a$ , accumulated years of schooling and of the different combined choices (e.g. school and work, work and crime, etc.) at $a$, and a shock that the researcher does not observe.

Equation (3.13) represents the alternative specific value function:

$$V_{ra}(\Omega_a) = R_{ra}(\Omega_a) + \delta E \left[ V_{a+1}(\Omega_{a+1}) | \Omega_a, d_{ra} = 1 \right] \tag{3.13}$$

that reduces to $V_{rA}(\Omega_A) = R_{rA}(\Omega_A)$ at age $A$.

A full numerical solution of the model is obtained via backward recursion starting from the last period of interest. The decision process involves the comparison of the seven value functions and the choice of the one with the highest value.

## 3.4 Estimation

### 3.4.1 Estimation technique

Simulated method of moments (SMM) is used to estimate the parameters in the model. In the SMM approach parameters are selected to minimize the weighted distance between chosen moments from actual data and the theoretical counterparts obtained from the simulation of a structural model (McFadden, 1989). Equation (3.14) shows the concept formally:

$$\hat{\theta}_{SMM} = argmin[\psi^d - \psi^s(\theta)]' W [\psi^d - \psi^s(\theta)] \tag{3.14}$$

where $\theta$ represents a set of structural parameters to estimate, $\psi^d$ is a vector of moments obtained from observed data, $\psi^s$is an average of vector moments derived from $S$ simulations, and $W$ represents a weighting matrix used to achieve efficient estimators when the model is over-identified.

This work uses an identity matrix as weighting matrix, providing consistent but inefficient estimators for the model parameters due to the use of the same weight for each moment. The objective function is minimized using the downhill simplex method, a direct search derivative-free method developed by Nelder and Mead (1965).

The chosen method can lead to valid estimates for the parameters of interest if the selected moments are informative. Hence, moments selection should depend on the parameters so that a slight change in parameters is translated into different values for the moments. The next subsection discusses parameter identification.

### 3.4.2 Identification

The selected moments, used to identify the 44 parameters of the model, ensure that the model replicates trends and levels observed in the actual data. Chosen moments comprise state frequencies, average legal and illegal earnings, variance of wages in licit and illicit sectors, computed at different ages. These moments are useful to identify the parameters generating occupational and criminal choices in the model and the penalties associated with combined choices.

The average and variance of legal and illegal earnings, given youth previous imprisonment status and arrest, are used as moments to enable the identification of the stigma effect on wages for ex-convicts and the increase in criminal capital due to imprisonment. Moreover, equations (3.1) and (3.3) are estimated by OLS for the simulated dataset, and the distance between the obtained results and estimation from actual data is minimized. This allow to further identity rewards parameters.

The proportion of arrested youths, is used to identify the probability of apprehension, while the proportion of individuals in correction facilities identifies the detention rate. Furthermore, correlation between the binary variable defining criminal organisation in the area and the dichotomous one identifying delinquent peer is used to obtain the impact of the former on the latter.

A list of the moments used in the estimation can be found in Appendix B.4.

## 3.5 Estimation results

Table 3.6 and 3.7 report parameter estimates for key parameters and asymptotic standard errors, while the simulated outcome produced by the SMM estimates is reported in table 3.8 along with the NLSY97 data in order to asses model fit.

### 3.5.1 Parameter estimates

Legal and illegal acquisition of skills plays a fundamental role in determining the returns in licit and illicit sectors, as shown by the large magnitude of the coefficient for returns to experience and to legal and illegal schooling in the wage equations. Table 3.4 also presents a large magnitude for the coefficients of experience and schooling, signalling that the structural estimation of the parameters is consistent with the reduced form analysis.

Table 3.6: SMM ESTIMATES

| | *Legal wage* $ln(w_a^l)$ | *Illegal wage* $ln(w_a^c)$ | *School Return* $ln(w_a^p)$ | *Home Return* | *Pr(Soc=1)* |
|---|---|---|---|---|---|
| *Constant* | *8.418* | *6.458* | *8.521* | | *-3.053* |
| | (0.001) | (0.002) | (0.001) | | (0.002) |
| $S_a$ | *0.257* | | *-0.310* | | |
| | (0.0058) | | (0.0002) | | |
| $X_a$ | *0.342* | | | | |
| | (0.0002) | | | | |
| $X_a^2$ | *-0.064* | | | | |
| | (0.0005) | | | | |
| *Type1* | *0.1981* | | *0.650* | | |
| | (0.002) | | (0.0005) | | |
| $Soc_a$ | | *0.726* | | | |
| | | (0.002) | | | |
| $Z_a$ | | *0.605* | | | |
| | | (0.001) | | | |
| $Z_a^2$ | | *-0.028* | | | |
| | | (0.002) | | | |
| *Type2* | | *0.355* | | | |
| | | (0.001) | | | |
| $\rho_1$ | *0.5807* | | | | |
| | (0.0001) | | | | |
| $\rho_2$ | | *0.2899* | | | |
| | | (0.002) | | | |
| $\rho_3$ | *0.460* | | | | |
| | (0.007) | | | | |
| $\rho_4$ | | | *0.489* | | |
| | | | (0.012) | | |
| $\rho_5$ | | | *0.396* | | |
| | | | (0.0001) | | |
| $\rho_6$ | | *0.045* | | | |
| | | (0.0026) | | | |
| $\eta$ | | | | *0.2109* | |
| | | | | (0.0003) | |
| $A_a$ | | | | | *1.57* |
| | | | | | (0.002) |

NOTES: Asymptotic standard errors are in brackets

Table 3.7: SMM ESTIMATES (CONT'D)

| | *Criminal* Capital | *Human* Capital | Pr(Arrest=1) |
|---|---|---|---|
| Constant | | | *0.127* |
| | | | (0.0002) |
| $Soc_a$ | *0.052* | | |
| | (0.003) | | |
| type 2 | | | *-0.221* |
| | | | (0.005) |
| $Jail_a$ | *0.109* | | |
| | (0.0053) | | |
| $H^l_a depreciation$ | | *-0.081* | |
| | | (0.001) | |
| $H^c_a$ | | | 0.185 |
| | | | (0.0027) |
| $H^{c^2}_a$ | | | -0.129 |
| | | | (0.002) |
| | *Cholesky elements* | | |
| $l_{33}$ | $l_{44}$ | $l_{43}$ | $l_{42}$ |
| *0.062* | *0.05* | *0.004* | *0.154* |
| (0.0005) | (0.095) | (0.005) | (0.862) |
| | *Type probability parameters* | | |
| | *Type 1* | *Type 2* | |
| *Constant* | *0.599* | *-2.733* | |
| | (0.0035) | (0.002) | |
| *Degree_parents* | *0.177* | | |
| | (0.001) | | |
| $Lowexpectation$ | | *0.198* | |
| | | (0.0101) | |

NOTES: Asymptotic standard errors are in brackets

Table 3.6 and 3.7 illustrate how heterogeneity contributes to the determination of the rewards and consequently to the decisions of young men. In particular, heterogeneity presents its stronger effect in the equation for the reward in choosing school, thus confirming the idea that parents with higher education have a positive influence on their children's decisions. In the same equation, the higher cost associated with university decreases the reward by 0.31%. Furthermore, heterogeneity contributes to defining the probability of being arrested, with type 2 individuals, constituting 6.8% of the population, facing a lower probability of apprehension.

The results for criminal rewards can be compared to one previous empirical work, Loughran et al. (2013). The authors argue that individuals may have a higher reservation wage and decide to participate in illegal activity only if the returns can off-set the risks associated with it. Thus, an individual with criminal experience can commit offences leading to higher monetary returns, if he wants to off-set the associated risk. This fact justifies the difference in returns to experience for legal and illegal wage, respectively 0.343 and 0.605. Comparing the results for criminal rewards to those obtained by Loughran et al. (2013), this study confirms the strong positive effect on the returns to crime and social criminal capital.

As in the criminal capital literature, time spent in prison has a positive impact on illegal skills accumulation and a negative effect on accumulated legal ones. In particular, the produced estimates are similar to the ones presented by Munyo (2013). The suggested impact of imprisonment on criminal capital in the latter work is 0.09, while the obtained estimate here is 0.109.

Results for combined alternatives indicate that a youth choosing to work and enrol in school earns 46% of the wage he could obtain by choosing only work, while his illegal wage will be 4% lower if he decides to engage in criminal activity while attending school in the same period. The difference in the penalties can be identified in the opportunity for the youth to commit certain felonies while at school (e.g. selling stolen goods to school mates) whereas working cannot be conducted while in school.

If the individual decides to work and commit crimes in the same time period, his criminal and legal wages are respectively 29% and 58.1% lower. Again, the difference may be a consequence of the possibility of committing crime while at work.

### 3.5.2 Model fit

Table 3.8 reports a comparison between simulated choice distributions and actual ones. The comparison is presented for three age periods: 14-18, 19-22 and 14-22. The bottom of table 3.8 assesses the match between actual arrest, imprisonment and recidivism percentages with the simulated ones.

Table 3.8: ACTUAL AND PREDICTED OUTCOMES

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Actual | Predicted | Actual | Predicted | Actual | Predicted |
| | 14-18 | | 19-22 | | 14-22 | |
| Home | 0.061 | *0.076* | 0.168 | *0.152* | 0.105 | *0.11* |
| School | 0.687 | *0.699* | 0.183 | *0.156* | 0.477 | *0.458* |
| Work | 0.041 | *0.004* | 0.417 | *0.451* | 0.195 | *0.203* |
| Crime | 0.011 | *0.002* | 0.012 | *0.023* | 0.011 | *0.012* |
| School and Work | 0.118 | *0.120* | 0.179 | *0.181* | 0.143 | *0.147* |
| School and Crime | 0.080 | *0.095* | 0.009 | *0.00* | 0.051 | *0.053* |
| Work and Crime | 0.007 | *0.003* | 0.029 | *0.037* | 0.016 | *0.018* |
| | | Arrested | | | | |
| Actual | Predicted | Actual | Predicted | Actual | Predicted | |
| Social $H^c$(14-22) | | 0.268 | *0.273* | Recidivism (14-22) | | |
| 0.098 | *0.104* | Jail if Arrested | | 0.318 | | *0.304* |
| | | 0.122 | *0.113* | | | |

NOTES: Figures are in row percentage.

Considering the results reported in table 3.8, the model matches actual data well. In fact, it manages to fit the trend observed in table 3.2, with the majority of individuals choosing school in the age range 14-18 and then preferring the work alternative with its possible combinations. Crime plays a major role during adolescence with around 10% of adolescents choosing crime and its combination both in the actual and simulated data.

Furthermore, when considering the age range 14-22 (column (5) and (6)), the highest difference between actual and predicted percentage is 1.9%, which is registered for the school alternative. This result is due to the underestimated rate of people attending school in the age range 18-22, as shown in columns (3) and (4). Instead, the highest difference between actual and predicted results is for the working alternative in the age range 14-18. The model underestimates the state frequency for work during the age range 14-18, while it overestimates it for the second range.

The difference in the percentage point of youth arrested and then imprisoned are 0.005 and 0.009 respectively. Again, the model manages to match the data well. The difference becomes smaller for the percentage of persons close to the youth that are part of a gang: 0.006 percentage points.

The estimation results showed that the measures identifying criminal capital have a large effect on criminal earnings, but this is not enough to lead a vast majority of individuals to repeat their criminal choice in adulthood. The result is consistent with the argument proposed by Lochner (2004). In fact, in choosing crime the individual has to take into account the opportunity cost of his choice (the rewards associated with alternative choices) and the risk of punishment. From table 3.8, school and crime is chosen by 9.5% of individuals aged 14-18 of the simulated dataset, but by none in the age range 19-22. Meanwhile, a proportional increase in the other illegal alternatives is not observed. This indicates that choices change when there is an alteration of the trade-offs and it may be a consequence of the increased opportunity cost of crime.

Lastly, the model provides a good match for recidivism, providing evidence of potential criminal capital accumulation while in correction facilities.

## 3.6 Policy simulations

This subsection presents simulation exercises for three policies with the potential of reducing juvenile crime.

The first policy simulation implementation shows how policy makers intervention can reduce crime through a decrease of the social measure of criminal capital.

The second and third policies aim at increasing the opportunity cost of crime.

The importance of social interactions with delinquents has already been underlined in this work and in previous literature. Tools able to reduce the probability of having a delinquent peer may be fundamental in decreasing illegal behaviour. This can be tested using the proposed model, since its mechanisms allow to decide whether policy aimed at decreasing social criminal capital can have an impact on youth choices.

Programs implemented in chosen cities in the U.S., aimed at gang and juvenile crime reduction had different outcomes. Successful programs had in common a social intervention focusing on creating opportunities in education and community mobilization. Policy makers can find valid allies in communities and education in fighting crime. Strategies that can decrease the opportunities for gangs to gather and commit crimes (e.g. surveillance of 'hot points'), and/or boost the message within a community that crime is wrong and not accepted can be effective in reducing gang/crime participation. In the model presented in Section 3.2, such policy implementation corresponds to a decrease in criminal groups' presence and thus affects the probability of having a delinquent peer.

Table 3.9 reports in column (2) the policy simulation result associated to a decrease in the likelihood of criminal behaviour in a peer of around 10%. This exercise produces a reduction of peers with delinquent behaviour of around 5% - passing from 10.4% to 5.8%. Additionally, a decrease of crime of 1.6% and an increase in the youth arrested fraction can be observed. These results are due to the different channels through which peers affect youth behaviour. In particular, there is a decrease in the rewards for crime and an increase in the probability of being arrested due to a lower number of peers with delinquent behaviour.

TABLE 3.9: COUNTERFACTUAL POLICIES

| | (1) Baseline | (2) Reduction in Pr($Soc_a$) | (3) Work-Study Program | (4) Ex-convicts Subsidy |
|---|---|---|---|---|
| Home | 0.11 | 0.11 | 0.09 | 0.11 |
| School | 0.458 | 0.463 | 0.475 | 0.456 |
| Work | 0.202 | 0.209 | 0.216 | 0.211 |
| Crime | 0.011 | 0.006 | 0.005 | 0.010 |
| School & Work | 0.147 | 0.151 | 0.166 | 0.143 |
| School & Crime | 0.0527 | 0.050 | 0.041 | 0.0526 |
| Work & Crime | 0.018 | 0.009 | 0.006 | 0.0161 |
| Arrest | 0.2784 | 0.332 | 0.40 | 0.292 |
| Jail if Arrested | 0.107 | 0.110 | 10.9 | 0.107 |
| Social $H^c$ | 0.104 | 0.058 | 0.104 | 0.104 |
| $\Delta c_{14-22}$ | | 0.016 | 0.029 | 0.003 |
| Recidivism | 0.317 | | | 0.09 |

Column (3) and (4) show the results of simulated policies with the purpose of increasing the opportunity cost of crime for high school students and ex-convicts respectively. Column (3) reports the simulated outcomes associated with an extension of the work-study program already active in the U.S.. The federal work - study program is a federally funded program that assists students in covering the cost of higher education through a part-time work program. The policy simulation exercise uses the idea of the program, and extends it to secondary education students who have been arrested. If the youth commits a crime and police arrests him, then he is enrolled in the program. From the reported outcome in Column (3), it emerges that such a policy can decrease crime by almost 3% and increase the portion of youth choosing legal alternatives. The policy also affects youths' future illegal choices and the fraction of arrested youth (increased to 0.40), thus meaning that the lower investment in criminal capital has an impact on arrest and subsequent criminal choices. Consequently, it is important to provide legal opportunities to youth exhibiting criminal behaviours.

The last policy focuses on understanding how an increase in the opportunity cost of crime can help in reducing recidivism. Specifically, the simulated policy looks at the impact of a subsidy of \$3,500 on recidivism - the subsidy consists of an increase in the accepted wage for full time employment for previously incarcerated individuals. The results of column (4) indicate that a subsidy can help in keeping ex-convicts away from crime. In fact, a subsidy for full employment is associated with a decrease in recidivism of almost 23%.

## 3.7 Conclusions

Criminal success is an important factor in determining criminal choices. Success is due to the investment in criminal capital that each individual decides to undertake. The literature does not provide an extensive framework for understanding the nature of criminal capital, how it is acquired and what its consequences are. The present study aims to fill the gap in the literature using a dynamic discrete choice model, where the youth maximizes his discounted remaining rewards. The behavioural model allows an individual to choose among seven alternatives leading to an increase in legal and illegal skills. Further, contrary to previous dynamic discrete choice models, and in line with the empirical literature on criminal capital, a central role is played by the effect that local criminal interactions can have in determining criminal choices and their associated rewards.

The model is used to match patterns observed in the NLSY97 which provides a rich set of information on criminal activity and criminal justice history of the youth. It also contains data on organised crime in the area (gangs), and participation in any of these associations by someone close to the respondent. Also, it includes data on enrolment status in education, number of hours worked and income from legal and illegal sources. The information provided in the NLSY97 can be exploited for the study of youth choices and criminal capital formation. Further, it may provide opportunities for future research aimed at analysing the effect of specialization in crime and the influence of drug use on criminal behaviour.

The parameters of the model are estimated through the simulated method of moments. The estimate of the returns to crime indicates a larger premium for criminal activity compared to work experience. This is consistent with the idea that experience in crime can lead to a potentially more risky and profitable outcome. Results from the DCDP model are consistent with empirical evidence produced in this work using a simple OLS regression, and criminal capital literature. The effect of schooling (legal and illegal) is positive and large in magnitude for both criminal and legal wages, meaning that schooling plays a key role in the determination of illegal and legal returns.

The model fit shows that the proposed model matches the actual data well. In fact, the predictions exhibit the same trends for schooling, crime and work of the actual data. Young men are more exposed to crime while attending high school and a large drop in crime is observed after high school graduation.

Three policies are simulated in order to answer the following question: what can be done to reduce juvenile crime? The first proposed solution is a decrease in the probability of having a delinquent peer. Such a decrease activates a mechanism that leads to a reduction of the criminal wage and capital, while an increase in the probability of being arrested is observed. These factors lead to a decrease in the proportion of youths choosing to commit offences. In particular, a decrease in the probability of a delinquent peer of 10% is associated with a decrease in crime of 1.6%. The second simulated policy has a larger impact on crime and consists of an extension of the U.S. work-study program to troubled adolescents attending high school. Its application increases the opportunity cost of crime allowing the youth to develop experience in the legal sector, which enables him to achieve higher work-related rewards. The impact of such a policy is not only immediate, but it also affects the decision process in the long-run. The last policy focuses on decreasing recidivism through a subsidy of $3,500 to ex-convicts choosing full time employment. Results show a decrease in recidivism equal to around 23%, again underling the important role played by the rewards offered by the alternative option.

In conclusion, this study shows the crucial importance of criminal embeddedness in the study of criminal choices and in the formation of criminal capital. It also offers policy makers some guidance to contrast juvenile crime and recidivism.

Further studies can look at the link between crime and substance use, but also at different dimensions of criminal capital. A behavioural model accounting for the decision to join a gang can also be produced, and the criminal capital concept used to explain the career path within the criminal organisation.

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# A Appendix to Chapter 2

## A.1 Correlation between homicide rate and mafia homicide rate

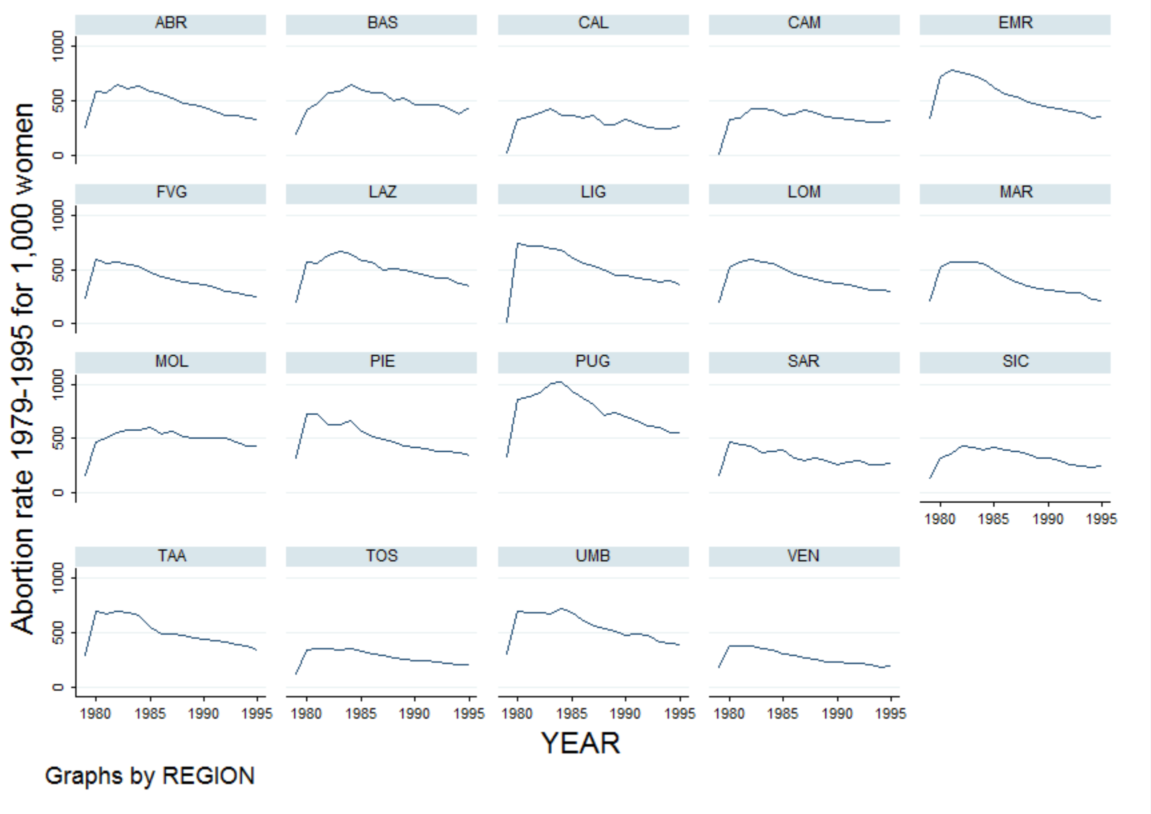
Table A.1: CORRELATION BETWEEN MAFIA HOMICIDE RATE (PER 100,000 INHABITANTS) AND HOMICIDE RATE (ATTEMPTED AND COMMITTED, PER 100,000 INHABITANTS)

| | ln(Mafia homicide rate) | ln(Homicide rate) |
|---|---|---|
| ln(Mafia Homicide rate) | 1 | |
| ln(Homicide rate) | 0.792 | 1 |
| p-value | 0.000 | |

## A.2 Additional information on the instrument

### A.2.1 Abortion rate per 1,000 women in Italian regions

Figure A.1: ABORTION RATE PER 1,000 WOMEN BETWEEN 1979-1995



### A.2.2 Correlation between abortion rate and GDP per capita

Table A.2: CORRELATION BETWEEN GDP PER CAPITA AND ABORTION RATE FOR 1,000 WOMEN DURING THE PERIOD 1979-1995

| | ln(GDP per capita) | ln(Abortion rate) | ln(Abortion rate$_{t-1}$) |
|---|---|---|---|
| ln(Abortion rate) | 0.025 | 1 | 0.584 |
| p-value | 0.648 | | 0.000 |
| ln(Abortion rate$_{t-1}$) | 0.041 | 0.584 | 1 |
| | 0.471 | 0.000 | |

## A.3 The effect of homicide rate on productivity

Table A.3: ESTIMATION OF EQUATION (2.6) WITH GDP PER UNIT OF LABOUR AS DEPENDENT VARIABLE

| Dependent variable:<br>ln(GDP per unit of labour) | (1)<br>POLS | (2)<br>FE | (3)<br>IV |
|---|---|---|---|
| Homicide rate | -0.030*** | -0.021* | -0.251*** |
| | (0.007) | (0.012) | (0.043) |
| Social Capital | 0.146*** | 0.022 | -0.064** |
| | (0.010) | (0.013) | (0.029) |
| Drop out rate | -0.004 | -0.029** | 0.012 |
| | (0.013) | (0.011) | (0.015) |
| Construction/Government Spending | 0.061*** | -0.003 | 0.044 |
| | (0.015) | (0.025) | (0.046) |
| Investment/GDP | -0.265*** | -0.004 | 0.047 |
| | (0.045) | (0.052) | (0.043) |
| Firms creation rate | 0.006 | -0.005** | -0.006* |
| | (0.005) | (0.002) | (0.003) |
| Population Density | 0.000*** | 0.000 | 0.001** |
| | (0.000) | (0.000) | (0.001) |
| Trend | 0.005*** | 0.003*** | 0.003*** |
| | (0.001) | (0.001) | (0.001) |
| $DU_{2008}$ | 0.047* | 0.024** | 0.021** |
| | (0.025) | (0.010) | (0.010) |
| $Du_{2009}$ | -0.014 | 0.002 | -0.015* |
| | (0.029) | (0.011) | (0.008) |
| Constant | 10.336*** | 10.861*** | |
| | (0.094) | (0.140) | |
| Observations | 289 | 289 | 289 |
| R-squared | 0.693 | 0.442 | |
| Adj.R-Squared | 0.682 | 0.422 | |
| F_stat | 101.015 | 25.908 | 142.268 |

NOTE : * p<0.1; ** p<0.05; *** p<0.01, standard errors in brackets

## A.4 The effect of homicide rate on productivity growth

Table A.4: ESTIMATION OF EQUATION (2.7) WITH GROWTH OF GDP PER UNIT OF LABOUR AS DEPENDENT VARIABLE

| Dependent variable: GDP per unit of labour growth rate | (1) |
|---|---|
| GDP per unit of labour$_{t-1}$ | -0.008 |
| | (0.011) |
| Homicide rate | -0.039* |
| | (0.023) |
| Social Capital | -0.015* |
| | (0.008) |
| Drop Out rate | 0.023* |
| | (0.013) |
| Construction/Government Spending | -0.035 |
| | (0.030) |
| Investment/GDP | 0.006 |
| | (0.026) |
| Firms creation rate | 0.002 |
| | (0.002) |
| Population Density | 0.0001 |
| | (0.000) |
| $DU_{i2008}$ | -0.019*** |
| | (0.007) |
| $DU_{i2009}$ | -0.037*** |
| | (0.005) |
| Observations | 272 |
| Number of instruments | 15 |
| Arellano-Bond test for AR(2) in first differences, | -0.95 |
| p-value | 0.344 |
| Hansen test | 1.58 |
| p-value | 0.904 |

Note: * p<0.1; ** p<0.05; *** p<0.01, standard errors in brackets

# B Appendix to Chapter 3

## B.1 Summary statistics for wages and criminal earnings

Table B.1: MEAN AND STANDARD DEVIATION FOR LEGAL AND ILLEGAL EARNINGS BY CHOICE AND CRIMINAL JUSTICE HISTORY

| | Legal wage | | Illegal Wage | |
|---|---|---|---|---|
| | Mean | Standard Deviation | Mean | Standard Deviation |
| Work | 18779.9 | 12136.5 | | |
| Crime | | | 3133.527 | 4954.894 |
| Work and Crime | 14479.65 | 9065.514 | 2102.683 | 6567.914 |
| School and Work | 11338.08 | 8154.636 | | |
| School and Crime | | | 2291.079 | 6604.435 |
| Any Choice | 15567.66 | 11157.53 | 2586.297 | 6241.781 |
| Previously imprisoned | 12494.56 | 8903.912 | 3149.126 | 5530.947 |

## B.2 The factors determining social criminal capital

Table B.2: LINEAR PROBABILITY MODEL RESULTS WITH SOCIAL CRIMINAL CAPITAL AS DEPENDENT VARIABLE

| Dependent variable: $Soc_a$ | (1) | (2) | (3) |
|---|---|---|---|
| Gang in neighbourhood | 0.239*** | 0.232*** | 0.219*** |
| | (0.009) | (0.009) | (0.010) |
| Previous imprisonment | | 0.097*** | 0.077*** |
| | | (0.011) | (0.012) |
| Cumulative experience in crime | | | 0.022*** |
| | | | (0.003) |
| Parents with degree | | | -0.024*** |
| | | | (0.005) |
| Age19-22 | | | -0.032*** |
| | | | (0.005) |
| Constant | 0.038*** | 0.029*** | 0.044*** |
| | (0.002) | (0.002) | (0.005) |
| R-squared | 0.119 | 0.130 | 0.141 |
| Adj.R-Squared | 0.119 | 0.130 | 0.141 |
| F_stat | 642.867 | 357.925 | 147.675 |

Note: * p<0.1; ** p<0.05; *** p<0.01, standard errors in brackets

## B.3 What does affect criminal choice?

Table B.3: LINEAR PROBABILITY MODEL RESULTS WITH CRIME AS DEPENDENT VARIABLE

| Dependent variable: Pr(crime=1\|X) | (1) | (2) | (3) |
|---|---|---|---|
| $Soc_a$ | 0.166*** | 0.118*** | 0.095*** |
| | (0.012) | (0.010) | (0.013) |
| Cumulative experience in crime | | 0.147*** | 0.139*** |
| | | (0.004) | (0.004) |
| Gang in neighbourhood | | | 0.027*** |
| | | | (0.007) |
| Previous imprisonment | | | 0.042*** |
| | | | (0.011) |
| Age | | | 0.039** |
| | | | (0.016) |
| Age squared | | | -0.002*** |
| | | | (0.00001) |
| Constant | 0.075*** | 0.010*** | -0.123 |
| | (0.002) | (0.002) | (0.145) |
| R-squared | 0.029 | 0.279 | 0.313 |
| Adj.R-Squared | 0.029 | 0.279 | 0.312 |
| F_stat | 193.168 | 747.446 | 302.564 |

Note: * p<0.1; ** p<0.05; *** p<0.01, standard errors in brackets

## B.4 Moments used in the estimations

Table B.4: MOMENTS USED IN THE ESTIMATIONS

| Moments |
|---|
| Choice distribution |
| Proportion of youths choosing crime, by specific age |
| Proportion of youths choosing crime and school, by specific age |
| Proportion of youths choosing crime and work, by specific age |
| Proportion of youths choosing work, by specific age |
| Proportion of youths choosing work and school, by specific age |
| Proportion of youths choosing school, by specific age |
| Proportion of youths choosing home, by specific age |
| Proportion of youths that completed high school |
| Criminal Wages |
| Average criminal wage by specific age |
| Average criminal wage by specific age and criminal justice history |
| Variance of criminal wage by specific age |
| Variance of criminal wage by specific age and criminal justice history |
| OLS regression of log criminal wage on experience, experience sq. and social criminal capital |
| Legal Wages |
| Average wage by specific age |
| Average wage by specific age and criminal justice history |
| Variance of criminal wage by specific age |
| Variance of criminal wage by specific age and criminal justice history |
| OLS regression of log wage on experience, experience sq. and high school completion |
| Apprehension, detention and social criminal capital |
| Proportion of youths arrested |
| Proportion of youths incarcerated |
| Proportion of youth with a delinquent peer |
| Correlation between criminal oganisation presence in the area and $Soc_a$ |
| Total number of moments: 161 |