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TIME DISCOUNTING AND CRIME: AGGREGATE EVIDENCE FROM THE ITALIAN REGIONS (2002-2007)

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TIME DISCOUNTING AND CRIME: AGGREGATE EVIDENCE FROM THE ITALIAN REGIONS (2002-2007)[♣]

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Abstract. This paper tests the relationship between time preferences and crime rates as posited by Davis (1988), whose theoretical analysis suggests that individuals' attitude towards the future significantly affect their propensity to commit crime. Our empirical analysis is based on a panel of Italian regions for the period 2002-2007. Various proxies for time preferences are considered: the consumer credit share out of the total amount of loans to households, the share of obese individuals out of the total population, and the rate of marriages out of the total population. In line with the theoretical prediction, our empirical analysis confirms that where people are more impatient and discount the future more heavily, property and violent crimes are higher. Results are robust to a number of alternative specifications including covariates drawn from the literature on the determinants of crime.

JEL Codes: D99, K42, Z13

Keywords: Time Preferences, Property Crime, Violent Crime, Italian Regions, Panel data.

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1. Introduction

The Ant and the Grasshopper - an Aesopian fable which became very popular just before the French Revolution - remarks the misfortune accruing to the grasshopper from imprudence, having it spent the warm months of the year singing away instead of storing up foods for the incoming winter. The allegory was used to give a bright description of the bourgeois virtues of hard working and saving, those virtues that the rising class - which would have soon taken the power - tried to attribute exclusively to itself. The bourgeois was depicted as l'*honnête homme* who grounds his success on both personal effort and the awareness that much *patience* is needed before the fruits accruing from hard-working and trustworthiness can be reaped.

A long-standing tradition in economics echoes similar arguments. This tradition emphasizes that the socially desirable respect of established ethical codes of conduct is possible only in the presence of a proper concern for the future. Such a concern, however, has varied significantly over the centuries and across cultures. Sociologists and anthropologists have in recent times emphasized that the vanishing of the future is actually one of the most distinctive features of modern societies: as uncertainty grows, individuals act as they were condemned to live an everlasting present (e.g. Augé, 2008).

In the eyes of an economist, the reduced concern for the future shows up in the long-term fall in saving rates across countries - a well-established feature of modern industrialized societies - but also in the widespread tendency of the amount of (short-term) debt to raise beyond what can be considered a socially responsible level, as the recent financial crisis has dramatically shown. Possibly, even the recent remarkable increase in corporate scandals may be ultimately due to a reduced concern for the future (coupled with some institutional changes which have considerably

affected the pay-off structure faced by managers and entrepreneurs in modern economies)[1].

More generally, there are grounds to argue that a 'life-is-now'-perspective may undermine the ethical codes of behaviour on which society is grounded, stimulating undesirable activities like delinquency and crime. Davis (1988) was the first to identify a *theoretical* link between crime and time preferences. In his words, this link finds an easy explanation in the fact that "the fruits of illegal activity…can be savoured *before* the costs of their acquisition must be paid" (Davis, 1988: 383). Hence, *ceteris paribus*, individuals who discount the future more heavily may be more prone to commit crimes.

The goal of this work is to provide a first empirical test to this theoretical prediction by considering both property and violent crimes. The main challenge is to find suitable proxies for time preferences. We focus on three very different measures: consumer credit, which represents short-term debt typically used by households to finance their consumption; obesity, which is linked to the intake of calories more than it is recommended by the consideration of future health; the willingness of individuals to engage in stable relationships, like the marriage. All these variables show clear trends in recent decades. The widespread tendency of both the amount of short-term debt and the number of obese people to increase, as well as the reduction in the willingness to engage in stable relationships, are common features of western industrialized countries, all of which may be (at least partly) related to time preferences.

Missing micro-data, our analysis is based on a panel of Italian regions observed over the period 2002-2007. In line with the findings of the growing scientific literature on crime, besides our main control for time preferences,

[1] Beraldo and Turati (2011) discuss several institutional changes that may have shortened the agents' time horizon. There are reasons to believe, for example, that contracts designed to provide professional managers adequate monetary incentives in order to align their objectives with those of the firms' owners may have led managers to maximise short term gains instead of long-term profits.

we also include in the models a number of covariates, like the unemployment rate, the GDP per capita, the level of education, the expenditure for law enforcement, the level of social capital.

Our main results basically confirm the 'Davis' hypothesis'. In particular we find that both violent and property crime are higher where people discount the future more heavily. This *ceteris paribus* correlation is especially clear in the case of violent crime, mainly when time preferences are proxied both by obesity and marriage rates. Additional covariates substantially confirm some well-established results in the literature on crime.

The remainder of the paper is organized as follows. In Section 2 we briefly describe the theoretical model due to Davis (1988). In Section 3 we illustrate our empirical strategy and our data. Results are discussed in Section 4. Section 5 briefly concludes.

2. The theoretical framework: time discounting and attitude to crime

Following Davis (1988), let us consider an individual contemplating illegal activity. If undetected she will get an income U(σ), where σ is the rate at which offences are committed. Suppose that the individual sees the future as split in two sub-periods: in the first sub-period she enjoys the fruits of illegal activity; in the second one she is possibly detected and punished. The individual does not know exactly when detection will occur. However, as soon as she is detected, a fine F must be paid, and - from then on - only an income Y accruing from some legal activity may be earned. Over an infinite time horizon, the expected present value of future income, accruing from both legal and illegal activity can be expressed as:

$$V(\sigma) = \int_0^{\infty} \{U(\sigma)[1 - G(t)] + YG(t) - Fg(t)\} e^{-rt} dt \qquad (1)$$

where $g(.)$ is the distribution of the time of detection, $G(.)$ is the cumulative of $g(.)$ and r is the individual discount rate, which summarise here the way individuals discount the future.

Let us now consider the probability of being detected within some small interval in the neighbourhood of t, $P(.)$, after having breached the law up to t. Assuming that the chances of being detected depend only on the offence rate at t and on the level of enforcement E, this can be written as:

$$P(\sigma,E)=\frac{g(t)}{1-G(t)} \tag{2}$$

The individual choice problem is that of maximizing (1) subject to (2). This optimal control problem is greatly simplified by the fact that $P(\sigma, E)$ is independent from time. With an infinite time horizon this implies σ to be constant, hence (2) can be written as a linear differential equation which can be substituted into (1). Integrating yields a reformulation of the objective of the agent, which is choosing σ such as to maximize:

$$V(\sigma,E)=\frac{U(\sigma)-Y-P(\sigma,E)F}{r+P(\sigma,E)}+\frac{Y}{r} \tag{3}$$

The numerator of the first term on the right-hand side of (3) represents the expected gains from crime (e.g., Becker, 1968); the denominator is the rate at which these gains are discounted. It is worth noticing that the effective discount rate is composed by the agent's usual time preference plus the probability of being detected. Therefore, the rate at which offences are committed, σ, determines both the expected income from crime and the rate at which such income is discounted.

The first order condition for a maximum, $\partial V(\sigma,E)/\partial\sigma = 0$, imposes that the usual condition of equating marginal costs and benefits must be satisfied in order for the choice of σ to be optimal. Some comparative statics

then reveals that $\partial\sigma / \partial r > 0$: that is, agents with higher discount rates will be more likely to commit crime, or, in other words, the amount of crime committed by different individuals can be explained by their attitudes toward the future. This is the theoretical prediction we aim at testing in the remainder of the paper.

3. The empirical strategy

3.1. An aggregate model of regional crime rates

We test the theoretical prediction briefly presented above by considering Italian regional data over the period 2002-2007. Since we use here aggregate data starting from an individual choice problem, we need to discuss aggregation issues before moving to our empirical analysis (e.g., Blundell and Stoker, 2005; Durlauf et al., 2008 and 2010). A standard representation of the individual expected utility associated with the choice of committing crime, which can be interpreted as a (linear) empirical counterpart of Eq. (3) above, is:

$$u_{it}(\sigma_{it}) = r_{it}\phi\sigma_{it} + X_{it}\gamma\sigma_{it} + Z_{lt}\beta\sigma_{it} + \xi_{lt}\sigma_{it} + \varepsilon_{it}\sigma_{it} \qquad (4)$$

where $\sigma=[0,1]$ is an indicator for having (1) or not (0) committed crime; r is the individual discount rate; X and Z are, respectively, individual (index i) and region (index l) specific observable variables that the literature on crime deems to important; ξ and ε are individual and region specific unobservables; finally, ϕ, γ, and β are (unknown) parameters describing preferences. Following Durlauf et al. (2008), we make the following assumptions to restrict the nature of unobserved heterogeneity:

$$\text{A.1.} \quad E\left[\varepsilon_{it}(1) - \varepsilon_{it}(0)\right] = 0$$

A.2. $[\xi_{lt}(1)-\xi_{lt}(0)]$ is independent of $[\varepsilon_{it}(1)-\varepsilon_{it}(0)]$

A.3. $[\varepsilon_{it}(1)-\varepsilon_{it}(0)]$ is independent of *r*, *X* and *Z*.

The i-th individual will commit crime if and only if $[u_{it}(1)-u_{it}(0)]$ is (strictly) positive, which implies:

$$r_{it}\phi + X_{it}\gamma + Z_{lt}\beta + [\xi_{lt}(1)-\xi_{lt}(0)] + [\varepsilon_{it}(1)-\varepsilon_{it}(0)] > 0 \tag{5}$$

or:

$$r_{it}\phi + X_{it}\gamma + Z_{lt}\beta + [\xi_{lt}(1)-\xi_{lt}(0)] > [\varepsilon_{it}(0)-\varepsilon_{it}(1)] \tag{6}$$

Eq. (6) makes clear that, conditional on *r*, *X*, *Z*, and $[\xi_{lt}(1)-\xi_{lt}(0)]$, individual choices are stochastic. Let us denote by A_{it} the cumulative distribution function of $[\varepsilon_{it}(0)-\varepsilon_{it}(1)]$; the probability to commit a crime can then be written as:

$$\Pr(\sigma_{it}=1 \mid r_{it}, X_{it}, Z_{lt}, \xi_{lt}(1)-\xi_{lt}(0)) = A_{it}(r_{it}\phi + X_{it}\gamma + Z_{lt}\beta + \xi_{lt}(1)-\xi_{lt}(0)) \tag{7}$$

This (conditional) probability to commit crime at the individual level can then be aggregated to obtain the (expected) regional specific crime rate Δ_{lt}:

$$E(\Delta_{lt} \mid F_{r_{it}}, F_{X_{it}}, Z_{lt}, \xi_{lt}(1)-\xi_{lt}(0)) = \int A_{it}(r\phi + X\gamma + Z_{lt}\beta + \xi_{lt}(1)-\xi_{lt}(0)) \tag{8}$$

where F_r and F_X are the empirical distribution functions in the l-th region of the discount rates and the individual controls *X*. Further assuming that:

A.4. dA_{it} follows a uniform distribution

we can derive the following linear regression model, which is our estimating equation to be tested below:

$$\Delta_{lt} = \bar{r}_{lt}\phi + \overline{X}_{lt}\gamma + Z_{lt}\beta + \xi_{lt}(1) - \xi_{lt}(0) + \vartheta_{lt} \tag{9}$$

where $\bar{r}_{lt}$ and $\overline{X}_{lt}$ are the empirical means of the discount rates and the variables in X within the l-th region, and ϑ_{lt} is the difference between realized and expected crime rates.

As for region specific crime rates Δ_{lt}, we consider both *property crime* and *violent crime* as measured by the Italian National Institute of Statistics (ISTAT). In particular, the property crime rate is the number of property crimes (like thefts, robberies, frauds and burglaries) per 1,000 inhabitants. The violent crime rate is the number of violent crimes (like rapes, homicides, kidnappings and injuries) per 10,000 inhabitants. Grounding on Davis (1988), we expect time preferences to be more important in the case of violent crime, as, given the level of enforcement, an higher discount rate is in this case generally required for an action to pass a cost-benefit test.

Before moving further it is worth noticing that – as the previous discussion make clear – we need a number of assumptions for model in Eq. (9) to be an adequate representation of the aggregate behaviour of individuals located in different regions. For instance, as highlighted by Durlauf et al. (2008), there is no reasons for the orthogonality assumptions to hold. Hence, this means that most (if not all) estimated coefficients will be biased, and one cannot make a correct causal inference. Moreover, as we discuss below, this problem is exacerbated here by the fact that we can measure only imprecisely the average discount rate. Our exercises below must then be interpreted as the search for robust *ceteris paribus* correlations.

3.2. Proxying time preferences

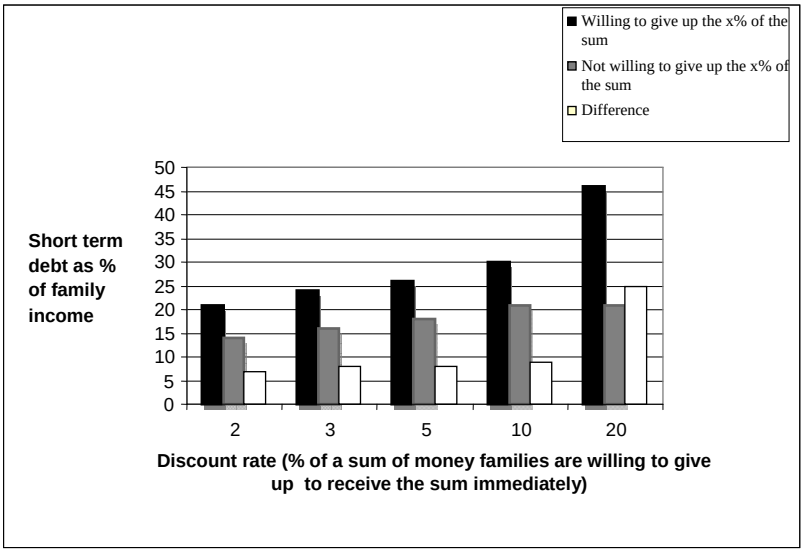
The main challenge for our analysis is to find proxies for the time preferences. We consider three different proxies, all of which can only capture loosely the discount rate: (i) the consumer credit share; (ii) the share of obese people; (iii) the marriage rate.

Consumer credit share. The consumer credit share is the most intuitive of such proxies. It measures the share of consumer credit out of total loans supplied to households. Consumer credit is a typical form of short-term debt, whereas total loans include, for instance, mortgages, that are typical long-term debts. According to the definition provided by the Bank of Italy in its official statistics, 'consumer credit' includes only short-term debts commonly financing the purchase of consumer goods, like - for instance - holidays or small appliances. The higher the discount rate - hence the lower the utility attached to future consumption - the higher should be the willingness to obtain short-term loans to increase current consumption. As the ability to obtain these types of loans depends also on the credit supply at the regional level, to define the variable *Consumer Credit Share* we standardize the total amount of short-term debt by the total amount of loans supplied to households.

Considering US data on credit card borrowing, Meier and Sprenger (2010) shows that present-biased individuals (i.e., individuals who show a particular desire for immediate consumption) are indeed more indebted, hence providing evidence of a strong correlation between time preferences and consumer credit. No studies are available on Italian data. However, as a simple test of the goodness of this measure to proxy for time preferences, one can consider Figure 1 below. Data are taken from the 2004 Bank of Italy Survey on Household, Income and Wealth (SHIW). We plot short term debt as a percentage of family income on the vertical axis, and some different values of the discount rate on the horizontal axis. Data on discount rates are collected in the SHIW by considering the percentage of a sum of money

available one year after the time of the interview that a particular family is willing to give up in order to get that (discounted) sum immediately.

Fig 1. Short term debt as a percentage of family income for the purchase of non durable goods



Source: Our calculations on Bank of Italy-SHIW data (2004).

Black bars refer to households willing to give up x% of the sum, whereas grey bars refer to households not willing to take up the deal. The white bars represent the difference between those who are willing to give up x% of the sum and those who are not. The Figure shows a clear positive association between the interest rate and the difference in the stock of short term debt as a percentage of family income. Intuitively, families more inclined to get into short term debt are also more impatient, and ask for more consumer credit relative to less impatient households. However, Figure 1 makes it clear that - quite obviously - consumer credit is used by less impatient households *too* as suggested by the few studies available on this type of loan. It is noteworthy that, considering European data, Magri et al. (2011) show that consumer credit is less widespread in Italy relative to other countries (multivariate analysis suggests that this type of short-term debt is primarily used both by larger households with youngest and well educated heads, and

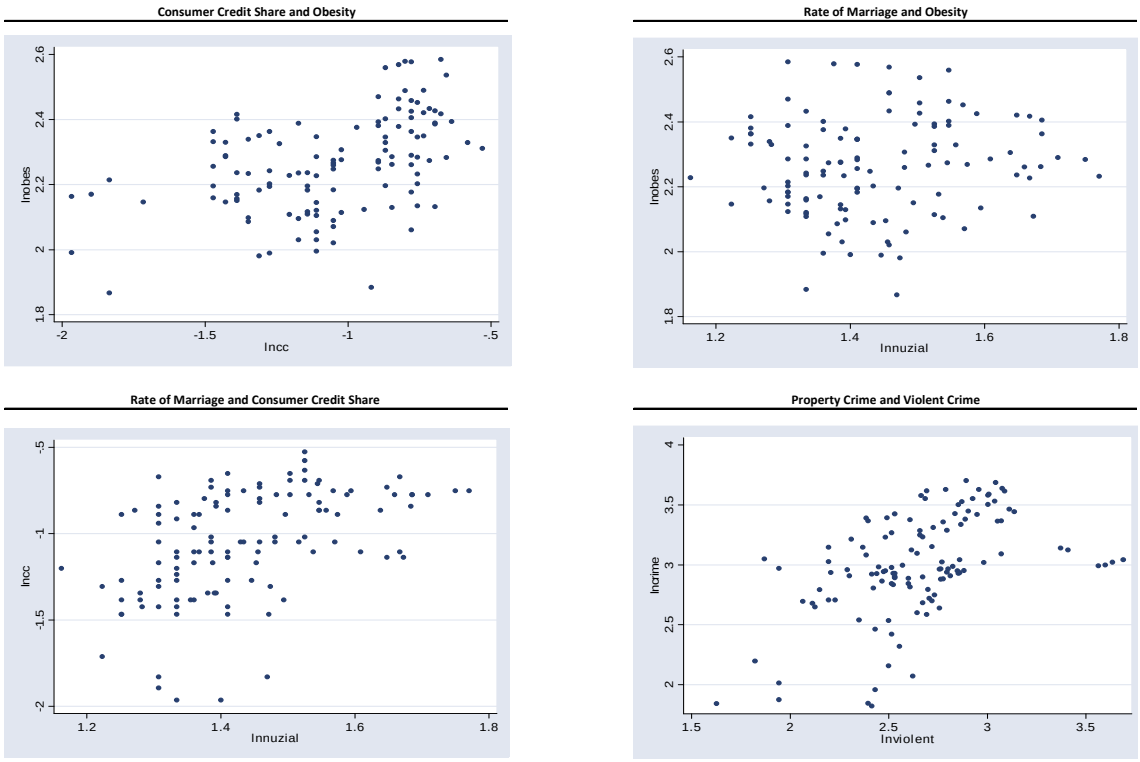
by poorer households). Delinquencies (i.e., problems in repaying consumer credit) are however higher in Italy relative to other countries. They are more frequent among poor households, and more common for the unemployed relative to other positions. Meier and Sprenger (2011) add that less patient individuals are more likely to default than more patient ones, suggesting that time discounting is also correlated to creditworthiness and not only to the willingness to get into short term debt.

Share of obese people. The second proxy for time preferences is the share of obese people out of the total population. Following international standards, obese people are defined according to their Body Mass Index (i.e., BMI $\geq$ 30). As suggested for instance by Borghans and Golsteyn (2006), the link between BMI and the individual discount rate can be traced by considering the immediate gratification of eating and the future effects of over-eating, both in terms of physical appearance and – most importantly – in terms of reduced health. Again, the higher the discount rate, the lower the utility attached to future health, hence the higher the food intake in the current period, which is likely to increase BMI. As before for consumer credit, the available empirical evidence highlights an association between BMI and some measures of time preferences at the individual level, although time preferences alone are not able to give a complete account of the sharp increase in the number of obese people observed in many countries (e.g., Borghans and Golsteyn, 2006; Daly et al., 2009).

Marriage rate. The third proxy for time preferences is the marriage rate, defined as the number of marriages per 1.000 individuals. The historical decline in marriage rates across industrialized countries and the change in marriage customs are discussed, for example, by Akerlof (1998) and Stevenson and Wolfers (2007). Akerlof (1998) also examines the impact of these changes on society at large, arguing that the observed widespread delay in settling down is likely to cause more crime and more substance

abuses with adverse effects upon the subsequent generations; notice that this establishes a direct link between marriage customs and crime.

Fig 2. Scatter plots for time preferences' proxies and crime rates



To the best of our knowledge, only Compton (2009) discusses the relationship between heterogeneity in time preferences and marriage stability, finding some evidence to support the idea that more patient individuals are less likely to divorce. Grounding on this finding we expect a negative correlation between marriage rates and crime: *ceteris paribus*, the higher the discount rate, the lower the utility attached to the future, hence the willingness to enter long term relationships.

Figure 2 reports four scatter diagrams to provide a snapshot of the correlation between the variables used to proxy for time preferences (in logs). Each point represents an Italian region in one particular year. It emerges a sizeable (linear) correlation between the consumer credit share and both the rate of marriage (r = 0.48) and the share of obese people out of

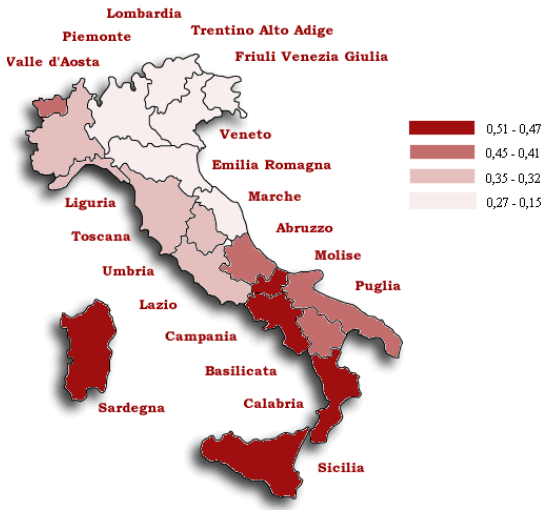
the total population (r = 0.46). On the contrary, much milder is the correlation between the rate of marriage and the share of obese people (r = 0.10). Finally, a scatter plot concerning property and violent crime is also reported. Property and violent crimes are positively correlated.

Figure 3 reports the geographical distribution of the variables proxying for time preferences and the regional distribution of both property and violent crime. All the variables are averaged over the period 2002-2007. Panel A displays the regional distribution of the consumer credit share. There is a clear North-South gradient, with South-Western regions reporting the highest values and North-Eastern regions reporting the lowest ones. A similar gradient is observable for the share of obese individuals out of the total population, although the picture is somewhat reversed in that the highest (lowest) values are achieved in South-Eastern (North-Western) regions, as Panel B shows.

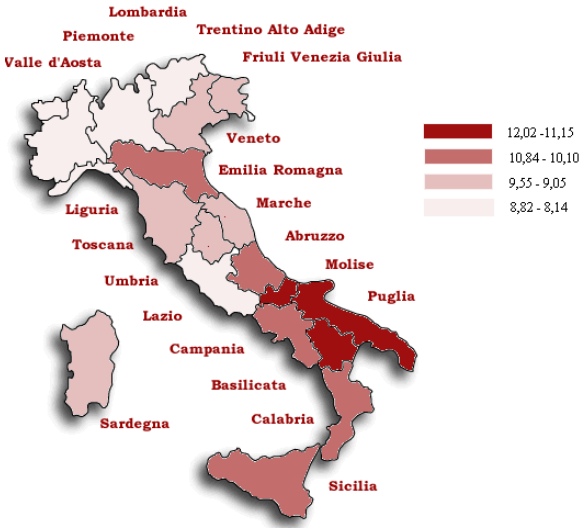
A very clear picture emerges also as far as the marriage rate is concerned. As Panel C shows it is generally higher in the South of Italy and declines as one moves from South to North.

Fig 3. Geographical distribution for time preferences' proxies

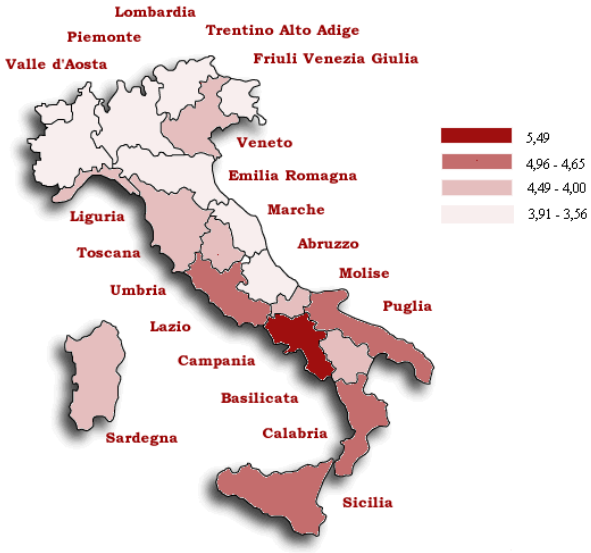
Panel A. Consumer credit share



Panel B. Share of obese people

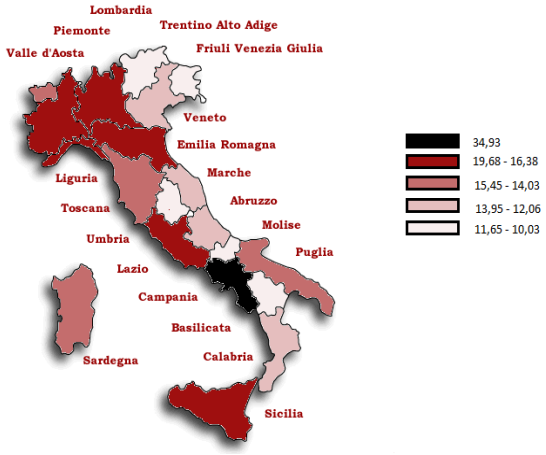


Panel C. Marriage rate

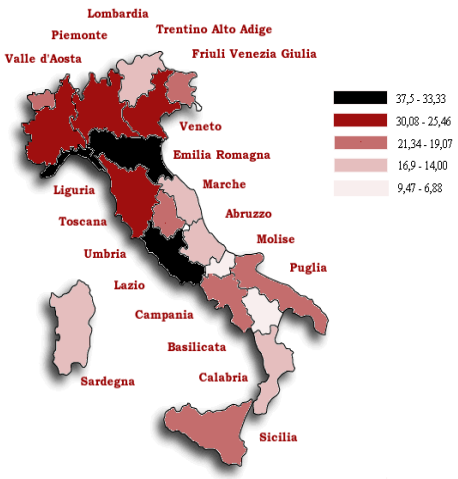


Besides the distribution of the proxies for time preferences, we also consider the distribution across regions of both property and violent crimes. As for violent crime, Panel D suggests that there are two big areas in which violent crime is concentrated. The first is the North-Western area including regions such as Lombardia, Piemonte and Emilia Romagna. The second area is more on the South-West side of Italy and includes regions such as Lazio, Campania and Sicilia . A similar distribution is observable also for property crimes (Panel E). Also in this case higher crime rates are observable on the South-West side of Italy, with the richest Northern regions (Piemonte, Lombardia, Emilia Romagna, Toscana) having the lion's share.

Panel D. Violent Crime Rates



Panel E. Property Crime Rates



3.3. Additional controls for crime

As additional controls, we consider a number of variables that the economic literature on crime deems to be important. We cluster these additional variables into five groups: 1) current economic opportunities; 2) future economic opportunities; 3) education; 4) enforcement and deterrence; 5) social capital. We discuss each in turn. Descriptive statistics and definitions are in Table A1 in the Appendix.

Current economic opportunities. We measure current (and past) economic opportunities by including in our models lagged GDP per capita and different measures of the unemployment rate, such as the long-term unemployment rate and the youth unemployment rate. With regard to unemployment, some theoretical studies predict a positive association between crime and unemployment, as the latter is considered a variable reliably capturing the opportunity costs associated to crime (e.g., Freeman, 1999; Ehrlich, 1996, 1973). This hypothesis has found robust empirical evidence for property crime (e.g., Neumayer, 2005; Levitt, 2001; Britt, 1997; Reilly and Witt, 1996; Allen, 1996; Chiricos, 1987; Phillips and Votey, 1981; Sjoquist, 1973). On the contrary, taking into consideration violent crime, there is a strand of literature which - by focusing on the 'opportunity perspective' - interprets the level of unemployment as an indicator of 'social inactivity', and posits a negative relationship between crime and unemployment. As unemployed are engaged in a reduced number of social interactions, their opportunities for delinquency are reduced[2]. In other words the 'opportunity perspective' maintains that a negative association between crime and unemployment is what one should expect. Although such interpretation has been proposed for both property and violent crimes (Cantor and Land, 1985), some evidence is available only as far as violent

[2] The direct role of social interactions on crime is discussed, for instance, by Glaeser et al. (1996) and Zenou (2003). The evidence that social interactions impact more on certain types of crime is consistent with the literature on the 'opportunity perspective'.

crime is concerned (e.g., Saridakis 2004; Levitt, 2001; Entorf and Spengler, 2000, Britt, 1997). While dealing with unemployment, in particular, we follow the empirical strategy expounded in Allen (1996) and Levitt (2001), thus focusing on the one year lagged values of both unemployment rates. Eventually, in line with a recent work by Fougère et al., (2009) we also control for youth unemployment, which is expected to increase crime[3]. This is particularly important in Italy which has traditionally the highest rate of youth unemployment among the G7 countries[4].

We also consider GDP per capita as an explanatory variable, as it has been proved to be significantly related to crime in the Italian case (Caruso, 2011; Scorcu and Cellini, 1998; Marselli, 1997). However, GDP per capita can have an impact on crime which is not perfectly predictable ex-ante. On the one hand, taking income per capita as a measure of economic opportunities, one can expect that where GDP is higher, opportunities are better, hence the tendency to commit crime should be lower. On the other hand, where GDP per capita is higher, opportunities for crime are higher, especially opportunities for property crime, as an higher level of income will lure criminals, impacting positively on crime rates.

Future economic opportunities. Current economic opportunities might catch only partly the set of incentives related to criminal activities. Indeed one might also indulge in crime when she expects lower future economic opportunities, somewhat anticipating the worsening of her economic situation. For this reason, two variables proxying for future economic opportunities have also been introduced in the model: investments in manufacturing and patent intensity. In a productive (non-parasite) economy, investments in manufacturing today are indeed supposed to be a

[3] A related argument focuses on both the frustration and the political violence emerging in the presence of growing rates of youth unemployment (Caruso and Schneider, 2011).

[4] For example in 2005 the youth unemployment rate in Italy was 24% while it was significantly lower in France (20.2%) Germany (15.5%), Japan (8.7%), UK (12.8%), USA (11.3%).

proxy of economic opportunities tomorrow. Therefore a negative relationship between investments in manufacturing and crime is expected. The use of this covariate is novel in the literature on crime. The only exception is the study by Caruso (2009), showing that a negative relationship between investments in manufacturing and crime rates holds for the case of organised crime in Italy.

As a second measure of future opportunities we consider patent intensity. Where patent intensity is higher, the development of new products is also higher, hence we expect better future economic opportunities and, as before, a negative relationship with crime.

Education. Another recurring feature of studies investigating the determinants of crime concerns its relationship with education. The established literature highlights a negative correlation between education and crime (e.g., Groot and van den Brink, 2010; Dills et al., 2008; Lochner and Moretti, 2004; Soares, 2004; Gould et al., 2002; Miron, 2001; Grogger, 1998), as education is expected to increase the returns of legitimate work and business, hence the opportunity costs of committing crime. Moreover, education is expected to have a deep impact on behaviour, as it frames individuals' beliefs and preferences. In a sense, more educated people should be better able at figuring out future consequences of their actions. Education can therefore be viewed either as a proxy for time preferences (we expect individuals with a longer time horizon to invest more in education), or as a variable which can heavily influence time preferences via its impact on the ability of individuals to figure out future scenarios (e.g., Borghans et al., 2008). We experiment with two measures for education: the share of the population between 25 and 64 years old holding a high school diploma, and the share of the population between 20 and 24 years old holding a high school diploma. The two variables capture different cohorts of individuals. For the former, diploma was less likely and really be a signal for patience. On the contrary, for the latter, diploma is much more common, and those

more patient would further improve their education enrolling in a university course.

Enforcement efforts. As for the level of law enforcement, we consider the current public expenditure in security on a regional basis. The use of such a variable is directly suggested by the model presented in Section 2, where the probability of being detected - which is clearly affected, as discussed by Davis (1988), by the amount of resources available to the Authorities to enforce legal rules - affects the effective discount rate of each agent (see Eq. 3 above). However, one of the recurring issues raised in the literature is that any measure of deterrence might be really co-determined with crime. This can explain why, in the empirical literature, different measures of deterrence are not statistically significant or, quite frequently, even positively related to crime (e.g., Benson et al., 1994*a*,*b*; Cameron, 1988; Devine et al., 1988; Cloninger and Sartorius, 1979; Corman et al., 1987).

Social capital. Finally, we also control for 'social capital' which began to be investigated in recent literature (Akçomac and ter Weel, 2012; Loureiro et al.,2009; Lederman et al., 2002; Rosenfeld et al. 2001). As for Italy, Buonanno et al. (2009) study whether social capital reduces crime, considering provincial level variations in associational networks. They find that a standard deviation increase in association density is related, for example, with a reduction in car thefts by 13 percentage points. Here we sum up social capital considering another commonly adopted measure, namely the ratio of volunteers in not-for-profit organizations out of the population. We expect a negative correlation with crime rates.

4. Results

We experimented with several different models using a fixed effects specification to control for unobserved heterogeneity across regions, that

cannot be captured by our covariates. Results are in Tables 1-3 for property crime and in Tables 4-6 for violent crime. For both types of crime we first estimated a very simple model including our proxies for time preferences only, and then augmented this baseline model by introducing those variables that the established literature indicates as important determinants of crime. We augment the baseline model by introducing one group of variables at a time: current economic opportunities; future economic opportunities; education; enforcement efforts; social capital. Results are substantially similar for both property and violent crime. The main findings of our empirical analysis follow.

The Davis' hypothesis. First, we find evidence supporting the Davis' hypothesis that time preferences are an important determinant of crime. This evidence is particularly clear when time preferences are proxied by either the share of obese people or the marriage rate. Remarkably, the coefficient for obesity is always positive and statistically significant in both cases of property and violent crime.[5] As for the marriage rate, the coefficient is always negative and statistically significant in the case of violent crime; in the case of property crime, it is still negative but turns insignificant whenever the variables capturing the level of education are added to the model. Results are less clear cut when using the consumer credit share as a proxy for time preferences (see tables 1 and 4 below). In fact, the consumer credit share coefficient is both positive and significant only in the baseline model (col. I). Its effect turns even negative and statistically significant in some specifications in which education is added to the model. This is probably due to the fact that consumer credit is only partly linked to time preferences.

[5] One may argue that more obese people are more prone to commit crime, since they have fewer opportunities in the labour market than non-obese. Evidence on this point is provided for instance by Price (2009). In this case, our results may simply be due to a story of opportunities, and be totally unrelated to time preferences. However, notice that we control for unemployment, so that the estimated coefficient for obesity is net of the effect working through the labour market, and seems to be a truly 'time-preference' effect.

[TABLE 1 AND 4 ABOUT HERE]

Indeed, considering coefficients' magnitudes, we observe in general that adding to the model extra covariates produces the effect of reducing the coefficients' size. This suggests that the variables proxying for time preferences are likely to be affected by other interacting factors, such as per capita income or the level of education. In fact, Meier and Sprenger (2010) shows that 'individual discount factors' – a more precise measure of time preferences, elicited in incentivized choice experiments – are associated to gender, education, but also disposable income. In those cases in which these interacting factors are important determinants of the specific variable proxying for time preferences, the estimated impact of the latter on crime shrinks, because its residual variability is not sufficient to accurately identify the coefficients. Notably, this happens for example in the case of consumer credit: we know that young and well educated people besides poor people use this type of credit to finance their consumption (Magri et al., 2011).

Current economic opportunities. Second, we observe that current economic opportunities have a different impact on property and violent crime. As far as property crime is concerned, the GDP coefficient is always positive and almost always statistically significant in models not controlling for the level of education; it turns insignificant when education is used as an additional control (see Tables 1-3, col. VI-IX).

[TABLES 2 AND 3 ABOUT HERE]

This is quite unsurprising, for education and GDP are strictly related and they probably tell a quite similar story in relation to crime.

As far as unemployment is concerned, we find that the coefficient for the unemployment rate is never statistically significant, whereas the coefficient for youth unemployment is always positive and statistically significant. Overall the evidence seems to indicate a negative effect of long-term unemployment on property crime, even if statistical significance strongly depends on both the model specification and the variables used to proxy for time preferences. Apparently, then, when young generations cannot find a job, they are more prone to indulge in property crimes.

A different story comes up when violent crime is considered. Coefficient on GDP per capita is positive and statistically significant in models not including any measure of education among the explanatory variables. Controlling for education makes the coefficient associated to GDP insignificant. Such coefficient moreover turns negative and significant when a proxy for social capital is included. This suggests the existence of a strong relationship between GDP per capita and measures of social capital, as pointed out by a now well-established literature (e.g., Knack and Keefer, 1997). These results hold with any of the variables proxying for time preferences (see Tables 4-6).

[TABLES 5 AND 6 ABOUT HERE]

It is worth mentioning that, considering violent crime, the coefficient measuring the impact of the unemployment rate is always negative and statistically significant (whereas coefficients for both long-term unemployment and youth unemployment are never significant). These results support the 'opportunity perspective' discussed above. Remarkably, these results hold irrespective of the variables used to proxy for time preferences.

Future economic opportunities. Third, we find evidence that future economic opportunities are negatively correlated with crime. Coefficients on

both variables measuring future prospects are almost always negative and statistically significant. In particular, as far as property crime is concerned, the coefficient for patent intensity is always negative and statistically significant. Remarkably, the range within which the coefficient varies is very narrow, no matter neither the specific variable used to proxy for time preference nor the model specification. The coefficient associated with investment in manufacturing always displays the expected sign, however, it is not statistically significant when a measure of social capital is introduced (see Tables 1-3).

The situation appears somewhat reversed when focusing on violent crime. In this case patent intensity almost always does not display a statistically significant effect (Tables 4-6), whereas investment in manufacturing does.

Besides the easiest explanation working via an 'income effect', a possible additional interpretation for these results is that where investments in both manufacturing and R&D are higher, people hold a stronger concern for the future.

Education. Fourth, as for the variables measuring the level of education, we find that only the share of the population between 25 and 64 years old holding a high school diploma matters. In particular, as far as property crime is concerned, the coefficient associated to this variable is negative and statistically significant only in models not including a proxy for social capital, (see Tables 1-3). Such a coefficient is however negative and statistically significant in all models explaining violent crime which consider the share of obese individuals and the marriage rate as proxies for time preferences (Tables 5 and 6). On the contrary, the coefficient measuring the impact of the variable High-school 20-24 on crime is never statistically significant. The negative association between education (as measured by the share of the population between 25 and 64 years old holding an high school diploma) and crime, confirms previous literature and suggests one easy

interpretation: education increases the returns of legitimate work, hence the opportunity costs of committing crime.

Enforcement. Fifth, consistently with the scientific literature on the determinants of crime, we find that the coefficient associated to public expenditure in security is never statistically significant in models considering property crime (Tables 1-3), whilst it is almost always insignificant in the case of violent crime (Tables 4-6). Coefficient on security turns out to be positive and statistically significant only when time preferences are proxied by consumer credit share in the case of violent crime (Table 4). Simultaneity bias is a plausible explanation of this apparently odd result, as crime rates clearly influence expenditure in security.

Social Capital. Finally, notice that the coefficient on our proxy of social capital is consistently negative and statistically significant in all models, except when time preferences are proxied by marriage rates in models where violent crime is the dependent variable (Table 6, col. IX). Hence, as largely expected, where people volunteer more, crime rates are lower. This finding should be thought more as a correlation than as a causal link between the two variables, since volunteering and crime are likely to be determined by some common underlying (cultural) factor, captured by the fixed effects included in the model.

5. Concluding remarks

In this paper we propose a first empirical test on the relationship between time preferences and crime using as a sample the whole set of Italian regions observed over the period 2002-2007. We consider both property and violent crimes. We proxy time preferences employing: 1) the amount of short-term debt to finance consumption (the consumer credit share); 2) the prevalence of obese people according to their body mass index (obesity); 3)

the willingness of individuals to engage in stable relationships (the marriage rate). In line with the theoretical prediction by Davis (1988), we find that where people are more impatient and discount the future more heavily, property and violent crimes are higher. In particular, the correlation between crime rates and time preferences is especially robust when time preferences are proxied both by the obesity and the marriage rates. Results are robust even when controlling for variables drawn from the established literature on crime, as well as when considering "measurement errors" in proxies for time preferences. Indeed, additional covariates (like current economic opportunities, education, security expenditures and social capital) substantially confirm the results already available in the literature on crime. A more novel result – emphasising the importance of the future - is the association between future economic opportunities and crime: where future economic prospects are expected to be better, crime rates are lower.

If time preferences are consistently associated with crime rates, it becomes important to understand how these preferences are shaped. One possibility is to think at these preferences quite *deterministically,* as fashioned, for instance, by cognitive (unobserved) abilities and/or other biological characteristics. This is not without consequences, however. Dohmen et al. (2010) suggest for example that cognitive ability and impatience are negatively correlated. One may therefore think that individuals with reduced cognitive ability are more prone to commit crime.[6] Daly et al. (2009) find that discount rates correlate positively with systolic blood pressure. Again, supporters of the deterministic vision would advocate that hypertensive individuals are more prone – *ceteris paribus* - to engage in antisocial activities. These ideas are not new. Indeed they imply that the propensity to commit crime is *biologically* determined, an hypothesis very close to the one first advanced by the Italian anthropologist Cesare Lombroso, and now firmly rejected on scientific grounds.

[6] Beraldo (2010) questions the findings of studies using some measure of cognitive ability (that is, some measure of the intelligent quotient, IQ).

An alternative hypothesis is that time preferences are *socially* determined. In other words, they are mostly determined by social processes related to the cultural transmission of values and norms. In this sense, our analysis at a regional level might properly catch the 'average' time preferences in a given *social context*. How society influences time preferences is then a key challenge for future research.

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Table 1. Property crime and consumer credit share (FE estimates)

	I	II	III	IV	V	VI	VII	VIII	IX
Consumer credit share	**.344****	.132	.126	.216	.201	-.210	-.190	.027	.088
	(.160)	(.189)	(.186)	(.181)	(.177)	(.196)	(.192)	(.228)	(.222)
GDP per capita (t-1)		**1.545****	**1.883*****	**1.341****	**1.563****	-.351	-.048	-.816	-.553
		(.775)	(.750)	(.739)	(.714)	(.804)	(.799)	(.828)	(.813)
Unemployment (t-1)		-.002		.038		.036		.028	
		(.056)		(.055)		(.052)		(.053)	
Long-term unemployment (t-1)			-.053		-.068		-.075		**-.087****
			(.053)		(.051)		(.048)		(.047)
Youth unemployment (t-1)			**.091****		**.101****		**.071***		**.072***
			(.048)		(.046)		(.043)		(.043)
Investments in Manufacturing				**-.212*****	**-.22*****	-.116	**-.129***	-.0868	-.097
				(.0860)	(.082)	(.083)	(.079)	(.0847)	(.081)
Patent intensity				**-.068*****	**-.068*****	**-.069*****	**-.068*****	**-.0735*****	**-.073*****
				(.023)	(.0239)	(.0215)	(.0211)	(.0213)	(.021)
High School 20-24						-.0346	-.1008	-.066	-.121
						(.305)	(.298)	(.305)	(.294)
High School 25-64						**-1.772*****	**-1.698*****	-.801	-.650
						(.426)	(.426)	(.610)	(.600)
Security								**-.765**	-.405
								(1.098)	(1.065)
Social capital								**-3.265****	**-3.111****
								(1.767)	(1.708)
Constant	**3.357*****	**-13.15**	**-16.80****	-7.30	-11.48	14.565	**11.621**	**22.033****	16.74
	(.169)	(8.293)	(8.000)	(8.01)	(7.741)	(9.320)	(9.243)	(11.740)	(11.476)
Obs	120	120	120	120	120	120	120	120	120
Groups	20	20	20	20	20	20	20	20	20
R square within	.0444	.0858	.1248	.1938	.2407	.3228	.3537	.3571	.3936
R square between	.1809	.5096	.5041	.4645	.4740	.3564	.1465	.2138	.1174
R square overall	.1604	.4874	.4824	.4469	.4563	.3238	.1165	.2014	.1097

Notes: *** significant at 1%, ** significant al 5%, *significant at 10%. For sake of readability statistically significant coefficients are in bold. Standard Errors in parenthesis.

Table 2. Property crime and obesity (FE estimates)

	I	II	III	IV	V	VI	VII	VIII	IX
Obesity	**.306*** **	**.243*** **	**.262*** **	**.258*** **	**.277*** **	**.176** **	**.199** **	**.175***	**.184** **
	(.091)	(.095)	(.094)	(.0910)	(.089)	(.0920)	(.0899)	(.101)	(.098)
GDP per capita (t-1)		**1.305** **	**1.651*** **	**1.254** **	**1.483*** **	-.553	-.226	-.803	-.470
		(.687)	(.647)	(.650)	(.608)	(.792)	(.780)	(.793)	(.778)
Unemployment (t-1)		-.002		.030		.045		.024	
		(.054)		(.0532)		(.051)		(.052)	
Long-term unemployment (t-1)			-.071		**-.081***		**-.088** **		**-.087** **
			(.051)		(.049)		(.047)		(.046)
Youth unemployment (t-1)			**.094** **		**.106*** **		**.080** **		**.073***
			(.046)		(.044)		(.042)		(.042)
Investments in Manufacturing				**-.179** **	**-.194*** **	**-.1345***	**-.146** **	-.105	-.117
				(.083)	(.078)	(.0797)	(.076)	(.084)	(.080)
Patent intensity				**-.072*** **	**-.073*** **	**-.075*** **	**-.074*** **	**-.076*** **	**-.076*** **
				(.0226)	(.022)	(.0213)	(.021)	(.021)	(.0204)
High School 20-24						.0993	.034	.0311	-.011
						(.30)	(.299)	(.305)	(.294)
High School 25-64						**-1.308*** **	**-1.222*** **	-.665	-.618
						(.381)	(.381)	(.466)	(.456)
Security								-1.510	-1.175
								(1.161)	(1.118)
Social capital								**-3.658** **	**-3.347** **
								(1.688)	(1.619)
Constant	**2.303*** **	**-11.303**	**-15.02*** **	-9.310	**-11.62** **	14.2668	**10.964**	**25.794** **	**20.147***
	(.206)	(7.218)	(6.738)	(6.874)	(6.42)	(9.198)	(9.059)	(11.75)	(11-42)
Obs	120	120	120	120	120	120	120	120	120
Groups	20	20	20	20	20	20	20	20	20
R square within	.1018	.1391	.1866	.2456	.3025	.3406	.3798	.3775	.4154
R square between	.3576	.5039	.4994	.4624	.4689	.4870	.4452	.2855	.2174
R square overall	.1650	.4831	.4790	.4460	.4525	.4514	.3989	.2698	.2044

Notes: *** significant at 1%, ** significant al 5%, *significant at 10%. For sake of readability statistically significant coefficients are in bold. Standard Errors in parenthesis.

Table 3. Property crime and marriage rate (FE estimates)

	I	II	III	IV	V	VI	VII	VIII	IX
Marriage rate	**-.594*** **	**-.491*** **	**-.510*** **	**-.478*** **	**-.488*** **	-.241	**-.276***	-.167	-.174
	(.148)	(.166)	(.164)	(.161)	(.157)	(.170)	(.167)	(.195)	(.1900)
GDP per capita (t-1)		**.941**	**1.265** **	.952	**1.180** **	-.508	-.181	-.770	-.445
		(.714)	(.678)	(.680)	(.641)	(.799)	(.788)	(.803)	(.7900)
Unemployment (t-1)		.002		.0301		.041		.024	
		(.053)		(.053)		(.052)		(.053)	
Long-term unemployment (t-1)			-.071		-.077		**-.085** **		**-.085***
			(.051)		(.048)		(.047)		(.047)
Youth unemployment (t-1)			**.089** **		**.100*** **		**.076***		**.071***
			(.046)		(.436)		(.043)		(.043)
Investments in Manufacturing				**-.157** **	**-.171** **	-.125	**-.1367***	-.092	-.102
				(.0835)	(.0789)	(.081)	(.0768)	(.084)	(.081)
Patent intensity				**-.069*** **	**-.0695*** **	**-.072*** **	**-.071*** **	**-.073*** **	**-.073*** **
				(.0224)	(.0212)	(.021)	(.0209)	(.021)	(.0206)
High School 20-24						-.026	-.1007	-.077	-.125
						(.304)	(.295)	(.304)	(.293)
High School 25-64						**-1.30*** **	**-1.214*** **	-.741	-.700
						(.402)	(.402)	(.476)	(.466)
Security								-1.126	-.779
								(1.169)	(1.126)
Social capital								**-3.29** **	**-2.969** **
								(1.691)	(1.626)
Constant	**3.847*** **	**-6.224**	**-9.61**	-5.025	-7.272	14.976	11.817	**24.043**	18.464
	(.212)	(7.657)	(7.230)	(7.306)	(6.882)	(9.27)	(9.149)	(11.93)	(11.613)
Obs	120	120	120	120	120	120	120	120	120
Groups	20	20	20	20	20	20	20	20	20
R square within	.1573	.1573	.2014	.2512	.3020	.3290	.3658	.3621	.3981
R square between	.5333	.5318	.5228	.4895	.4949	.4602	.3895	.2596	.1731
R square overall	.5125	.5109	.5024	.4738	.4788	.4255	.3444	.2450	.1621

Notes: *** significant at 1%, ** significant al 5%, *significant at 10%. For sake of readability statistically significant coefficients are in bold. Standard Errors in parenthesis.

Table 4. Violent crime and consumer credit share (FE estimates)

	I	II	III	IV	V	VI	VII	VIII	IX
Consumer credit share	**1.211*** **	.261	.389	.432	.573	**-.850** **	**-.716***	.327	.531
	(.389)	(.419)	(.447)	(.403)	(.418(	(.401)	(.416)	(.410)	(.426)
GDP per capita (t-1)		**4.231*** **	**5.749*** **	**3.641** **	**4.686*** **	-1.561	-.939	**-3.988*** **	**-3.32** **
		(1.720)	(1.800)	(1.649)	(1.690)	(1.648)	(1.734)	(1.502)	(1.558)
Unemployment (t-1)		**-.424*** **		**-.299*** **		**-.298*** **		**-.258*** **	
		(.124)		(.124)		(.107)		(.096)	
Long-term unemployment (t-1)			.056		-.034		-.041		-.128
			(.126)		(.120)		(1.03)		(.091)
Youth unemployment (t-1)			-.014		.007		-.084		-.038
			(.116)		(.108)		(.094)		(.083)
Investments in Manufacturing				**-.656*** **	**-.803*** **	**-.373** **	**-.513*** **	-.165	**-.286** **
				(.192)	(.193)	(.170)	(.172)	(.154)	(.155)
Patent intensity				-.034	-.038	-.038	-.041	**-.063***	**-.065***
				(.0519)	(.054)	(.0442)	(.046)	(.039)	(.0400)
High School 20-24						.185	.424	.349	.545
						(.626)	(.648)	(.553)	(.564)
High School 25-64						**-5.256*** **	**-5.33*** **	-1.413	-1.46
						(.873)	(.925)	(1.107)	(1.15)
Security								3.188	**4.61** **
								(1.994)	(2.042)
Social capital								**-6.697** **	**-5.30***
								(3.206)	(3.27)
Constant	**3.935**	**-40.835**	**-57.7*** **	-29.777	**-40.03** **	**41.40** **	**35.07***	31.77	15.29
	(.412)	(18.411)	(19.19)	(17.85)	(18.32)	(19.096)	(20.07)	(21.30)	(22.00)
Obs	120	120	120	120	120	120	120	120	120
Groups	20	20	20	20	20	20	20	20	20
R square within	.0890	.2733	.1874	.3530	.3139	.5416	.5087	.6585	.6405
R square between	.0330	.3281	.3491	.3710	.3889	.4468	.4253	.0495	.2021
R square overall	.0299	.2063	.2155	.2396	.2461	.2330	.2133	.0366	.1363

Notes: *** significant at 1%, ** significant al 5%, *significant at 10%. For sake of readability statistically significant coefficients are in bold. Standard Errors in parenthesis.

Table 5. Violent crime and obesity (FE estimates)

	I	II	III	IV	V	VI	VII	VIII	IX
Obesity	**1.224*** **	**.983*** **	**1.009*** **	**.948*** **	**.968*** **	**.763*** **	**.781*** **	**.505*** **	**.487*** **
	(.206)	(.194)	(.2111)	(.188)	(.197)	(.178)	(.185)	(.179)	(.186)
GDP per capita (t-1)		**2.722****	**4.662*** **	**2.602****	**4.135*** **	-2.412	-1.623	**-3.743*** **	**-2.858****
		(1.400)	(1.452)	(1.339)	(1.352)	(1.540)	(1.607)	(1.407)	(1.479)
Unemployment (t-1)		**-.415*** **		**-.314*** **		**-.260*** **		**-.278*** **	
		(.110)		(.110)		(.100)		(.092)	
Long-term unemployment (t-1)			-.013		-.082		-.0901		-.1166
			(.115)		(.108)		(.0961)		(.087)
Youth unemployment (t-1)			-.001		.023		-.0501		-.039
			(.104)		(.097)		(.0875)		(.0799)
Investments in Manufacturing				**-.556*** **	**-.717*** **	**-.448*** **	**-.576*** **	-.210	**-.331****
				(.171)	(.174)	(.155)	(.156)	(.149)	(.152)
Patent intensity				-.054	-.057	-.062	-.063	**-.068****	**-.068***
				(.046)	(.049)	(.041)	(.043)	(.037)	(.039)
High School 20-24						.764	.956	.624	.844
						(.601)	(.617)	(.541)	(.559)
High School 25-64						**-3.314*** **	**-3.50*** **	**-1.462***	**-1.903****
						(.741)	(.786)	(.826)	(.865)
Security								.967	2.497
								(2.060)	(2.122)
Social capital								**-7.286*** **	**-5.245***
								(2.996)	(3.073)
Constant	**-.113*** **	**-27.45***	**-48.71*** **	-22.048	**-37.45**	**40.015*** **	**32.44**	**42.14****	23.63
	(.465)	(14.71)	(15.132)	(14.16)	(14.29)	(17.87)	(18.676)	(20.85)	(21.67)
Obs	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**	**120**
Groups	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**
R square within	**.2636**	**.4231**	**.3384**	**.4955**	**.4428**	**.5984**	**.5749**	**.6838**	**.6600**
R square between	**.0082**	**.3122**	**.3415**	**.3590**	**.3736**	**.3730**	**.3605**	**.0003**	**.0502**
R square overall	**.0228**	**.2067**	**.2156**	**.2556**	**.2428**	**.2006**	**.1879**	**.0000**	**.0391**

Notes: *** significant at 1%, ** significant al 5%, *significant at 10%. For sake of readability statistically significant coefficients are in bold. Standard Errors in parenthesis.

Table 6.Violent crime and marriage rate

	I	II	III	IV	V	VI	VII	VIII	IX
Marriage rate	**-2.55*** **	**-2.19*** **	**-2.27*** **	**-2.06*** **	**-2.09*** **	**-1.551*** **	**-1.541*** **	**-.935*** **	**-.849*** **
	(.302)	(.313)	(.341)	(.309)	(.327)	(.320)	(.334)	(.343)	(.358)
GDP per capita (t-1)		.8801	**2.637** **	.952	**2.436** **	-2.37	-1.542	**-3.58*** **	**-2.71** **
		(1.346)	(1.412)	(1.305)	(1.332)	(1.503)	(1.581)	(1.412)	(1.487)
Unemployment (t-1)		**-.394*** **		**-.315*** **		**-.283*** **		**-.289*** **	
		(.101)		(.102)		(.097)		(.092)	
Long-term unemployment (t-1)			-.0266		-.079		-.087		-.113
			(.106)		(1.007)		(.0946)		(.088)
Youth unemployment (t-1)			-.024		-.0025		-.060		-.046
			(.096)		(.090)		(.086)		(.080)
Investments in Manufacturing				**-.447*** **	**-.605*** **	**-.384*** **	**-.52*** **	-.188	**-.311** **
				(.160)	(.164)	(.152)	(.154)	(.148)	(.152)
Patent intensity				-.047	-.049	-.052	-.053	-.060	-.061
				(.043)	(.045)	(.040)	(.042)	(.037)	(.039)
High School 20-24						.241	.4400	.281	.526
						(.572)	(.593)	(.535)	(.552)
High School 25-64						**-2.779*** **	**-3.01*** **	**-1.391***	**-1.881** **
						(.757)	(.806)	(.837)	(.877)
Security								1.112	2.762
								(2.055)	(2.121)
Social capital								**-6.444*** **	-4.38
								(2.973)	(3.062)
Constant	**6.32**	-2.695	**-21.70**	-.375	-15.13	**43.260*** **	**35.48**	**42.691** **	23.468
	(.434)	(14.45)	(15.07)	(14.025)	(14.31)	(17.46)	(18.37)	(20.98)	(21.868)
Obs	120	120	120	120	120	120	120	120	120
Groups	20	20	20	20	20	20	20	20	20
R square within	.4186	.5159	.4405	.5550	.5135	.6163	.5879	.6820	.6558
R square between	.1974	.1427	.3000	.1374	.3360	.3906	.3833	.0006	.0777
R square overall	.0155	.1294	.2006	.1665	.2381	.2089	.1980	.0000	.0598

Notes: *** significant at 1%, ** significant al 5%, *significant at 10%. For sake of readability statistically significant coefficients are in bold. Standard Errors in parenthesis.

APPENDIX

Table A1. Variables definitions and descriptive statistics

	Definition	Mean	St. Dev.	Min	Max
Property Crime rate*	Number of property crime (thefts, robberies and burglaries.) per 1000 inhabitants	2.993	.425	1.816	3.700
Violent Crime rate*	Number of violent crime (rapes, homicides, kidnappings, injuries and lesions)per 10,000 of inhabitants.	2.654	.363	1.629	3.691
Consumer Credit Share**	Ratio between the amount of consumer credit and the total amount of loans to households.	-1.057	.311	-1.966	-.528
Obesity rate	Share of obese people out of the total population (Body Mass Index ≥ 30)	2.260	.150	1.865	2.583
Marriage rate	Number of marriages per 1.000 individuals	1.434	.128	1.163	1.772
Unemployment (t-1)*	Unemployment rate.	1.961	.596	.916	3.091
Youth Unemployment (t-1)*	Proportion of the youth labour force (persons aged between 15-24) that is unemployed.	2.969	.555	1.974	3.873
Long- term Unemployment (t-1)*	Proportion of labor force out of work and looking for work for 12 months or more	3.667	.419	2.092	4.140
High School (20-24)*	Ratio of individuals holding a high school diploma aged 20-24 out of total population	4.316	.0861	4.038	4.436
High School (25-64)*	Ratio of individuals holding a high school diploma aged 25-64 out of total population	3.910	.114	3.621	4.117
GDP per capita (t-1) *	Gross Domestic Product per capita	10.54	1.089	8.100	12.471
Investments in Manufacturing (t-1)*	Gross Investments in Manufacturing	7.291	1.213	3.833	9.673
Patent Intensity (t-1)	Patents registered at EPO per 1,000,000 inhabitants	3.513	1.261	-1.204	5.233
Social Capital*	Ratio of volunteers out of the total population	.318	.700	-.879	2.257
Security*	Public expenditure in security	6.694	1.029	4.173	8.266

Sources: * Italian National Institute of Statistics (ISTAT); ** Bank of Italy. Note: all variables are logged

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