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Does Tax Evasion Affect Economic Crime?

Abstract

This paper examines the impact of tax evasion on criminal activities in Italy. Specifically, we consider three types of crime that are related to economic determinants: property crimes (including robbery, theft and car theft), fraud and usury. We estimate a dynamic panel using annual data from the Italian provinces (NUTS-3) for the 2006-2010 period and show that tax evasion positively affects economic crimes. Notably, the elasticity of tax evasion to fraud is related to the size of the tax burden; in addition, these crimes demonstrate different levels of persistence over time, reflecting different adjustment costs. Finally, we find that property crimes, fraud and usury are not influenced by deterrence or clearing-up variables.

JEL-Codes: C330, H260, K420.

Keywords: property crime, usury, fraud, tax evasion, deterrence effect.

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1. Introduction

In recent years, the economics of crime have shifted the analysis from Becker's economic crime framework, which is based on the relationship between crime and punishment, to a more "flexible" approach in which many demographic and socioeconomic variables play different roles in explaining crime.

In this literature, crime has been linked to unemployment, the age and gender composition of the population, education, income, employment activity, etc. In this empirical context, several deterrence variables that approximate the probability and severity of punishment are also often significant.[2] In this paper, we investigate whether high levels of tax evasion, i.e., substantial unreported wealth, lead to increased criminality. Although an extensive stream in the economics literature has examined the determinants of crime, the role of tax evasion has not received sufficient attention. Specifically, our research question is the following: giving the quantitative importance of the underground economy and tax evasion in Italy, can tax evasion be considered a determining variable for economic crimes?

Empirical data from the Italian provinces have shown that tax evasion is an important source of income that is separate and distinct from official income. As such, tax evasion operates in the determination of economic crimes exactly as the standard measure of the value added – with the important difference that it controls for illicit (or illegal)[3] sources of income. Therefore, the first effect that is expected in investigating the relationship between tax evasion and economic crime is, in fact, a "wealth effect".

Of course, we might think that criminal activities are indirectly shaped by tax evasion for several reasons. In Italy, the *income redistribution* that results from tax evasion with respect to any income

[2] See Buonanno (2003) and Buonanno and Montolio (2008) for a survey. For an analysis of crime in Italy, see Marselli and Vannini (1997), Buonanno and Leonida (2006), Cracolici and Uberti (2008) and Bianchi et al. (2012), among others.

[3] In Italy, tax evasion is considered criminal activity if the amount of taxes concealed exceeds a threshold that depends on the modality through which tax evasion is undertaken.

that is not clearly attributable and subject to withholding tax is particularly important. In recent decades, in the context of continuing increases in the tax burden in Italy, Braiotta et al. (2015) documented that massive tax evasion by small businesses, artisans, shopkeepers, merchants and professionals has led to (or reinforced) strong inequalities that might have impacted on criminal activity (see, for instance, Fajnzylber et al., 2002). An additional factor concerns the *criminogenic environment* that the growth of underground economy produces: if entrepreneurship and legal income are far less lucrative than irregular or unreported income, the growth of underground activities might lead to a culture of illegality in which the potential gain for criminals is fully recognized.

We consider three types of crime that are related, in particular, to economic determinants: i) property crime (including robbery, theft and car theft), ii) fraud and iii) usury. These are crimes that have a strong impact on the economic and social structure of the affected areas and that are typically linked in the literature to socio-economic and demographic determinants; thus, the literature has generally ignored these crimes' association with the underground economy and (as a result) tax evasion.

To investigate these complex dynamics, we exploit a new dataset on the tax gap that comes from the Italian Revenue Agency (Agenzia delle Entrate), together with many socioeconomic and demographic control variables. We estimate a dynamic panel model, following the Arellano-Bond (1991) and Arellano-Bover (1995) procedures, for the Italian provinces (NUTS-3) from 2006 to 2010, and we find that tax evasion is an important determinant of the selected economic crimes although the role it plays varies with the crime. For property crimes and fraud, tax evasion acts as a real wealth effect and has a positive relationship with both types of crime (see Bianchi et al., 2012, among others, for the case of property crimes). In this sense, the goal of our research is to explore not only the role of recorded wealth – as discussed in the literature on the determinants of crimes (see Fajnzylber et al., 2002 and Buonanno and Leonida, 2006, among others) – but also the role of

unreported wealth, as evading taxes on such wealth results in unpaid tax revenues. In fact, as shown in the Appendix, the measure of tax evasion that we use is derived from the difference between potential and effective tax revenues. Both types of tax revenues have as a reference tax base the value added, which represents a measurement of wealth that is produced in a geographical area.

The relationship of the crime of usury with tax evasion must be analyzed within the context of credit rationing for households and small businesses. In fact, the size of a loan is affected by the value of the assets pledged as collateral, based on the balance sheet data. The presence of tax evasion reduces the value and amount of the goods used as a guarantee such that credit constraints, forcing borrowers to turn to illegal credit, i.e., usurious loans, as a source of financing.

The estimates also indicate that the selected crimes are characterized by different persistence over time, which reflects different adjustment costs. Finally, we find that property crimes, as well as fraud and usury, are not influenced by any deterrence or clearing-up variables.

The remainder of this paper is structured as follows. Section 2 describes the data used in the empirical analysis. Section 3 discusses the methodology used, whereas the empirical results are presented and interpreted in section 4. Finally, section 5 concludes the analysis. The Appendix contains the calculation method used by the Italian Revenue Agency for the tax gap at the provincial level.

2. Some stylized facts about economic crimes and tax evasion

In the economics literature, crime is typically analyzed using the framework established by Gary Becker (1968). The notion is that would-be criminals rationally weigh the expected costs and benefits of breaking the rules. If the probability of being caught is low or the punishment not particularly severe, then the expected costs might be outweighed by the expected benefits. In this case, choosing crime can be rational, and the related activities can be profitable. Thus, theft,

robbery, usury and fraud are quite different criminal activities with different determinants that entail different types of choices and that impinge on different markets. Although the outline of a theoretical framework for these economic crimes is not the subject of this paper, we examine the crime of usury in an explicit market setting, whereas for the crimes of fraud and against property, rather than focusing on a virtual market setting (Erlich, 1996) we will simply model the supply of criminal activity, as suggested originally by Becker.[4]

2.1 Economic crimes

Measuring crimes is an important topic. The literature uses two methods to record crimes: one method is based on enforcement reports, which reflects crimes that are reported, recorded, and not subsequently cancelled, and the second relies on survey data based on victim studies (victimization statistical surveys). Both methods suffer from under-reporting. The first method is used by Eurostat and national statistical offices (see, for instance, Clark, 2013); although the data are obtained from administrative records, direct comparison of crime levels based on absolute figures are affected by many factors because laws and practices vary between jurisdictions and over time. The second method can overcome the issue of the limited comparability of the crime data across countries because these data are based on repeated surveys that aim to monitor and study the volume of crimes, the perceptions of crime and the attitudes toward the criminal justice system from a comparative, international perspective (Van Dijk et al. 2007).

In this study, we measure economic crimes by the number of offenses reported to the judicial authorities.[5]

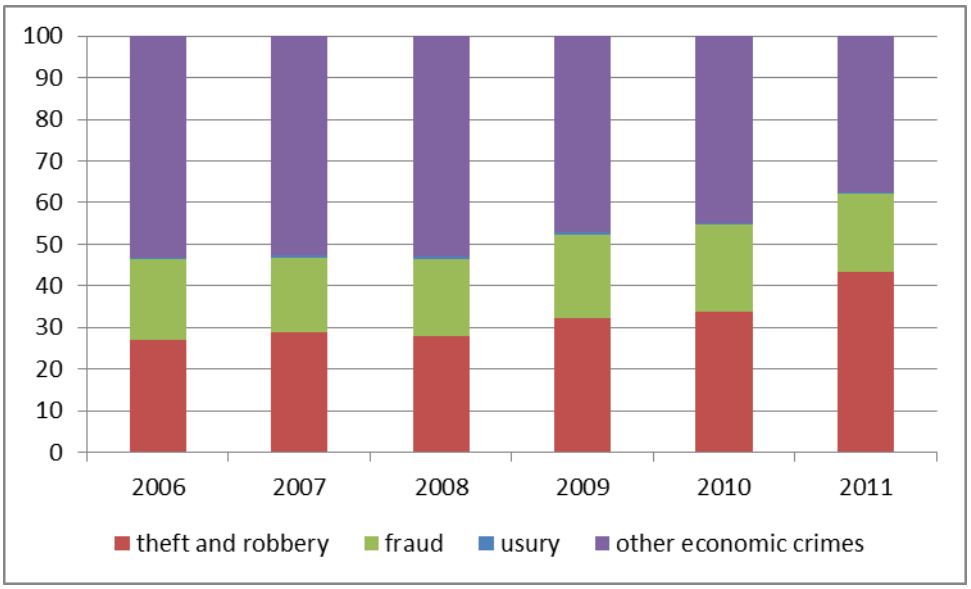
Figure 1 shows that the selected crimes (offenses against property, fraud and usury) accounted for more than 46% of the total crimes in Italy in 2006 and increased to 62% in 2010. Moreover, there was an upward and significant trend in crimes against property, rising from a low of 27% in 2006 to

[4] See, amongst others, Freeman (1999).

[5] Table 3 reports the variables used in the estimated models.

a peak of 43% in 2011, which might certainly be explained by the deep recession that Italy experienced during the period considered, with a deep trough for real GDP of -5% in 2009.

Figure 1: Selected economic crimes as a percentage of total economic crimes



Crimes against property (robberies and thefts) and fraud accounted for almost all the criminal activities involving redistributive conduct (92-95%)[6]. Conversely, among the economic crimes related to production activities, usury is quantitatively less important, constituting approximately 1% of crimes during the observed time period. However, one of the greatest problems in fighting usury crimes is the low reporting rate; in this sense, the number of complaints submitted to the courts does not reliably measure the true extent of the problem[7]. These crimes might also not carry severe penalties for the offender (such as a lengthy prison term), but it is nonetheless well known that they have serious negative spillover effects on the economy.

[6] The Italian Statistical Institute (ISTAT) distinguishes among economic crimes those linked to a production activity, such as counterfeiting, drug trafficking and production, exploitation of prostitution, money laundering, illegal betting, illegal weapons trafficking, activities linked to money falsification, activities against procurement laws, and smuggling, from those linked to a re-distributive business, including theft, robbery, fraud, extortion and kidnapping.

[7] In this regard, the National Statistics Institute has estimated that only 35% of property crimes are reported to the authorities, whereas there are no official estimates for unreported fraud and usury.

It is enough to recall, for example, how usury is intertwined with the credit market, deeply affecting it in some contexts, as well as how important usurious "debit contracts" are in a country of approximately 5 million small businesses and micro firms, which often face financing constraints that push them to seek non-bank financing alternatives.

Similarly, fraud (which depends on asymmetric information) is one of the most commonly reported crimes and is thus important to the economy. Crimes involving fraud include credit card fraud, false accounting (manipulation of accounts and accounting records), insurance fraud, mortgage fraud, payroll fraud, pyramid schemes, bogus invoicing, counterfeiting, forgery, and copyright abuse, to name just a few.[8]

2.2 Tax evasion

Cheating the government is a thriving practice in many countries and particularly in Italy, where the latest official estimates indicate that approximately 250 billion euros from the value added tax base are hidden from the Revenue Agency.[9] The National Institute of Statistics, consistently with international standards and with the 1995 System of National Accounts, in particular, has estimated and regularly updated a time series of the size of the underground economy since 2000, which indicates a hidden production of more than 16% of the total GDP. To study the relationship between unreported wealth and crime, we use the tax gap data on a provincial basis, which are provided by the Italian Revenue Agency (Agenzia Delle Entrate).

Table 1 reports the evolution of the tax gap (the difference between the potential tax collection and the tax that is actually paid) over the 2006-2010 period in terms of the main descriptive statistics, i.e., mean, median and relative standard deviation (RSD).[10] On average, more than 1500 euros of

[8] An agent is said to have committed fraud when he or she misrepresents the information at his or her disposal so as to persuade another individual (the principle) to choose a course of action he or she would not have chosen had he or she been properly informed (see Karni, 1989).

[9] Ministero dell'Economia e delle Finanze (2013).

[10] In the Appendix, we briefly report the methodology used by the Italian Revenue Agency for the construction of the tax gap.

tax receipts per capita[11] were concealed from tax authorities in the Italian provinces during the 2006-2010 period.

Table 1: Per capita tax gap (euro), Italian provinces, 2006-2010

Year	Mean	Min	Max	Median	RSD
2006	1629.4	616.5	3719.7	1386.9	0.33
2007	1438.1	610.5	2945.7	1297.3	0.33
2008	1637.4	523.7	3611.4	1411.3	0.34
2009	1604.1	552.6	3048.6	1359.3	0.34
2010	1495.4	546.8	2862.6	1326.5	0.33

The figures in the table show that, although there is significant variability between the minimum and maximum values observed (extreme values are due to some outliers), tax evasion (for the given population) in the Italian provinces does not show excessive variability. The phenomenon appears quite relevant and persistent, despite the fact that the Revenue Agency achieved good results in the fight against tax evasion during the period examined. In fact, in the years considered (2006-2010), the number of investigations of activities of tax evasion increased from 420 to 705 thousand. The number of investigations, thanks to the selection of subjects on the basis of risk analysis for each type of taxpayer and the strong use of agency databases, has become more targeted such that, in 2009 and 2010, when the number of investigations were basically stable, the additional tax assessed reported a sharp increase. The tax assessed rose from 13 billion euro in 2006 to approximately 28 billion euro in 2010. Similarly to that recorded for the additional tax assessed, total collections from tax evasion showed a systematically dynamic increase over the period (from 4 to approximately 11 billion euro). In particular, the significant collections in 2009 and 2010, when the revenue collected

[11] The mean values are computed as weighted averages of the per capita tax gap with the population in each province.

remarkably increased despite the economic crisis (see Agenzia delle Entrate, 2010), should be noted.

The propensity for tax evasion, reported in Table 2 below, is calculated using the ratio between the tax gap and tax compliance[12] in each Italian province: $\frac{taxgap}{taxcompliance}$.

Table 2: Propensity for evasion (% of tax compliance), Italian provinces, 2006-2010

Year	Mean	Min	Max	Median	RSD
2006	24.34	10.16	145.2	38.53	1.50
2007	20.52	9.24	122.5	31.54	1.44
2008	23.08	11.74	114.48	36.44	1.34
2009	24.18	10.86	118.44	42.23	1.40
2010	22.63	9.85	119.73	40.19	1.34

The table highlights several important stylized facts regarding the variability, dynamics and extent of tax evasion in the Italian provinces. First, what stands out immediately is the extent[13] of the propensity to evade taxes: in 2006, a magnitude equal to approximately 25% of tax compliance was hidden from the tax authorities in the Italian provinces, on average. Second, there is a huge variability among Italian provinces, with a minimum ratio of tax evasion to tax compliance of approximately 10% to a maximum of more than 145%: in some areas of Italy, tax evasion is far greater than tax compliance. The magnitude of the propensity to evade taxes between the various provinces is further emphasized by the RSD. Third, the propensity for evasion appears surprisingly stable over the years of the sample considered, although there was a significant reduction between 2006 and 2007. Finally, the dynamics of the propensity for evasion is characterized both by the business cycle and by tax evasion: in fact, tax evasion increased as the recession became more

[12] As specified below and in Appendix, tax compliance is measured with the tax revenues paid spontaneously.

[13] The mean values are computed as the ratios between the average tax gap and average tax compliance in the provinces.

severe (with a consequent reduction in the value added and the reported tax base) in 2008 and 2009 with a growth of the propensity to evade, but the ratio decreased as the recovery began in 2010.

3. Data and explanatory variables

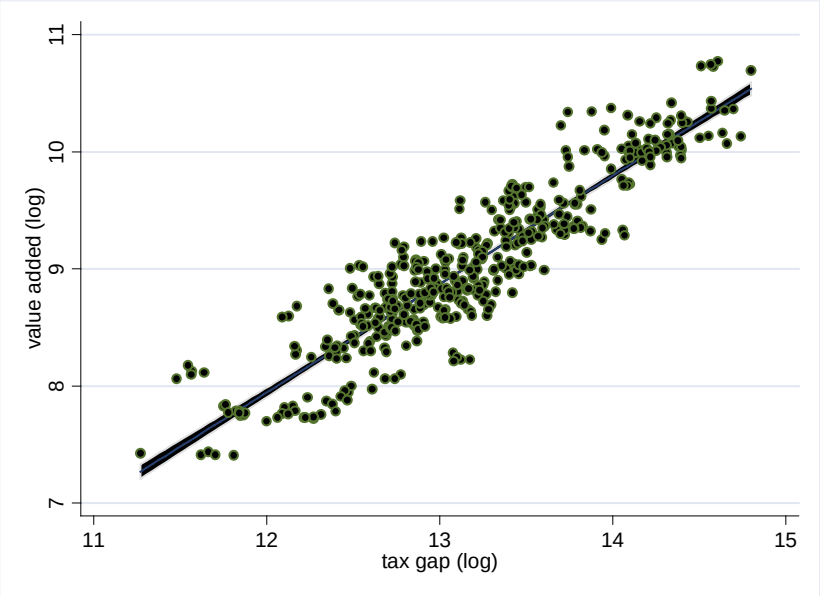
3.1 The crime variables

In addition to the tax gap, our panel dataset contains annual observations from 101 Italian provinces over the 2006-2010 period (Table 3). The dependent variable is derived using crime data from the Italian National Statistical Institute (ISTAT, Statistiche Giudiziarie e Penali). More specifically, our crime variable represents the number of crimes reported to the judicial authorities. We perform three model regressions distinguishing among property crime (including robbery, theft and car theft), fraud crime, and usury crime. All the crime variables are normalized per thousand inhabitants.

3.2 The Tax evasion variables

Regarding tax evasion, we consider the propensity for evasion to be given by the ratio of the tax gap to tax compliance. The latter is measured by the spontaneous fiscal revenues in each province. In the literature on crime models, GDP and value added are typically both considered proxies for the general level of prosperity, leading us to use, as an alternative measure of the propensity to evade taxes, the ratio of the tax gap to the value added in each province, rather than the absolute value of the tax gap, which would be collinear with the value added and would thus obscure the individual effects on crime (Figure 2).

Figure 2: Scatter plot of tax gap and value added in the Italian provinces (logs)



Finally, to obtain an idea of the difference between the two indicators of tax evasion discussed above, we must bear in mind that the propensity for evasion measured in terms of value added can be re-written as follows:

$$\frac{taxgap}{value\ added} = \frac{taxgap}{taxcompliance} \cdot \frac{taxcompliance}{value\ added} \qquad (1)$$

This manner of interpreting the effect of the new propensity for evasion is convenient because it allows us to identify the first component, which is the propensity for evasion in terms of tax compliance, namely the tax gap/tax compliance ratio, and a second component, which is a measure of the tax burden. Hence, the propensity for evasion as a share of value added also includes the size of the tax burden, thus leading to an increase in the ratio $\frac{taxgap}{value\ added}$ when the tax burden grows, for a given value of $\frac{taxgap}{taxcompliance}$.

In the estimated models reported below, we compare the two indicators of the propensity for evasion to capture the tax burden effect. The use of compliance is more informative because it is the

true tax base (the value added incorporates an estimate of the underground economy) and because the value added data do not consider the difference between firms' production areas and their registered offices. However, the comparison is notable because it provides insights into possible interactions between the propensity for tax evasion and fiscal pressure.

3.3 The deterrence variables

Following the theoretical framework and empirical analyses (Buonanno, 2003), the explanatory variables are derived from socioeconomic, socio-demographic and deterrence factors (Table 3). As usual, the expected return from crime is affected by the deterrence variable. In this study, we use three different measures for the probability of apprehension. The first is the share of crimes committed by unknown offenders to all the recorded crimes in each category. The second deterrence variable used is the number of defendants convicted by a final judgment on a regional basis, weighted by the ratio of the number of crimes for which prosecution has begun in each province to the same data in the region of origin (the prosecution rate). The third deterrence measure employed in our empirical analysis is the per capita number of the police force (including police, Carabinieri, financial police, port authorities, prison guards and rangers) in each province, which comes from the Ministry of Interior.

3.4 The socio-economic and demographic variables

We also use several demographic variables. The percentage of men aged 15-29 years old (because these males are supposed to be more prone to engaging in criminal activities) and the regular component of immigration are both normalized as shares of the population in the Italian provinces[14] (Bianchi et al. 2012 and the literature quoted therein). The socioeconomic variables include per capita value added, the growth rate of the value added, the activity rate (both total and the female activity rate), the unemployment rate (as a proxy for legitimate and illegitimate income

[14] In models with fixed effects, many authors include population to control for population density as a further determinant of criminal activity.

opportunities), a metric to measure social capital (source ISTAT), illegal betting (source ISTAT) and the Gini coefficient to control for inequality.[15]

The importance of the availability of credit is "captured" using a metric to measure banks' non-performing loans. Specifically, we use the ratio of non-performing loans to performing loans (source, ISTAT elaborations on Bank of Italy data). An additional financial variable included in the estimated models to test wealth effects are the per capita bank deposits in each province. Finally, we include in the estimated models a standard measure of market concentration in the loan market, the Herfindahl index for loans (source, Bank of Italy).[16]

We also include education in the analysis, and we define it as the number of men aged 24-34 years who have achieved at most a middle school diploma for every 100 men in that same age group. In addition, as a policy variable, we include the expenditures for interventions and social services for families and children, the disabled, addictions, the elderly, immigrants and the homeless.

Finally, we use personal consumption of drugs (Article 75 D.P.R. 309/1990, source Ministry of the Interior) and the number of illegal drug doses seized by the police as explanatory variables. This latter variable is provided by the Ministry of Interior and captures the environment of lawlessness, which affects criminal activity.

To avoid the influence of the size of the population in the different provinces, the crime data and explanatory variables used in the models are normalized by the number of residents in the area, which yields crime rates per 10,000 inhabitants. In so doing, we used a double log model and followed a selection strategy from the general to the particular.

[15] Inequality appears to be significantly associated with crime rates. See, for instance, Kelly (2000), Bourguignon (2001) and Fajnzylber et al. (2002), among others. The data on the Gini index for the Italian provinces were kindly provided by Sauro Mocetti (Bank of Italy) and Paolo Acciari (Ministry of Economics). See, for a description of the data, Acciari and Mocetti (2012).

[16] We thank Riccardo De Bonis (Bank of Italy), who kindly provided the Herfindahl index data. On some aspects emphasized by the concentration indicator in the market for Italian loans, see De Bonis and Ferrando (2000) and Infante and Rossi (2009), among others.

Table 3: Variables used in the models. Unless otherwise specified, per capita variables are normalized per 10,000 inhabitants

Variable	Source	Definition
Crime	ISTAT, Statistiche Giudiziarie e Penali	Per capita numbers of crimes against property (including robbery, theft, and car theft), fraud and usury reported to the judicial authorities
Propensity for evasion (1)	Italian Revenue Agency	Ratio of tax gap to tax compliance
Propensity for evasion (2)	Italian Revenue Agency (tax evasion); ISTAT (value added)	Ratio of tax gap to value added
Deterrence (1): crimes committed by unknown offenders	ISTAT- Statistiche Giudiziarie e Penali	Ratio of crimes committed by unknown offenders to all recorded crimes in each category
Deterrence (2): number of defendants convicted by a final judgment	ISTAT, Statistiche Giudiziarie e Penali	Number of defendants convicted by a final judgment on a regional basis, weighted by the rate of prosecution between the province and the region
Deterrence (3): enforcement	Italian Ministry of the Interior	Per capita number of police officers (Carabinieri, police, financial police, port authorities, prison guards, and rangers)
Young men	ISTAT	The percentage of men aged 15-29
Population	ISTAT	Total resident population
Immigration	ISTAT	Regular component of immigration as a share of population
Value added	ISTAT	Per capita value added
Activity rate	ISTAT	Total activity rate
Unemployment	ISTAT	Ratio between the unemployed and the labor force (unemployment rate)
Gini coefficient	Acciari and Mocetti (2012)	Gini coefficient calculated in each province
Social capital	ISTAT	Share of employees of the cooperatives on the total number of employees (percentage)
Non-performing loans	ISTAT elaborations on Bank of Italy data	Ratio of non-performing loans to performing loans
Bank deposits	Bank of Italy	Per capita value of bank deposits
Herfindahl index for loans	Bank of Italy	The sum, multiplied by 100, of the squares of the ratios between loans by the bank (or group) to firms at the provincial level and the total of the bank's (or group) loans to firms
Education	ISTAT	Number of persons aged 25-34 who attended middle school as their highest educational level per 100 men in the same age group

Variable	Source	Definition
Social expenditures	ISTAT	Per capita expenditures for interventions for the disabled, addictions, the elderly, immigrants, the homeless, etc.
Drugs	Ministry of the Interior	Per capita consumption of drugs (article 75, D.P.R. 309/1990)
Drug doses	Ministry of the Interior	Per capita amount of drugs seized by police forces
Illegal betting	ISTAT, Statistiche Giudiziarie e Penali	Per capita number of crimes reported to the judicial authorities in violation of gambling laws

The existence of a causal link between all these explanatory variables and crimes has been widely investigated in the literature; here, we use them to specify a model of crime determinants in which the tax gap plays a role. However, the estimation of such models of crime produces certain statistical problems (heteroskedasticity, multicollinearity, endogeneity, etc.) that we attempt to overcome in our empirical framework.

4. Empirical framework

The following model analyzes the impact of tax evasion on crime activity in a panel dataset of 101 provinces over 6 years (2006-2010):

$$C_{it} = \beta_1 C_{it-1} + \beta_2 Taxevasion + \beta_3 X_{it} + \eta_t + c_i + u_{it} \qquad t = 1,...,T \tag{2}$$

Equation (2) is the basic function of crime estimated by the literature, where η_t is a separate time period intercept, X_{it} is a *1xK* vector of explanatory variables defined in the previous section, c_i is the time-constant unobserved fixed effect, and u_{it} are idiosyncratic errors. In summary, the econometric model follows the empirical model of the supply of crime initially proposed by Ehrlich (1973) and adopted by many other authors. As we will see, this framework is well suited for crimes against

property and fraud, whereas with regard to usury crimes, the estimated equation better suits a demand equation.

With regard to the dynamic features of the model, the literature assumes that there is a significant relationship between crime rates in t and t-1; hence, the empirical models include the lagged dependent variable C_{it-1}. There may be several explanations for this dynamic relationship, not least of which is one that sees the persistence of criminal activity as a learning-by-doing process, which leads to a reduction in the costs of the criminal activity itself (see Buonanno and Montolio, 2008, for a survey).

These estimates of criminal activity involve some statistical problems. First, time invariant territorial characteristics (fixed effects) might be correlated with the explanatory variables. Second, because causality can run in both directions with crime for several variables included in the vector *K*, these regressors might be correlated with the error term, potentially giving rise to endogeneity. Third, the presence of the lagged dependent variable C_{it-1} results in autocorrelation. Finally, a shortcoming of crime data involves measurement error (under-reporting and so forth). These panel data require an instrumental variable procedure that can account for the model dynamics, such as the generalized method of moments (GMM) estimator suggested by Arellano and Bond (1991) and Arellano and Bover (1995). As is well known, this instrumental variable estimator allows for the use of multiple instruments to control for endogeneity and the absence of orthogonality between the residuals and the regressors. Furthermore, the persistence of the dependent variable for one lag can eliminate the first order autocorrelation problem. Finally, the use of robust standard errors takes the presence of heteroskedastic errors into account.

5. Empirical results

To better appreciate the complexity of the relationship under investigation, we first examine the link between propensity to evade and economic crime rates, controlling for other potential crime

determinants, by using OLS pooled (columns 1 and 2 in Tables 4-6) and IV-2SLS regressions (columns 3 and 4 in Tables 4-6). Subsequently, we correct for model dynamics, joint endogeneity and measurement error by applying an instrumental variable estimator for panel data (columns 5 and 6 in Tables 4-6).

The OLS pooled and IV-2SLS panel models are estimated using the sample in levels, to explain criminal activities (property crimes, frauds and usury) in the Italian provinces. The basic sample consists of 460 observations for the pooled levels.[17]

The variables enter the model in a linear or log-linear fashion. We do not find statistical significance for time dummies. Moreover, we test the interaction effects between variables as well as the quadratic functions to capture decreasing or increasing marginal effects without success.

The odd-numbered columns (1-3-5) of each table provide the best estimates when we use tax evasion measured as share of tax compliance whereas, in the even-numbered columns (2-4-6), tax evasion is measured as proportion of value added, as specified in section 3.2.

The results support the idea that economic crimes are positively affected by tax evasion, since the estimated elasticities are positive and statistically significant in all the regressions. For property crimes and usury the OLS estimates show an elasticity substantially lower than the instrumental variable models (both in static and dynamic regressions). With regard to the remaining explanatory variables, the different specifications provide qualitatively similar results: the statistically significant coefficients are the same across columns, and in general they have the expected sign.

[17] We have excluded from the sample the provinces of Piedmont and Valle d'Aosta, due to some inconsistency in the definition of the crimes in the original source of data, making the data of these provinces not comparable with the figures of the crimes of the other provinces. We have also dropped other small provinces where the data were not available for all the years considered in the sample.

Table 4: Estimations for property crimes

Property crimes (in log)						
Variables	(1) OLS POOLED	(2) OLS POOLED	(3) IV-2SLS PANEL	(4) IV-2SLS PANEL	(5) GMM-SYSTEM	(6) GMM-SYSTEM
Log (Property Crimes)$_{t-1}$					0.629 (0.09)***	0.621 (0.08)***
Log (Propensity for Evasion) (1)	0.150 (0.04)***		0.432 (0.15)***		0.342 (0.12)***	
Log (Propensity for Evasion) (2)		0.017 (0.00)***		0.499 (0.16)***		0.370 (0.14)***
Log (Enforcement)	-0.030 (0.03)	-0.045 (0.03)*	-1.500 (1.50)	-1.021 (1.90)	-0.112 (0.14)	-0.052 (0.13)
Metropolitan Areas	0.365 (0.08)***	0.431 (0.07)***	0.267 (0.08)***	0.766 (0.02)***	0.740 (0.28)***	0.795 (0.30)***
Log (Drugs)	0.070 (0.20)***	0.067 (0.02)***	0.024 (0.01)***	0.026 (0.01)***	0.268 (0.15)*	0.242 (0.15)*
Log (Education)	0.079 (0.01)*	0.106 (0.06)*	0.157 (0.08)*	0.161 (0.1)*	0.363 (0.22)*	0.454 (0.13)***
Log (Unemployment)	-0.015 (0.00)*	-0.069 (0.03)**	-0.096 (0.05)*	-0.094 (0.02)***	-0.310 (0.14)**	-0.143 (0.08)*
Constant	5.713 (0.22)***	5.465 (0.24)***	9.542 (3.29)***	8.131 (3.30)***	0.152 (1.17)	0.852 (0.79)
Number of observations	460	460	460	460	368	368
Number of lags					L (0/4)	L (0/4)
R-squared (overall for static panel estimation)	0.17	0.15	0.15	0.13		
Number of instruments			4	4	53	53
Hansen Test (p-values)					0.27	0.20
Pesaran Test (p-values)					0.68	0.70
AR(1) (p-values)					0.09	0.09
AR(2) (p-values)					0.48	0.40

*Robust standard errors in parenthesis. ***, ** and * indicate that the coefficient is significant at the 1%, 5% and 10% levels of significance, respectively.*
Instrumented variables: log (propensity for evasion); log (enforcement).

Exogenous instruments for two stage least squares, first differences and level equations: social capital; log (immigration); log (bank deposits for 10,000 inhabitants); Gini coefficient

GMM-type instruments: log (property crimes); log (propensity for evasion); log (enforcement).

Table 5: Estimations for fraud

Fraud crimes (in log)						
Variables	(1) OLS POOLED	(2) OLS POOLED	(3) IV-2SLS PANEL	(4) IV-2SLS PANEL	(5) GMM-SYSTEM	(6) GMM-SYSTEM
Log (Fraud Crimes)$_{t-1}$					0.128	0.133
					(0.07)*	(0.08)*
Log (Propensity for Evasion) (1)	0.056		0.395		0.307	
	(0.01)***		(0.10)***		(0.12)***	
Log (Propensity for Evasion) (2)		0.077		0.400		1.127
		(0.01)***		(0.12)***		(0.13)***
Log (Enforcement)	0.048	0.051	-5.929	-6.036	0.032	0.049
	(0.03)	(0.07)	(2.02)***	(2.97)**	(0.10)	(0.10)
Metropolitan Areas	0.397	0.365	0.312	0.313	0.836	0.328
	(0.10)***	(0.09)***	(0.08)***	(0.10)***	(0.31)***	(0.19)*
Log (Social Capital)	-0.025	-0.027	-0.130	-0.114	-0.354	-0.645
	(0.01)***	(0.01)***	(0.03)***	(0.03)***	(0.18)**	(0.28)**
Log (Unemployment)	0.364	0.405	0.280	0.198	0.299	0.593
	(0.05)***	(0.05)***	(0.10)***	(0.03)***	(0.15)**	(0.14)***
Constant	3.524	3.729	13.871	15.164	2.538	3.542
	(0.17)***	(0.16)***	(3.59)***	(4.44)***	(0.56)***	(0.71)***
Number of observations	460	460	460	460	368	368
Number of lags					L (0/4)	L (0/4)
R-squared (overall for static panel estimation)	0.23	0.22	0.10	0.11		
Number of instruments			4	4	53	53
Hansen Test (p-values)					0.12	0.12
Pesaran Test (p-values)					0.32	0.32
AR(1) (p-values)					0.00	0.00
AR(2) (p-values)					0.28	0.24

*Robust standard errors in parenthesis. ***, ** and * indicate the coefficient is significant at the 1%, 5% and 10% levels of significance, respectively.*
Instrumented variables: log (propensity for evasion); log (enforcement).

Exogenous instruments for two stage least squares, first differences and level equations: log (immigration); log (bank deposits for 10,000 inhabitants); Gini coefficient; log (education)

GMM-type instruments: log (propensity for evasion); log (enforcement)

Table 6: Estimations for usury

Usury crimes (in log)						
Variables	(1) OLS POOLED	(2) OLS POOLED	(3) IV-2SLS PANEL	(4) IV-2SLS PANEL	(5) GMM-SYSTEM	(6) GMM-SYSTEM
Log (Usury Crimes)$_{t-1}$					0.163	0.202
					(0.10)*	(0.09)**
Log (Propensity for Evasion) (1)	0.071		0.024		0.080	
	(0.02)***		(0.01)***		(0.03)***	
Log (Propensity for Evasion) (2)		0.086		0.074		0.092
		(0.03)***		(0.02)***		(0.04)**
Log (Enforcement)	-0.022	-0.033	-0.628	-0.644	0.009	-0.062
	(0.01)**	(0.01)***	(0.38)*	(0.10)***	(0.04)	(0.03)**
Metropolitan Areas	0.037	0.012	0.508	0.540	0.005	0.056
	(0.02)**	(0.00)**	(0.30)*	(0.15)***	(0.03)	(0.04)
Log (Non-performing Loans)	0.034	0.056	0.034	0.002	0.037	0.060
	(0.01)***	(0.01)***	(0.01)***	(0.00)***	(0.02)**	(0.02)***
Log (Illegal betting)	0.977	1.185	0.111	0.131	0.662	0.674
	(0.20)***	(0.23)***	(0.05)***	(0.02)***	(0.24)***	(0.19)***
Herfindahl index for loans	-0.754	-0.761	-0.164	-0.234	-1.313	-1.620
	(0.11)***	(0.12)***	(0.05)***	(0.12)**	(0.46)***	(0.45)***
Constant	-0.040	0.104	1.310	1.323	-0.004	0.038
	(0.06)	(0.06)*	(1.10)	(1.00)	(0.09)	(0.13)
Number of observations	455	455	455	455	368	368
Number of lags					L (1/5)	L (1/5)
R-squared (overall for static panel estimation)	0.26	0.23	0.12	0.11		
Number of instruments			4	4	71	71
Hansen Test (p-values)					0.12	0.19
Pesaran Test (p-values)					0.49	0.50
AR(1) (p-values)					0.00	0.00
AR(2) (p-values)					0.92	0.86

*Robust standard errors in parenthesis. ***, ** and * indicate that coefficients are significant at the 1%, 5% and 10% levels of significance, respectively.*
Instrumented variables: log (propensity for evasion); log (enforcement).

Exogenous instruments for two stage least squares, first differences and level equations: log (social capital); log (immigration); log (bank deposits for 10,000 inhabitants); Gini coefficient

GMM-type instruments: log (usury crimes); log (propensity for evasion); log (enforcement)

The OLS pooled estimates might be biased because of the possibility that crime rates themselves might affect the right-hand-side variables. For instance, illegal betting and tax evasion might be determined by usury, as well as property crimes and drug consumption may be characterized by a two-way causality. Neglecting the joint endogeneity of the determinants provides inconsistent estimates. Moreover, it is very likely that the crime rates are measured with error and this latter might be correlated with some of the explanatory variables, in particular with the tax gap/value added ratio. As a matter of fact, the growth of the underground activity and tax evasion can generate a culture of illegality and this may affect the crime underreporting. Finally, these regressions (OLS pooled and IV-2SLS models) do not take into account the possibility that crime tends to persist over time. These issues, certainly more stringent in statistical terms, lead us to examine in detail the estimates obtained with the GMM estimator reported in columns 5 and 6. These columns show selected GMM-system estimates for, respectively, property crimes, fraud crimes and usury crimes in the Italian provinces. This estimator allows us to control for unobserved province-specific effects that are potentially correlated with our determinant of crime rates and to account for dynamic and endogeneity aspects.

With *L(0/i),* we use only the first *i* lags of the endogenous variables as instruments[18]. Four tests are reported: the Pesaran test, with p-values that indicate a cross-sectional independence, thus confirming the validity of the estimator; the Hansen test of overidentifying restrictions (we use a robust variance matrix estimator; see Roodman, 2009), distributed as chi-square under the null hypothesis of the validity of instrument; and the first- and second-order serial correlation tests. The estimates are performed using the GMM-system procedure, combining transformed and level instruments.

In all the estimates, the Hansen test does not reject the null hypothesis for the validity of the instrument set, and the serial correlation tests indicate that there is no evidence for first-order serial

[18] In all the estimates for level equations, the constant is always used as an additional instrument.

correlation, whereas there is evidence of second-order serial correlation. We set three GMM-type instruments (Tables 4-6) in the three estimated equations, i.e., the crime under investigation, propensity to evade and enforcement.

5.1 The role of tax evasion

The first notable result is that the propensity to evade taxes is statistically significant for all the crimes considered (and robust to different specifications)[19]. In addition, consistently with our hypotheses, the sign of the propensity for tax evasion is significant and positive for property crimes. The elasticity is rather high for both the versions of the indicator of propensity to tax evasion: the estimated coefficient appears substantially similar, which indicates that the tax burden effect does not matter for this crime.

The estimates suggest that tax evasion acts on property crimes as a wealth effect in that it signals higher expected gains for the criminal**.** Moreover, tax evasion might also capture a redistribution-inequality effect and, as a result, it might lead to an increase in theft and robbery. In this sense, the endogeneity of tax evasion with regard to the crimes considered is controlled by including the Gini coefficient among the exogenous instruments. The positive sign of the tax gap coefficient might also be connected to the criminogenic environment that is related to the underground economy. This latter coefficient might lead to a culture of illegality, in which the potential gains from crime are fully recognized.

A positive relationship between tax evasion and crime also emerges for fraud and usury. Tax evasion is particularly relevant for fraud crimes, in which the elasticity is quite high, from 0.3 to almost unity in the value added version of the propensity for evasion (Propensity for evasion (2) in Table 5). This elasticity is, however, much lower for the IV-2SLS estimates. With regard to fraud, given the information asymmetries that characterize this economic crime, the hypothesis tested

[19] For all the crimes considered, the propensity to evade taxes is statistically significant for several lags, but to save space, we report the best specification in terms of statistical significance for each crime.

involves agents that are, among other things, willing to defraud insurance markets for automobiles, health care, unemployment, etc. if they can defraud the state with tax evasion. The literature has emphasized factors such as changes in morality, modification of the behavior of some intermediaries (medical doctors, mechanics, etc.), and insurers' attitudes (see, Dionne 2012, among others) as causes of the rapid growth of insurance fraud. Our analysis shows that once an individual finds a system to defraud the tax authorities, it becomes easier for him to commit fraud in the private markets. This is a complementary effect, although it seems possible to interpret the positive coefficient of the relationship with tax evasion as a wealth effect.

The comment on the estimates found for property and fraud crimes reflects an interpretation that is consistent with the supply side approach to crime.

Finally, the hypothesis underlying the relationship between usury and tax evasion is that this type of crime is more likely to affect small business owners, shopkeepers, tradesmen and professionals, namely the economic categories that are heavily involved in tax evasion and, as a consequence, are themselves subject to credit rationing practiced by the banking system on small firms[20]. Hence, in a credit-constrained setup, tax evasion affects the demand for illegal credit.

A similar picture emerges from the analysis of the activities of the victims of usury offered by Cnel[21] (2008), who have shown that more than 90% of usury victims are related to small businesses (traders, entrepreneurs, artisans, professionals).

Our findings show that tax evasion may determine an increase in usury; in fact, the growth of unreported output amplifies credit constraints in the legal credit market because loans cannot be secured with appropriate collateralization. As a result, an increase of illegal credit occurs, thus generating a raise of usury.

5.2 The role of the tax burden

[20] See Corte dei Conti (2014) and Chiarini and Monteleone (2016).

[21] Cnel is the Italian acronym of the National Council for Economics and Labor.

Tables 4-6 also show the GMM estimates of the three crimes considered, measuring the propensity for evasion using the ratio of the tax gap to value added (the even-numbered columns).

The results using the value added as a scale variable in the tax gap generally provide, in all the estimates, higher elasticities than those found for compliance (with propensity for evasion measured using the ratio of the tax gap to tax compliance). In the crime of fraud, the coefficient of the propensity for evasion using value added shows much greater elasticity (0.30 vs. 1.1).

As emphasized in section 3, this manner of interpreting the effect of the propensity for evasion is instructive because it allows us to identify an initial component, which is the propensity for evasion in terms of tax compliance, the tax gap/tax compliance ratio, and a second component, which is a measure of the tax burden (see Equation (1)). The highest elasticity found for tax evasion in Table 5 (1.127) shows that the wealth effect increases with the tax burden: *ceteris paribus*, the higher the tax burden, the more the individual opts for fraud, along with tax evasion. This relationship is strong for fraud, although it is less important for property crimes and usury.

5.3 The credit market

The crime of usury is also affected by our credit market variables (the ratio between non-performing and performing loans and the Herfindahl index for loans).[22] Hence, our estimates of the table 6 show that the conditions on the credit market are important for this crime (the estimated elasticities are significant), and malfunctions in the circuit of credit facilitates usury, pushing intermediaries to ration the borrowers considered to be the most unreliable. These borrowers include low- and middle-income families, small and medium-size businesses that are undercapitalized because they declare to the tax authorities only a part of their goods and services, and companies operating in the most deprived areas and in the areas most at risk. In this context,

[22] Sapienza (2013) estimates a panel for the 2004-2008 period relative to some southern Italian regions, finding that bank credit for households strongly (and negatively) affects the number of crimes of usury, confirming the relationship between legal and illegal supplies of credit.

lenders limit the supply of additional credit to those borrowers who request funds and who are willing to pay higher interest rates.

Those borrowers who cannot offer a full guarantee to cover their debt in the event of project failure are implicitly declaring the probability of success to be low. In the context of adverse selection, the party most interested in offering a guarantee (collateral) is the borrower with the most secure project (see Manove et al., 2001).

The positive elasticity between tax evasion and the number of crimes of usury reported to the judicial authorities has important policy implications: a policy enforcement for tax evasion is able to weaken usury. Moreover, usury and tax evasion (both considered GMM-type instruments) seem to be triggered by credit market constraints. Hence, once the government undertakes efforts to remove the barriers of access to the credit market, particularly for micro and small business, the use of tax evasion as a type of self-financing device is discouraged, thus also negatively affecting usury crimes.

Finally, we interpret the negative sign of the indicator of concentration in the sense of efficiency: the entry of large banks into provincial markets, characterized by the presence of small financial intermediaries with substantial market power, is able to limit those inefficiencies and fragmentation in credit granting that characterize local financial institutions. Hence higher credit concentration reduces the cost of monitoring, providing more credit to businesses and curbing usury.

In this sense, our evidence supports a positive causal relationship between bank concentration and efficiency in the credit market (see Casu and Girardone, 2009, among the others).

5.4 Deterrence

The deterrence variables involve the cost side of the economic crime models by means of the probability of being caught committing a criminal offense. The significance of these measures has important policy implications for crime prevention. In this regard, many empirical studies (see Tauchen et al., 1994 and Marselli and Vannini, 1997, among the others) have used the ratio of

crimes committed by unknown offenders to all recorded crimes in each category. We use this indicator in our estimates but without success; moreover, it is notable that the denominator of this ratio is part of the dependent variable that we aim to explain.

As described above, we test two other deterrence variables conviction (prosecution rate) and the presence of police forces in the territories[23]. However, we do not find that these variables have a statistically significant power and we find the expected sign in some cases only for the per capita number of the police force. This lack of significance might be due to increased difficulty in the intervention and prevention of economic crimes in Italy. This phenomenon is likely linked to certain inefficiencies in the institutions responsible for the prevention and suppression of crime, as well as to similar problems in the Italian judicial system. In Italy, unlike most of the empirical analysis,[24] it follows that deterrence variables (certainty of conviction and/or clear-up rates) play a limited role with respect to these types of economic crimes, thus showing that an effective crime prevention should be better pursued through indirect measures of contrast, such as an increase of schooling, an enhancing of social capital and a progressive removal of credit market constraints.

5.5 The socio-demographic variables

Among the socioeconomic variables, we find that unemployment negatively affects property crimes, which is a troublesome result because the economic literature on crimes typically emphasizes that labor market conditions have a positive explanatory power, particularly with regard to property crimes (Altindag, 2012). However, the effects of unemployment on crime in Italy have been recently debated by Buonanno (2005), who found that unemployment significantly affected crime only in the southern regions. In our context, it is likely that unemployment captures a wealth effect, indicating that poorer provinces are less attractive for crimes against property.

[23] It is important to emphasize that the variable used in the estimated models includes not only the police and Carabinieri but also the financial police, port authorities, prison guards and rangers.

[24] See Marselli and Vannini (1997) for Italy and Entorf (2012) for a survey.

With regard to property crimes, the estimates show a weak relationship with personal consumption of drugs (at the 10% level of significance), indicating that drug use might be a motivation for theft and robbery. Moreover, this is the only crime affected by education. To interpret the sign of this variable, one should keep in mind that it is the number of persons aged 25-34 years who have attained a maximum of middle school per 100 men in the same age group. This implies that provinces with more of these persons report more property crime.

Focusing on fraud crimes, unemployment probably involves elements of labor demand, i.e., the opportunity costs of participating in this illegal activity (in the absence of work and income, more people are available to commit fraud), and supply, as the unemployed are a fragile component of society and are therefore more prone to this type of crime. In this view, the unemployment rate in a province is a complementary indicator of income opportunities available in the legal labor market. If these opportunities are scarce, fraud will increase, and the labor supply is allocated to the illegal market.

Moreover, the significance found for the social capital variable (following the standard literature, it should capture different levels of collective confidence) in the fraud crime is particularly notable. Our estimates indicate that provinces with high social capital experience a substantial reduction in their fraud crimes. The social capital variable (approximated by the percentage of employees of cooperatives compared with the total number of employees in the province) enters into the other estimated models as an exogenous instrument.

Usury is positively and strongly related to illegal betting: this illicit destination of money might render legal credit an inadequate source of financing, thus enhancing usury. The positive sign found for illegal betting represents a further need for illegal financing, which is certainly not permitted by the banking system. Hence a higher presence of gambling in the provinces is an indicator for evaluationg the exposure to debt and the risk of the crime of usury. Notably, the dummy for

Metropolitan Areas is highly significant and very important in indicating how property and fraud crimes are most relevant in these areas, whereas it does not affect usury crimes.[25]

Our estimates exclude many of the explanatory variables listed in Table 3 because of their statistical insignificance or because of collinearity problems. Therefore, important variables, such as the percentage of men aged 15-29 years old, immigration and education, which had been previously investigated in the literature on Italy (Buonanno and Leonida 2006; Bianchi et al. 2012), play no role in our estimated model.[26] However, many of these variables (immigration, population, education, bank deposits, etc.) have been used as instruments in the GMM-system. Moreover, we estimate a fixed effects model, and the unobserved province effect might therefore include certain demographic features of the population (age, education): people living in different provinces might have different attitudes toward economic crimes, and these attitudes are typically slow to change.

5.6 The costly learning process

The significance of the lagged value of the crime rate in the estimated models indicates that the dynamic specification used is appropriate: there is a persistence of crime in the Italian provinces, particularly with regard to property crimes (with a coefficient of the lagged dependent variable of approximately 0.60). The persistence effect is less intense for usury and fraud, which show a lower degree of inertia than the property crimes (the coefficient is significant at the 5% and 10% levels).

In an interpretation of adjustment costs, the dynamic model reveals that the level of crimes committed does not instantly adjust to changes in the determinants of crime. The latter are gradually considered by criminals because it is expensive to adjust to change rapidly, as it requires a learning process:

[25] Metropolitan cities are ten new "territorial bodies of large area," and these territories coincide with those of the homonymous provinces: Roma Capitale (Rome), Turin, Milan, Venice, Genoa, Bologna, Florence, Bari, Naples and Reggio Calabria. The metropolitan areas are operational from 1 January 2015, as a result of Law No. 56 of 7 April 2014.

[26] See Bell and Machin (2013) for a survey on immigration and crime.

$$\Delta C_{it} = C_{it} - C_{it-1} \quad = \quad \lambda\left(C_{it}^{*} - C_{it-1}\right) \quad \Rightarrow \quad C_{it} = \lambda C_{it}^{*} + (1-\lambda)C_{it-1} \qquad (3)$$

where $0 \leq \lambda \leq 1$ is the speed of adjustment, and C_{it}^{*} is the goal (or desired) level of crime. Following this interpretation, we can see that for crimes such as usury and fraud, the adjustment is instantaneous or at least much faster than that for crimes against property.

6. Concluding remarks

In this paper, we investigate the impact of tax evasion on certain criminal activities in the Italian provinces during the 2006-2010 period. A set of hypotheses is tested using a GMM-system estimator, an instrumental approach that considers the dynamic properties of a dataset and controls for measurement errors and the joint endogeneity of the explanatory variables.

We have shown that the economic crimes here considered (theft and robbery, fraud and usury) are strongly influenced by tax evasion. In a country such as Italy that is characterized by both a substantial underground economy and tax evasion, these phenomena also affect economic crimes. In particular, we find that usury is triggered by tax evasion as a result of credit constraints arising from the presence of unreported output on firms' balance sheets, whereas for crimes against property and fraud, the increase in tax evasion generates growth in the crime via wealth, redistribution and inequality effects. Usury and fraud show less inertia (or a coefficient of speed of adjustment that is very high and barely statistically significant) than property crimes.

Furthermore, the estimates also show that for fraud, *ceteris paribus*, the higher the tax burden, the more likely it is that the individual chooses tax evasion and fraud.

Finally, in Italy, unlike most of the empirical analysis, deterrence variables (certainty of conviction and clear-up rates) play limited roles (if any) for these types of economic crimes.

These results pose serious problems for policy makers. It is clear from our estimates that the fight against tax evasion cannot be separated from the contrast to illegal credit and fraud and that the problem of usury cannot be uncoupled from issues related to credit rationing and the Italian

production structure. The latter consists of many small and micro firms, which are more prone to tax evasion and tax avoidance, due to both high tax burden (the effective rate is more than 50%) and inefficiencies in the mechanism adopted to estimate the taxable income of small firms, the self-employed and professionals (*Sector Studies – "Studi di Settore"*).

Therefore, a government agenda focused on the contrast of economic crimes cannot be separated from a more efficient tax audit activity and must be based not only on sanctions but also on spontaneous fulfillment of obligations related to tax compliance.

Appendix

Tax gap: definition and methodology of calculation

To test the existence of the relationship between criminal activity and tax evasion, we use the measure of tax gap calculated by the Revenue Agency on a provincial basis. The overall tax gap is a complex variable derived from the sum of the tax gaps in IRAP (Regional Tax on Productive Activities), VAT, and income and profit taxes.[27]

The tax gap estimated for Italy by the Italian Revenue Agency (hereinafter RA) is defined as the difference between the potential collection and the tax that is actually paid.[28] There are a number of methods to calculate the tax gap that rely on the available information, the tax law and the economic structure.[29] The RA adopts a *top-down* approach, based on the comparison between tax data and National Accounts figures provided by Italian National Institute of Statistics (ISTAT). These latter data provide an indicator of the "potential" tax base, but they also incorporate an estimate of the underground economy. From this potential base, an estimate of the corresponding collection is then derived through which it is possible to calculate the tax gap[30]. The Italian tax gap relies mainly on two key tributes: VAT and IRAP.

The similarity between the IRAP tax base and National Account value added is remarkably important in the study of the tax gap. In fact, the National Accounts are the basic unit that determines GDP; therefore, they contain all the incomes that generate changes in the country's wealth. It follows that the IRAP tax base encompasses much of the tax base resulting from the

[27] VAT (value added tax) is an internationally standardized tax, whereas IRAP is the Italian acronym for the regional tax on productive activities, which was created in 1997: the tax base for the IRAP consists of the taxpayer's net revenues from purchases before labor costs (with some differences related to the type of the employee contract) and financial expenses. For a detailed analysis of the construction of the tax gap, see Pisani (2014), Braiotta et al. (2013), D'Agosto et al. (2014) and Braiotta et al. (2015).

[28] The RA has adopted a methodology to estimate potential collection, the amount "which could be collected if no taxpayers would voluntary breach the law and involuntary errors would amount to zero"; see Das-Gupta and Mookherjee (2000).

[29] For a summary, refer to OECD (2002). See also HMRC (2012) and Pisani (2014).

[30] The adopted methodology is based on international best practices (see, among others, HMRC, 2012).

production of goods and services. In addition, the large number of taxpayers subject to this tax indicates that the IRAP tax base gap represents a macro-indicator of the value added that is concealed from tax authorities.

As discussed above, the RA uses a *top-down* approach to calculate the gap, comparing (after having proceeded with harmonization of the two quantities) the IRAP tax base inferred from tax returns with the National Accounts value added at factor costs.

With regard to the VAT, to obtain an accurate measurement of the potential liability, it is necessary to identify both the taxable base and the suitable legal VAT rates with regard to legislation.[31]

Next, the VAT gap can be derived, and it includes tax evasion, the deliberate intention to defraud, insolvency, negligent acts and misinterpretation of the law.

The taxpayers' voluntary compliance is calculated from VAT revenues on an accrual basis, which represent the VAT revenues that an economic system generates as a result of transactions burdened by VAT during the reference period (a fiscal year). The theoretical VAT base (consistent with the classifications and definitions applied for the declared VAT bas) is calculated to estimate the base gap. The total tax base is estimated from detailed expenditure subclasses of National Accounts macro-cluster components: Households, General Government and Uses for Market Enterprises.

The RA requires highly detailed National Accounts aggregates to capture the complex system of VAT regulation and to calculate an accurate theoretical base. For each detailed subclass of National Accounts, the share is deducted from the exempted base; then, the residual amount is associated with its own proper statutory VAT rate. The VAT gap is estimated by deducting the VAT revenues from the potential liability.

From the perspective of economic analysis, the VAT gap captures the phenomenon at the time of consumption, whereas the IRAP tax gap is focused on the time of production. This difference is

[31] See D'Agosto et al. (2014) for details.

important for spatial analysis because some areas of the country have a large concentration of production plants, whereas others are characterized primarily as places of consumption. Therefore, it is possible that evasion occurring in the first area turns into purchasing power in the second area.

Finally, the tax gap for income and profit taxes is estimated beginning with the IRAP tax gap. In fact, if the labor cost of undeclared employees is subtracted from the IRAP base gap, by definition, an estimate is obtained from the corresponding gap in gross profits, by definition. Hence, by applying the appropriate fiscal rate to the gap in gross profits, an estimate is derived of the corresponding tax gap. The overall tax gap is equal to the sum of the tax gaps in the IRAP, VAT and income and profit taxes.

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