How crime affects the economy: evidence from Italy

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How Crime Affects the Economy: Evidence from Italy

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Abstract

Italy represents an interesting case study for an empirical analysis of the impact of crime on economic performance. The country, in fact, presents considerable disparities among its regions in terms of economic outcomes and crime rates. Using a panel data on 19 Italian regions and effective abortion rate as an instrument for crime, the results indicate that crime substantially affects the level of GDP per capita and economic growth across Italian regions, especially in the so-called Mezzogiorno.

1 Introduction

Convergence in growth rate across Italian regions has been widely investigated by researchers. Previous studies show that convergence is generally not occurring[1] except for the 1960s, when Cassa per il Mezzogiorno[2] drove the outcome. However, immediately after that period, convergence was no longer detectable.

Two of the factors that may explain the lack of convergence and the Italian dualism[3] are the large presence of crime and organized crime in Italy.

Crime imposes several costs, not only to individuals that commit offenses. A large presence of crime in the area may lead to a loss in the opportunities for development and the Italian case may be one of the best example of this. The literature has shown several channels through which crime could have affected the Italian development.

The large presence of organized crime in the South of the country discourages firm investments, including foreign direct investment (FDI). Using data on the Italian provinces Daniele and Mariani (2010) estimate the impact of crime on FDI inflow. The results of their analysis show that the correlation between organized crime and FDI inflows is substantially negative and statistically significant.

A further important channel that could affect the Italian economic performance is the misallocation of public fundings. Barone and Narcisio (2013) empirically analyze how mafia affects the allocation of public transfers. Using an instrumental variables approach they correct for possible simultaneous causality among public fundings and the presence of Mafia. Their findings suggest that Mafia attracts and absorbs public fundings in Sicily.

Finally, a higher incidence of crime can lead to higher interest rates and reduced access to credit. Crimes related to organized crime have been shown to affect the loan market (Bonaccorsi di Patti, 2009).

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

[2] Cassa per il Mezzoggiorno was foundend in the 1950s with the aim of solving the Italian dualism through several investments in the southern area.

[3] Italy can be seen as composed by two entities, in terms of economic performance, the North-Center and the South.

While the negative effects on the channels affecting the development have already been explored, the literature that investigates the effect of crime on the Italian economic performance is not large and the approaches adopted by researchers are varied.

Mauro and Carmeci (2007) use Pooled Mean Group (PMG) estimators to explore the link between crime, unemployment and economic activity using Italian regional data. They find that crime and unemployment have long-run effects on the level of Italian regional income but no long-run growth effects.

Pinotti (2012) uses policy evaluation methods for studying the economic effects of organized crime in two Italian regions (Apulia and Basilicata) recently exposed to this phenomenon (since the 1970s). The comparison of actual and counter-factual development shows that as murders increase the presence of organized crime lowers the growth path. Furthermore, lower GDP reflects a net loss in economic activity since private capital has been substituted with less productive public capital.

Rana and Neanidis (2013) study the effect of organized crime and corruption on the economic growth of Italian regions between 1983 and 2009, using difference GMM and system GMM estimators. Their analysis shows that both corruption and organized crime inhibit growth, but if both phenomena are present together in the area the joint effect is less severe.

The aim of this study is to analyze the effect of crime on the GDP per capita and economic growth of the Italian regions. It contributes to the literature by explicitly addressing the potential endogeneity issue, e.g. simultaneous causality between GDP per capita and crime, using an instrument that has its roots in the economics of crime literature.

The chosen instrument for crime is effective abortion rate. Donohue and Levitt (2001) claim that the link between abortion and crime is causal, while a direct causal link between effective abortion rate and economic performance is likely to not exist here since the time span between the two variables is of at least 16 years.

The rest of the paper is structured as follows. The next section describes the data, the variables used in the analysis and the importance of the research question. In Section 3

are presented the theoretical motivations. Section 4 outlines the empirical methodology and discusses the instrument for crime. Section 5 presents the results. Robustness checks are explored in Section 6. The last section concludes.

2 Data and preliminary analysis

A panel of 19 Italian regions (Aosta Valley is excluded from the analysis) during the period 1995 - 2011 is used in this work. Data are from ISTAT (Italian National Institute of Statistics).

The economic performance of the Italian regions is measured by GDP per capita (base year 2005). The crime variable is given by the homicides rate (attempted and committed) per 100,000 inhabitants.

Homicides rate may be a good a proxy for organized crime since mafia organizations use force and fear in order to obtain the control of a certain territory or activity. Moreover, data on other types of crime, especially the ones related to organized crime (e.g. extortions), are subject to under-reporting and under-recording bias, whereas these problems are negligible for homicides.

Figure 1 illustrates the variation across Italian regions in terms of GDP per capita and the homicides rate. Calabria stands out as having the lowest level of GDP per capita and the highest level of homicide rate. The homicides rate is generally higher in the Southern part of Italy (where there is a greater presence of organized crime) and GDP per capita is lower. This may be due to reverse causality. GDP per capita may be lower because of the presence of crime and organized crime, and the large presence of crime and organized crime may be due to the economic situation of these regions. As shown in Figure 2, there is a clear negative correlation between GDP per capita and homicide rate (the OLS fitted values are also presented in figure 2).

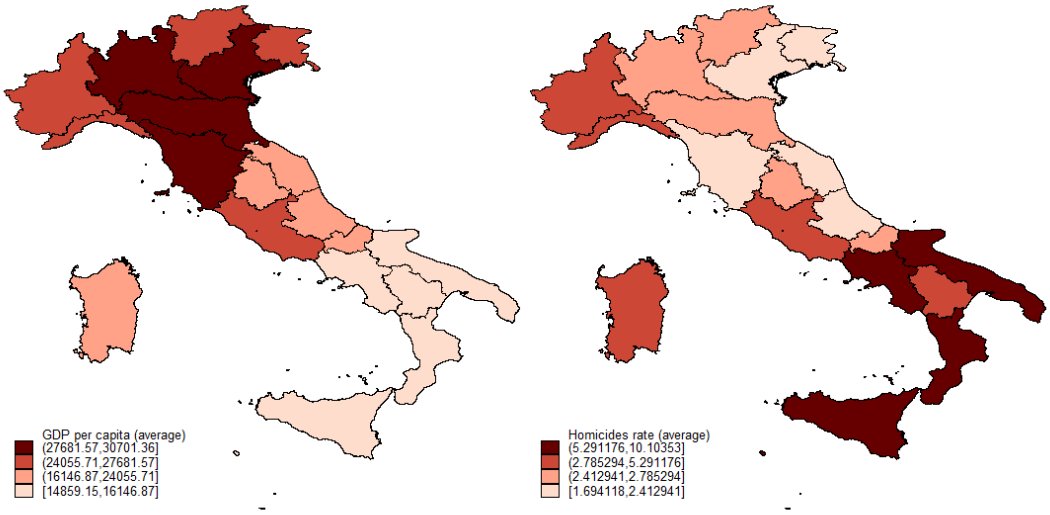
Because of possible reverse causality an instrumental variables approach will be adopted in this work. The approach involves the choice of an appropriate instrument that is, for

this case, the "effective abortion rate".

Additional variables included in the analysis and used as control variables are the ratio of investment to GDP, the ratio of regional government spending in construction and regional planning to total regional government spending, the dropout rate after one year of high school, the long-run unemployment rate, population density and an index of social capital (ratio of people engaged in volunteering activities aged at least 14 over the total population aged at least 14) and the rate of firm creation (difference between the number of firms created in year t and the firms died in the same year over the number of firms existing the year before in the region).

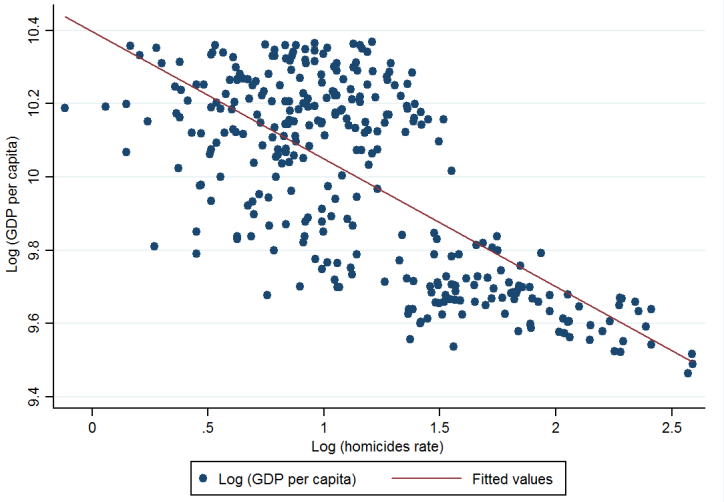
The selection of control variables is suggested by the economic growth and economics of crime literatures. Investments are a primary source of growth, while the government spending in construction is preferred to the total because it contributes to the GDP and crime at the same time. The drop-out rate is used here, instead of the level of human capital, to control for the young people that may choose crime over employment opportunities. The long-run unemployment rate helps to control for the deficiencies of the labor market, especially in the Southern area. Social capital, as suggested by the literature, is likely to be one of the factor explaining the level of economic activity and be negatively correlated with crime. In particular, the social capital index is created following the work of Putnam (1993, 2000). According to Putnam (2000), the most general forms of social capital are trust and social participation. Volunteering activity falls in the latter category. Putnam argues that participation in voluntary organizations and social associations promotes among the members collective norms and trust which is fundamental for the production and the maintenance of the community's well-being. Hence, the use of the ratio of people engaged in volunteering activities aged at least 14 to the total population aged at least 14 partly captures the social capital present in the region.

Figure 1: Heterogeneity across Italian regions in terms of GDP per capita and homicide rate (per 100,000 inhabitants)



Descriptive statistics for the variables used in the analysis can be found in Table 1.

Figure 2: GDP per capita and homicide rate



Calabria has the lowest level of GDP per capita (1995) and the highest homicide rate

(in 1996). Lombardy has the highest GDP per capita (in 2007), while the lowest growth rate is in Piedmont (in 2009).

The variables that may affect the economy in a negative way, such as the dropout rate and long-run unemployment rate, are higher in the Southern regions

Table 1: Summary statistics

VARIABLES	Mean	St. Dev.	Min	Max
GDP per capita	22,659	5,668	12,892	31,848
Homicide rate	3.682	2.267	0.89	13.35
Growth rate (%)	0.439	2.390	-9.132	5.315
I/GDP	0.213	0.0276	0.152	0.304
Construction/Government spending	20,728	3,511	10,486	28,057
Long-run unemployment rate	4.597	3.345	0.400	15
Dropout rate (%)	10.75	2.715	5	18.30
Population density	197.3	107.2	58.70	434.5
Rate of firms creation (%)	1.38	1.075	-2.67	6.29
Social capital (%)	11.08	4.854	4.421	27.70

All the variables are used in logarithmic terms except for population density and rate of firms creation.

Hereafter, the term South is used to denote the macro-area formed by Campania, Apulia, Basilicata, Calabria and Sicily.

3 Theoretical motivation

The output of region i at time t is assumed to be obtain with the following production function:

$$Y_{it} = F(K_{it}, A_{it}(Cr_{it})L_{it}) \tag{1}$$

that is a production function with labour-augmenting technological progress.$Y_{it}$is a function of capital (K_{it}, that depreciates at a rateδ), technological progress (A_{it}, that grows at a rate g), and labour (L_{it}, that grows at a rate n).

The difference respect the Solow growth model is in the term A_{it}, here the technological progress is a function of crime, in particular $\frac{\delta A_{it}}{\delta Cr_{it}} < 0$.Hence, as the crime level in the economy increases the technological progress decreases.

The other conditions are the same of the Solow growth model.

Assuming that the return to scale are constant, the output can be rewritten in terms of output per efficiency unit of labour as:

$$y_{it} = \frac{Y_{it}}{A_{it}(Cr_{it})L_{it}} = \frac{1}{A_{it}(Cr_{it})L_{it}} F(K_{it}, A(Cr_{it})L_{it}) = f(k_{it}) \tag{2}$$

where $k_{it} = \frac{K_{it}}{A_{it}(Cr_{it})L_{it}}$.

High presence of crime in the region implies that resources are wasted for protection and prevention and investment are discouraged. Moreover, money may be taken away from the legal economy through pizzo[4] if mafia organizations are present in the region.

This leads to a resource constraint, in intensive form, for the economy given by:

$$c_{it} + i_{it} + (wastedresources)_{it} = y_{it} = f(k_{it}) \tag{3}$$

where the wasted resources are funded by a tax that depends on the level of crime

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

present in the region, $wastedresources_{it} = \tau(Cr_{it})y_{it}$.

The net accumulation of physical capital is given by $\dot{K_{it}} = I_{it} - \delta K_{it}$, with investments equal to savings and as following: $I_{it} = S_{it} = (1 - \tau(Cr_{it}))sY_{it} - C_{it}$.

Using the last two equations, we get :

$$\dot{K_{it}} = (1 - \tau(Cr_{it}))sY_{it} - C_{it} - \delta K_{it} \tag{4}$$

That gives the following fundamental Solow Equation of motion:

$$\dot{k}_{it} = (1 - \tau(Cr_{it}))sf(k_{it}) - k_{it}(\delta + g + n) \tag{5}$$

From equation (5) emerges that a higher tax implies a lower level of capital accumulation, that will be associated with a lower level of output. The intuition is similar to the one present in the Solow growth model with unproductive government spending.

The equations presented in this section will not be estimated but some of its elements can be found in the empirical part, e.g. investment and population density as proxy for population growth.

The theoretical framework gives an intuition on how crime can affect the output and justify the idea of the work.

4 Empirical methodology

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

$$Y_{it} = \alpha_i + \beta_1 t + \beta_2 Crime_{it} + \sum_{j=1}^{m} \gamma_j X_{j,it} + \delta_1 DU_{it} + \varepsilon_{it} \tag{6}$$

where Y_{it} is the logarithm of GDP per capita in region i in period t, t is a time trend, $Crime_{it}$ is the logarithm of the homicides rate, $X_{j,it}$ are control variables comprising the ratio of investment to GDP, the ratio of regional government spending in construction and

regional planning to total regional government spending, the drop out rate after one year of high school, the long run unemployment rate, the population density and an index of social capital, and the rate of firm creation. DU_{it} is a dummy variable that is equal to 1 if $t > T_B$ (where T_B denotes the structural break) and 0 otherwise. α_i is a time-invariant region specific effect, and ε_{it} is the error term.

Equation (6) will also be estimated with the two stage least square method (2SLS) using an instrument for crime in order to further take into account potential endogeneity problems.

The choice of the instrument is explained in subsection 4.1.

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

$$Y_{it} - Y_{it-1} = \beta_1 Y_{it-1} + \beta_2 Crime_{it} + \sum_{j=1}^{m} \gamma_j X_{j,it} + \delta_1 DU_{it} + \varepsilon_{it} \tag{7}$$

the new regressor Y_{it-1} may be correlated with the error term and thus be potentially endogenous.[5]

Equation (7) is estimated using the System GMM[6] developed by Arellano-Bond (1991), Arellano-Bover (1995) and Blundell-Bond (1998)[7].

A difficulty associated with this estimator relates to the choice of the number of lags to use in order to obtain the instruments. In estimating equation (7), a lag of two to a maximum of three is used and the instruments are collapsed[8].

[5]The specification does not include a trend since Y_t is I(1). Thus, passing to first difference eliminates the trend.

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

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

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

4.1 The instrument for crime

In the economics of crime literature, Donohue and Levitt (2001) argue that a decline in crime rates in the US, during the 1990s, followed from the abortion legalization. The claim is that the link between abortion and crime is causal.

Their main argument is the following: legalized abortion may lead to reduced crime either through a cohort size effect and/or thought possible lower rates of criminality for children born after the abortion legislation.

The first argument relies on the fact that when the cohort reaches the "criminal age" there will be fewer people in their highest - propensity crime years and thus less crime. The second argument follows from two points: women who choose abortion are the ones that are more likely to give birth to children that later may engage in criminal activity; and second, women's ability to child care may vary with age, education and income, hence abortion may be used to optimize the timing of child-bearing[9].

In Italy, abortion was legalized in 1978 through law 194/1978. This law allows a woman to stop her pregnancy during the first 90 days of child-bearing in a public structure, e.g. hospital. Data on abortion rate for 1,000 women are available from 1979, the first full year that the law had an effect. Data on GDP per capita and crime are available from 1995 to 2011. This allows to build up an instrument that follows Levitt's considerations.

The instrument is constructed as follows:

$$EffectiveAbortion_{it} = \sum_{a} Ab_{it-a} \tag{8}$$

The effective abortion for region *i* at time *t* is given by the sum of the abortion rate in that region at time *t* - *a,* where *a* is the age of the cohort.

The abortion data covers the period 1979 - 1995. Hence, for 1995 the effective abor-

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

tion rate is the abortion rate in 1979 (the cohort age is 16 years old). For 1996, the effective abortion rate is the abortion in 1979 plus the abortion rate in 1980 (cohort age: 16 and 17). This is repeated until 2011 where the last cohort is the one born in 1995.

Construction of the instrument is different from the effective abortion rate proposed by Donohue and Levitt (2001) since the aim of this work is different. In this study, the effective abortion rate is only an instrument for crime.

Importantly, a direct causal link between the effective abortion rate and economic performance is likely to not exist since the time span between the two variables is of at least 16 years. Hence, effective abortion is likely to affect the dependent variable only through its effect on crime.

Using the instrument in the Two Stage Least Square (2SLS) procedure for the estimation of equation (6) leads to the following first stage equation:

$$Crime_{it} = \alpha_i + \beta_1 t + \pi_1 EffectiveAbortion_{it} + \sum_{j=1}^{m} \gamma_j X_{j,it} + \delta_1 DU_{it} + v_{it} \qquad (9)$$

5 Results

In the following the results will be presented for the full specification and for a specification without the time factor; this is done since the results with the time specification have to be read carefully because of the structural break[10].

If the thesis that crime is one of the factor explaining the Italian dualism is right, the result of the regression should show a negative effect of homicides rate on the GDP per capita. Moreover, it may be that using homicides rate as crime variable we can capture part of the effect that organized crime has on the economy, especially on the South one where the organized crime presence is higher[11]. If this is the case, the homicide rate

[10] The presence of a structural break for the period 2008-2009 has been detected using the Chow test.

[11] Organized crime organizations use force and fear in order to achieve the control of a territory or activity, homicide is one of their most used "tool".

Furthermore, the correlation between the homicide rate and mafia homicides is 0.82 as shown in the appendix.

must have a higher negative effect than other types of crime (such as bank robberies and bag-snatching) which do not necessary require a mafia organization to take place.

In the following the results of the estimations are presented. Table 2 shows Pooled OLS (POLS) and fixed effects results.

The two approaches present different magnitudes of the effect of crime but it is highly significant in both specifications.

As previously argued, the estimation via the two cited methods is not adequate since there may be reverse causality between GDP per capita and crime, hence a potential endogeneity problem.

Table 2: POLS and fixed effects estimation of equation (6)

	POLS				Fixed Effects			
Homicide rate	-0.349***	-0.351***	-0.084***	-0.091***	-0.043**	-0.042***	-0.040**	-0.037**
	(0.015)	(0.014)	(0.013)	(0.012)	(0.018)	(0.013)	(0.018)	(0.014)
Control variables	no	no	yes	yes	no	no	yes	yes
Time specification	no	yes	no	yes	no	yes	no	yes
Observations	323	323	323	323	323	323	323	323
R^2	0.486	0.502	0.892	0.896	0.04	0.483	0.510	0.641
Adj. R^2	0.484	0.497	0.889	0.893	0.037	0.478	0.497	0.630

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

Hereafter, the analysis in conducted on the sample comprising 19 Italian regions and a sub-sample of 5 of them (South in the tables): Apulia, Calabria, Campania, Basilicata and Sicily.

Table 3 presents the effect of effective abortion rate on GDP per capita. The results of Table 3 supports the claim that the instrument has an effect on the GDP per capita through its effect on crime. If it is true that the effective abortion rate has a negative effect on crime, one would expect a positive effect on GDP through the reduction on crime.

Table 3: Reduced form results

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:						
GDP per capita$_{it}$		Italy			South	
Effective abortion rate	0.032***	0.026***	0.026***	0.036***	0.031***	0.029***
	(0.002)	(0.003)	(0.003)	0.005	(0.006)	(0.005)
Control variables	no	yes	yes	no	yes	yes
Time specification	no	no	yes	no	no	yes
Observations	323	323	323	85	85	85

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

The first stage regression results presented in Table 4 allow us to understand the determinants of homicides rate in the two samples.

From Table 4 some striking results emerge. First, the long run unemployment rate[12] has a different direction effect on homicide rate for the two groups of regions. Second, the variable construction/(government spending) changes drastically magnitude and significance when the analysis is for South. This is coherent with the idea that using homicides rate as a proxy for organized crime, we may capture the possible distortion of the allocation of government spending for constructions and regional planning. The most known case is "Sacco di Palermo"[13]. It is with this event that mafia realized that lucrative gains could be achieved through the government spending in constructions. Social capital assumes the expected sign for both groups (in line with the results obtained in other studies where the emphasis is on the effect of social capital on crime and with the definition of social capital presented before), the same is true for the population density.

The results of the first stage regressions indicate that the the effective abortion rate has a negative impact on crime (as argued by Levitt) and is highly significant. Furthermore, the coefficient of the instrument is higher when the sample is restricted to the Southern

[12]The long-run unemployment rate has been chosen in order to capture the structural deficiencies of the Southern Italy labor market and its effect on crime shows how when other opportunities are really difficult to find, people may end up committing crime.

[13]"Sacco di Palermo" is a term that describes the extensive construction that took place in Palermo during the 1950s and 1960s in which Mafia took part through the use of Mafia-controlled firms.

Table 4: First stage regression results

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:						
Homicide rate$_{it}$		Italy			South	
Effective abortion rate	-0.061***	-0.081***	-0.082***	-0.133***	-0.111***	-0.103***
	(0.012)	(0.015)	(0.016)	(0.025)	(0.026)	(0.028)
Long-run unemployment rate		-0.118**	-0.109*		0.305**	0.302*
		(0.051)	(0.055)		(0.141)	(0.156)
I/GDP		0.140	0.120		0.640**	0.607*
		(0.207)	(0.212)		(0.308)	(0.325)
Construction/Government spending		0.255	0.257		1.809***	1.656***
		(0.213)	(0.213)		(0.511)	(0.569)
Social capital		-0.313***	-0.304**		-0.163	-0.147
		(0.112)	(0.115)		(0.136)	(0.137)
Dropout rate		0.036	0.044		0.118	0.121
		(0.074)	(0.077)		(0.096)	(0.104)
Population density		0.007***	0.007***		0.025**	0.020*
		(0.002)	(0.002)		(0.010)	(0.012)
Rate of firm creation		0.014	0.012		0.009	0.009
		(0.011)	(0.012)		(0.018)	(0.023)
Trend			0.001			-0.003
			(0.003)			(0.005)
DU			-0.004			-0.059
			(0.046)			(0.064)
Time specification	no	no	yes	no	no	yes
Observations	323	323	323	85	85	85
F-statistic of excluded instrument	25.37	27.65	27.11	27.40	18.51	14.06
A.P. chi squared	25.45	28.40	28.03	27.75	20.56	16.07

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

regions.

The F statistic for the excluded instrument shows that the instrument is not weak. Additionally, the endogenous regressor is not under-identified. The Angrist-Pischke (AP) first-stage chi-squared statistic clearly shows that the null hypothesis can be rejected.

Table 5 displays the 2SLS results of equation (6) estimation.

The results imply that if the homicide rate increases by 1% then the GDP per capita will decrease by 0.32%. Restricting the sample to Southern regions the corresponding decrease is 0.26%. When the time trend is included, the magnitude of the effect becomes bigger for South and smaller for Italy while remaining significant at 1% level . It may be that the change in magnitude derive from the 2008-2009 economic crisis. This crisis leads to a stronger negative effect of crime on Southern economy. In sum, the results clearly show that the major effect of crime is on part of the Italian Mezzogiorno.

Comparing Tables 2 and 5, it emerges that the effect of crime on GDP is upward biased in the POLS and fixed effects specifications. A possible explanation may be corruption (not explored in this work). The literature argues that if corruption is organized then the effect on the economy may be less severe (Rana and Neandis, 2013).

5.1 The effect of crime on the economic growth

Estimating the effect of crime on the growth rate, using a dynamic panel model, leads to two potentially endogenous regressors. The estimator adopted to control for the potential endogeneity problem is the system GMM (Arellano-Bond (1991), Arellano-Bover (1995) and Blundell-Bond (1998)). Despite the Difference GMM, the system GMM estimator uses the lags of the potential endogenous variables in level and first differences for the construction of “internal” instruments and collapsing instruments avoids their proliferation. In addition, the external instrument already used in the 2SLS estimation (effective abortion rate) can still be used together with the internal ones.

The system GMM results are reported in Table 6.

Table 5: Second stage results

Dependent variable:						
GDP per capita$_{it}$	Italy			South		
Homicide rate	-0.52***	-0.325***	-0.316***	-0.275***	-0.262***	-0.276***
	(0.110)	(0.063)	(0.061)	(0.041)	(0.040)	(0.050)
Long-run unemployment rate		-0.093***	-0.060***		-0.079**	-0.025
		(0.017)	(0.018)		(0.040)	(0.043)
I/GDP		0.100	0.033		0.276***	0.177*
		(0.072)	(0.070)		(0.091)	(0.097)
Construction/Government spending		0.100	0.107*		0.584***	0.541***
		(0.062)	(0.058)		(0.173)	(0.167)
Social capital		-0.107**	-0.070		-0.053	-0.038
		(0.045)	(0.044)		(0.039)	(0.040)
Dropout rate		-0.022	0.003		-0.039	-0.011
		(0.026)	(0.025)		(0.029)	(0.030)
Population density		0.001**	0.001**		0.007**	0.003
		(0.001)	(0.001)		(0.004)	(0.003)
Rate of firm creation		0.012***	0.005		0.020***	0.010
		(0.004)	(0.004)		(0.006)	(0.007)
Trend			0.004***			0.003
			(0.001)			(0.002)
DU			-0.024			-0.043**
			(0.015)			(0.021)
Time specification	no	no	yes	no	no	yes
Observations	323	323	323	85	85	85

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

The trend is absent since the dependent variable is I(1) and one of most common methods for detrending is the use of the first differences. Additional time effect is captured by DU_{it}.

Column (2) shows that crime produces a negative effect on the growth rate. An increase of 1% in the homicide rate leads to a decrease in the growth rate of 0.14% if DU_{it} is excluded. The magnitude increases if DU_{it} enters as control (0.15%). These magnitudes are substantial considering that Italy has experienced low growth rate and periods of recession for the past 20 years. Additionally, the results are consistent with the absence of convergence across the Italian regions. In fact, as previously showed, homicide rate has a strong effect when the sample is restricted to the Southern regions only.

To verify the validity of the instruments two tests are conducted. The first test is the Arellano-Bond test for AR(2) in first differences. Here, the null hypothesis is the absence of auto-correlation in the residuals using a lag length of two. The null hypothesis cannot be rejected, implying that the instruments are not endogenous.

The second, Hansen test, checks the validity of the instruments under the null hypothesis that the covariance among the instruments and the error term is zero. Again, the null hypothesis cannot be rejected. Thus, the instruments are exogenous.

The results presented in this section illustrate that crime has a significant and negative impact on economic performances. Since the homicide rate, typically associated with organized crime associations, is higher in Southern Italy, the results suggest that organized crime can partially explain the lack of convergence across regions in Italy and the Italian dualism.

Table 6: Estimation of the effect of crime on the economic growth

Dependent variable: $\triangle$GDP per capita$_{it}$	(1)	(2)	(3)
GDP per capita$_{it-1}$	0.001	-0.058	-0.057
	(0.002)	(0.077)	(0.073)
Homicide rate	0.002	-0.136*	-0.150**
	(0.015)	(0.075)	(0.069)
Long-run unemployment rate		0.007	0.009
		(0.026)	(0.042)
I/GDP		0.024	0.029
		(0.052)	(0.047)
Construction/Government spending		0.040	0.036
		(0.070)	(0.068)
Dropout rate		0.088	0.104
		(0.064)	(0.075)
Social capital		-0.067	-0.066
		(0.065)	(0.099)
Population density		0.001	0.001
		(0.0001)	(0.001)
Rate of firm creation		0.015**	0.016**
		(0.005)	(0.007)
DU			-0.002
			(0.017)
Control variables	no	yes	yes
Observations	304	304	304
No. of instruments	7	13	14
Arellano-Bond test for AR(2) in first differences,	-3.27	-1.54	-1.34
p-value	0.001	0.123	0.179
Hansen test,	16.41	5.83	6.42
p-value	0.006	0.212	0.170

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

6 Robustness checks

If organized crime is one of the factor explaining the dualism that characterizes Italy, then considering other types of crime, not associated solely with an organized crime association of mafia type and whose distribution is more homogeneous among regions, should lead to different results.

The two crimes chosen in order to test the validity of the thesis are: bank robberies (per 100,000 inhabitants) and bag-snatching (per 100,000 inhabitant). The choice of these

two particular crimes is related to their nature: the first, does not necessary need a criminal organization of mafia type to take place, and the second does not need any type of organization.

Figure 3 presents a descriptive analysis of data on bank robberies and bag-snatching. The figure shows that the level of bag-snatching is almost uniform across the regions but bank robberies rate is higher for regions with a higher GDP per capita.

Equations (6) and (7) are re-estimated using bank robberies and bag-snatching instead of the homicide rate and without the time specification. The results of the 2SLS estimation are presented in Table 7. The results of system GMM are found in Table 8.

In Table 7, the results of the first stage for both variables are reported in columns (1) and (2) while columns (3) and (4) report second stage regression results. Bank robberies and bag-snatching have a negative and significant effect on GDP per capita, but it is smaller than the effect of homicides. The statistics indicate that the instrument is not weak in both regressions, and the potential endogenous regressor is not under-identified. Moreover, the magnitude of the effective abortion rate, in both cases, is larger than in the correspond estimates using homicides rate.

In Table 8 are reported the effects of bank robberies and bag-snatching on economic growth. Results for bank robberies are in column (1) and results for bag-snatching are in column (2).

The results indicate that bank robberies has a negative but insignificant effect on economic growth. Bag-snatching has a small and insignificant positive effect on economic growth.

The tests for the validity of the instruments reported in Table 8 clearly reveal that the null hypothesis of absence of covariance among the instruments and the error term cannot be rejected. Thus, the instruments are valid.

This section showed how crimes that may not be related to organized crime have a smaller effect on the economic performance of Italian regions if compared to homicides (usually related to mafia associations). Hence, the homicide rate may be a good proxy for

Figure 3: Bank robberies and bag-snatching in the Italian regions

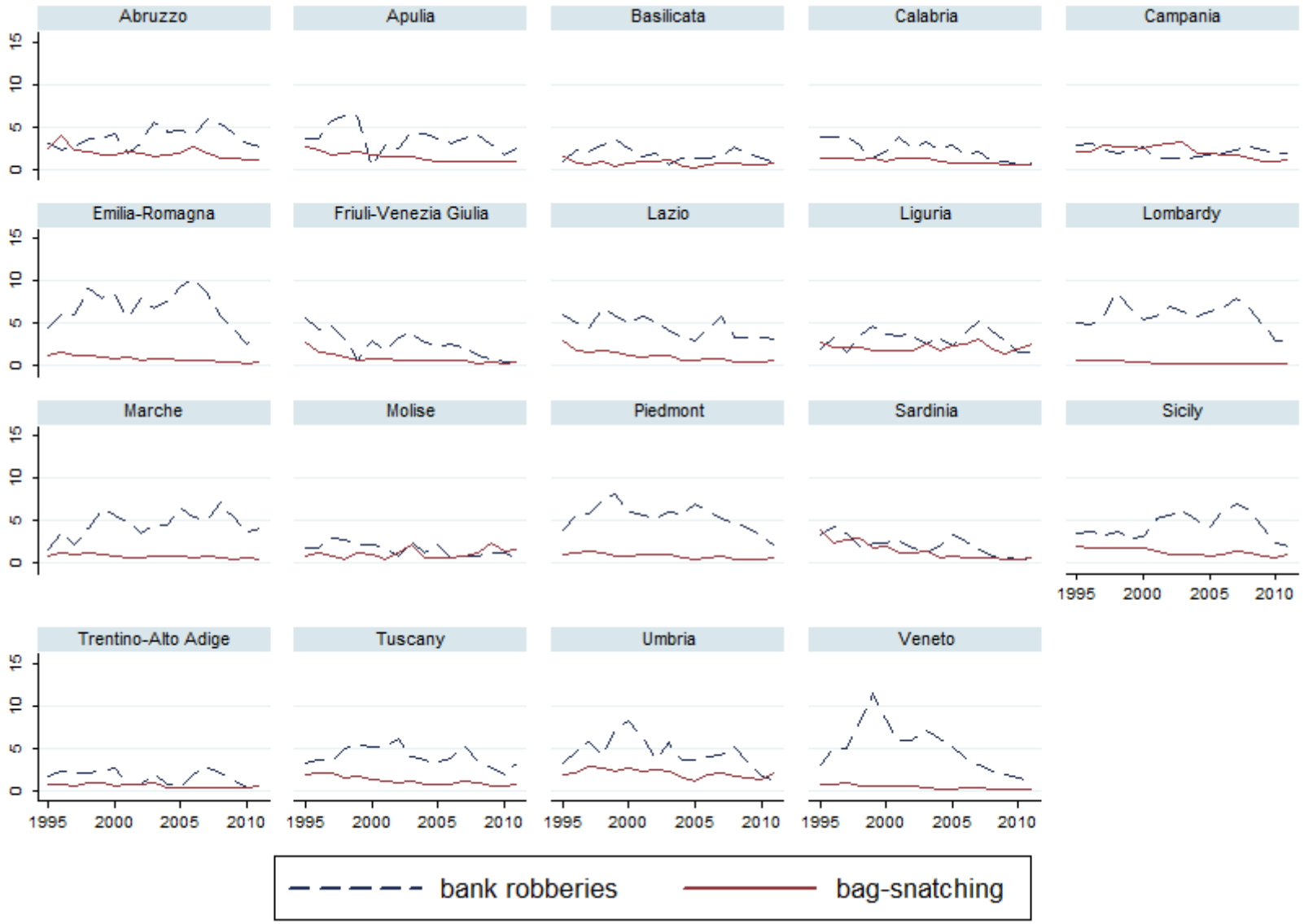


Table 7: The effect of bank robberies and bag-snatching on GDP per capita

	(1)	(2)	(3)	(4)
	First stage regression		Second stage regression	
	Bank robberies$_{it}$	Bag-snatching$_{it}$	GDP per capita$_{it}$	GDP per capita$_{it}$
Effective abortion rate	-0.128***	-0.165***		
	(0.034)	(0.036)		
Bank robberies			-0.206***	
			(0.048)	
Bag-snatching				-0.162***
				(0.030)
Long-run unemployment rate	-0.652***	-0.093	-0.189***	-0.070***
	(0.106)	(0.078)	(0.032)	(0.013)
I/GDP	-0.623	-0.557*	-0.074	-0.036
	(0.401)	(0.335)	(0.099)	(0.064)
Construction/Government spending	-0.345	0.032	-0.053	0.023
	(0.349)	(0.331)	(0.068)	(0.047)
Social capital	-0.383*	-0.277*	-0.084	-0.050
	(0.221)	(0.157)	(0.054)	(0.033)
Dropout rate	-0.153	0.065	-0.066	-0.024
	(0.179)	(0.145)	(0.040)	(0.024)
Population density	0.002	-0.023***	-0.001	-0.005***
	(0.004)	(0.003)	(0.001)	(0.001)
Gross rate of firm creation	0.130***	0.053***	0.034***	0.016***
	(0.027)	(0.019)	(0.008)	(0.004)
Observations	323	323	323	323
F statistic of excluded instrument	14.46	20.11		
AP chi squared	14.85	20.65		

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

organized crime and manages to partially capture its effects.

Table 8: The effect of bank robberies and bag-snatching on the economic growth of Italian regions

Dependent variable: $\triangle$GDP per capita$_{it}$	(1)	(2)
GDP per capita$_{it-1}$	0.027	0.053
	(0.115)	(0.111)
Bank robberies	-0.038	
	(0.037)	
Bag-snatching		0.041
		(0.073)
Long-run unemployment rate	0.166	0.140
	(0.203)	(0.122)
I/GDP	0.079	0.140
	(0.133)	(0.248)
Construction/Government spending	0.008	0.029
	(0.082)	(0.068)
Dropout rate	-0.029	-0.114
	(0.024)	(0.083)
Social capital	0.017	0.242
	(0.032)	(0.203)
Population density	-0.001	0.001
	(0.003)	(0.001)
Gross rate of firm creation	0.002	0.001
	(0.006)	(0.010)
Observations	304	304
No. of instruments	11	11
Arellano-Bond test for AR(2) in first differences,	-0.39	-0.08
p-value	0.698	0.934
Hansen test,	2.78	2.25
p-value	0.249	0.325

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

7 Conclusions

This study provides estimates of the effect of homicides rate on the economy of the Italian regions. Homicides rate has been chosen since it may be a proxy for organized crime and because data on other crimes are not reliable due to under-reporting and under-recording bias.

The estimation strategy addresses potential endogeneity issues by using effective abortion rate as an instrument for the homicide rate. The instrument has its roots in the economics of crime literature and the statistics presented in the work show its validity.

The empirical exercises indicate that crime may be an important factor explaining regional economic disparities in Italy.

Additionally, the effect on the economic growth has been estimated using the system GMM estimator. The results of the latter show that crimes, such as homicide (typically associated to organized crime) inhibit the growth path, partially explaining the absence of convergence among Italian regions.

Robustness checks show that other types of crime, that do not require an organized crime association of mafia type, and whose distribution is more homogeneous among the Italian regions, have a smaller effects.

This work suggests that organized crime have to be addressed before the implementation of policies that aim to accelerate economic performance in Italy.

Further research could look at a longer time period, and understand when and through which channels crime and organized crime started to affect the economy of Southern Italy.

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Appendix

Table 9 shows the Pearson product-moment correlation coefficient for organized crime homicides (per 100,000 inhabitants) and homicide rate (per 100,000 inhabitants). It clearly shows a high dependence among the two variables.

This may confirm the use of the homicide rate to capture some of the effect of organized crime on the economy.

Table 9: Correlation between mafia homicide rate (per 100,000 inhabitants) and homicide rate (attempted and committed, per 100,000 inhabitants)

	Mafia homicide rate	Homicide rate
Mafia Homicide rate	1	
Homicide rate	0.82	1