CONTRIBUTI DI RICERCA CRENOS

A NOTE ON MARGINAL DETERRENCE: EVIDENCE

Claudio Detotto
Bryan C. McCannon
Marco Vannini

WORKING PAPERS

2013/10

CUEC

CENTRO RICERCHE ECONOMICHE NORD SUD
(CRENOS)
UNIVERSITÀ DI CAGLIARI
UNIVERSITÀ DI SASSARI

CRENOS was set up in 1993 with the purpose of organising the joint research effort of economists from the two Sardinian universities (Cagliari and Sassari) investigating dualism at the international and regional level. CRENoS' primary aim is to improve knowledge on the economic gap between areas and to provide useful information for policy intervention. Particular attention is paid to the role of institutions, technological progress and diffusion of innovation in the process of convergence or divergence between economic areas. To carry out its research, CRENoS collaborates with research centres and universities at both national and international level. The centre is also active in the field of scientific dissemination, organizing conferences and workshops along with other activities such as seminars and summer schools.
CRENoS creates and manages several databases of various socio-economic variables on Italy and Sardinia. At the local level, CRENoS promotes and participates to projects impacting on the most relevant issues in the Sardinian economy, such as tourism, environment, transports and macroeconomic forecasts.

www.crenos.it
info@crenos.it

CRENoS – CAGLIARI
VIA SAN GIORGIO 12, I-09100 CAGLIARI, ITALIA
TEL. +39-070-6756406; FAX +39-070- 6756402

CRENoS - SASSARI
VIA TORRE TONDA 34, I-07100 SASSARI, ITALIA
TEL. +39-079-2017301; FAX +39-079-2017312

Title: A NOTE ON MARGINAL DETERRENCE: EVIDENCE

ISBN: 978 88 84 67 825 6

First Edition: May 2013

© CUEC 2013
Via Is Mirrionis, 1
09123 Cagliari
Tel./Fax 070 291201
www.cuec.it

A Note on Marginal Deterrence: Evidence

Claudio Detotto
University of Sassari and CRENoS
Bryan C. McCannon
Saint Bonaventure University
Marco Vannini
University of Sassari and CRENoS

Abstract

Empirical evidence of the marginal deterrent effect is provided. Exploring a data set of kidnapping crimes in Sardinia between 1960 and 2012 changes in Italian policy regarding sanctions for kidnapping and their associated impact on murders is considered. Deaths associated with kidnappings increase in prevalence when the kidnapping sanction increased, causing a decrease the marginal sanction for murder. Death rates reversed when enhanced sanctions for murder were later introduced.

Keywords: crime, kidnapping, marginal deterrence, murder, Sardinia
Jel classification: K42, H11

1. Introduction

The idea of marginal deterrence is that one should not necessarily consider a criminal act in isolation. In many circumstances individuals considering whether to engage in criminal behavior have multiple illegal activities to choose from. Marginal deterrence recognizes that the setting of sanctions for one particular offense not only affects deterrence of that crime, but also affects the incentives to engage in other activities. Early discussion of this phenomenon is done by Stigler (1970).

Shavell (1992), pioneering the formal analysis of marginal deterrence, considers an environment where an individual can choose between one of two illegal acts. Increasing the sanction for one offense encourages substitution to the other. He distinguishes between enforcement that can be made specific to each offense and general enforcement where both crimes are apprehended at the same rate, deriving optimal sanctions in each environment. Theoretical extensions include marginal deterrence in the context of completing a crime (Kramer, 1990), a normative analysis (Wilde, 1992), optimal sanctions with differing enforcement costs (Mookherjee and Png, 1994), enforcement of environmental standards when the regulatory agency can select its inspections (Franckx, 2004), optimal marginal deterrence sanctions in antitrust enforcement (Houba, Motchenkova, and Wen, 2011), and examples in Islamic law (Gouda, 2012).

Friedman and Sjostrom (1993) take the theoretical analysis a step further. They consider the situation where one first decides whether to commit a crime and, then, if the illegal act occurs decides whether to commit another complementary crime. They motivate their analysis with an illustration of deterring armed robbery. If sanctions were enhanced to attempt deterrence, the marginal deterrence of the complementary crime of murdering the store clerk is, in fact, mitigated.

Evidence of a substitution effect between related crimes exists. See Detotto and Pulina (2013) for an example of Italian crime, Koskela and Viren (1997) for a substitution between robbery and auto theft, and Shepherd (2002) for an example of spillover of California's Three Strikes law onto other crimes not covered by the legislation. To the best of our knowledge, though, the phenomenon of marginal deterrence of

complementary crimes has not been documented.[1] This is important. If increased sanctions for an act, in an attempt to deter, can be shown to encourage more violent and serious crimes, then the cost imposed due to the enhanced sanction may be exacerbated.

We argue a reasonable application of the theory of marginal deterrence exists for the crimes of kidnapping and its complement, murder. Once kidnapping has commenced, the perpetrators decide whether or not to kill the victim. While the death exposes the criminals to punishments, if the sanction for kidnapping is great, then the marginal sanction for homicide is reduced.

We use a unique data set of kidnappings on the island of Sardinia between 1960 and 2012 to test the theory of marginal deterrence. Kidnapping was a major concern for Italy in the 1960s and, as a consequence, in 1974 a new set of sentencing policies were set with greatly enhanced punishments for the crime. The 1974 reforms, though, did not change the sanction for murder. Thus, marginal deterrence for death reduced. In 1978 in response to increased homicides[2], the Italian government created escalated sanctions for deaths resulting from kidnappings, addressing the marginal deterrence problem. We document that the impact on kidnapping-related homicides coincide with the predictions of the theory. The initial reforms correlate with an increased level of kidnappings resulting in homicides. The escalation of sanctions for kidnap-murders of 1978 reduced the prevalence of death. Thus, Shavell's (1992) "classic example" of kidnapping/murder as an application of marginal deterrence finds empirical support.

2. Kidnapping in Sardinia

We first provide a brief history of the setting of sanctions for kidnapping in Italy. Then we describe the data collected to be used in the analysis.

[1] Ekelund et al (2006) do find no evidence of a deterrent effect of capital punishment on multiple murders, which is in line with the theory of marginal deterrence.

[2] As will be discussed, the change in the policy occurred immediately after the assassination of the influential politician, Aldo Moro.

2.1 History of Italian Kidnapping Sanctions

Currently, the Italy penal code §630 on ransom kidnapping (*sequestro di persona a scopo di estorsione*) outlines the sanctions for kidnapping as (Zagrebelsky and Pacileo, 1999),

> (1) Any person who seizes another person with the aim of reaping, for himself or for somebody else, an unjust profit as a price of the liberation, shall be punished by imprisonment for 25 to 30 years.
> (2) If the hostage dies as a result of the kidnap, but this consequence was unintentional for the offender, the latter shall be punished by imprisonment for 30 years.
> (3) If instead the kidnapper intentionally causes the death of the hostage, then he shall be punished by imprisonment for life.

Moreover, in case one of the offenders withdraws from the criminal organization and helps free a hostage (not as a result of the payment of the ransom), then he shall be punished according to the terms of the simple kidnapping (§605), i.e. imprisonment for 6 months to 8 years. However, even in this case, if the victim dies as a consequence of the kidnap, after the liberation, imprisonment from 6 to 15 years shall apply.

Article 630, as it stands today, derives from the original 1930s penal code. In the initial code, the penalty for ransom kidnapping was (a) imprisonment for 8 to 15 years (plus a fine from 400,000 to 800,000 Italian Lira) if the ransom was not paid and (b) imprisonment for 12 to 18 years in case "the intended profit is realized", i.e. the ransom was actually paid. Thus, the sanction for kidnapping was based solely on whether a payment was received. Since the original 1930s code, two major changes have occurred to shape the current policy.

Kidnappings under this code became a significant problem. In the three-year window of 1966-68, for example, the island of Sardinia alone experienced 42 kidnappings, as compared to an average of 1.6 kidnappings per year between 1955 and 1965. This phenomenon occurred similarly throughout Italy making the country the world leader in the crime (Caramazza and Leone, 1984). Thus, policy needed to adjust to the rising concern.

As a response, in 1974 with law n. 497 the punishment for ransom kidnapping was escalated. Clause (a) above was increased to imprisonment for 10 to 20 years (and a fine of not less than 400,000 Italian Lira) whereas clause (b) was extended to imprisonment for 12 to

25 years (and a fine of not less than 1,000,000 Italian Lira). In addition, a new clause was added which addressed the scenario where the offender helped free the victim. Hence, the 1974 reform escalated, specifically, the punishment for kidnapping. The sanction for death deriving from the kidnapping did not increase. Consequently, the marginal sanction for murder reduced. The theory of marginal deterrence, then, would predict an increase in the rate of deaths conditional on kidnapping occurring.

Finally, against the backdrop of the kidnapping of the political leader Aldo Moro, seized by terrorists on March 16, 1978 and killed on May 9, new enhanced sanctions were introduced. The new law (n. 191) enacted in May 1978 specifically increased the sanction for deaths associated with kidnapping. Accordingly, §630 was amended creating clauses (2) and (3) previously cited. Hence, while ransom kidnappings retained strong sentences, reforms targeting deaths were addressed. The theory of marginal deterrence, then, would predict that law focusing on the marginal sanction should decrease the prevalence of this complementary crime. It is these two policy interventions in the 1970s we explore to test the validity of the theory of marginal deterrence.

2.2 Description of Data

A data set is compiled of all kidnapping events on the island of Sardinia between 1960 and 2012. The primary sources used are *Anonima Sequestri Sarda* (Casalunga, 2007) and *Sardegna Criminale* (Ricci, 2009). Both publications, produced by law enforcement officials, collect factual information on kidnapping in Sardinia. They provide information on the kidnapping experiences. Additionally, background information on the victims was filled in from local newspaper articles. A total of 162 observations arise. There are no incomplete observations from this time period, but failed attempts were excluded. In failed kidnappings the criminals did not have the choice to murder the victim and are, since the emphasis here is on the choice to kill, not included.

A number of measurable variables arise. The primary variable of interest, *Death*, captures whether a kidnapping experience ended in the death of the victim. Also, information on the gender, age, and nationality is collected. With regards to the crime the time of year, whether or not a ransom was paid, and the location within Sardinia in which the crime occurred is also noted. The primary independent variables, *1974* and *1978*, document events that occur in these two policy regimes. Specifically, *1974* = 1 if the kidnapping was initiated between October 14, 1974 and May 18, 1978 (the beginning dates of the policies).

Similarly, *1978* = 1 if it occurred after this end date. Table 1 provides the descriptive statistics.

[Insert Table 1 here]

In addition to these variables a number of other dummy variables are created to control for environmental factors. The occupation of the victim (or victim's family) is included. The occupations are classified into agriculture/farming, business manager/entrepreneur, or freelancer (self-employed) such as doctors, lawyers, and dentists. In the case of a child or unemployed spouse, the occupation of the primary income earner was used. Controls for the four seasons of the year under which the kidnapping occurred, along with the four provinces within Sardinia (Nuoro, Sassari, Oristano, and Cagliari) are measured as well.

3. Empirical Results

To test the hypothesis that the changes in the sanctions affected the incentive to murder the victim, binary probit models are estimated with the dummy variable *Death* as the dependent variable. Controls for the characteristics of the victim, time of year, and location were included. Table 2 presents the main results.

[Insert Table 2 here]

The results in Table 2 provide confirmation of the theory. The adoption of the enhanced sanctions for kidnapping in 1974 resulted in an increase in the prevalence of death. The marginal effect is an increase in the likelihood by 16-22%. Additionally, the escalated sanctions for murder in 1978 coincides with a reduction in the chance of death. The impact ranges from a 13% to 15% decrease in the likelihood.

The timing of the crime is important for the estimation. While the base model includes those cases occurring either immediately before or immediately after the change in the policy, it seems reasonable to expect that the impact of the new law may take time to affect behavior. For example, kidnapping organizations must pre-plan their attacks. Similarly, since the dating of the crimes is at the initiation of the kidnapping, we exclude those crimes that occur immediately before the policy change. Kidnappers could, for example, anticipate changes in the rules and adjust their behavior. Thus, Column II lags the policy variables

three months, Column III leads them, while IV and V drop those within this interval around 1974 and 1978 respectively. Column VI drops both. The sign, magnitude, and statistical significance of the coefficient change vary little over the specifications.[3]

The payment of a ransom is negatively and statistically related to death. Thus, while a completed ransom payment continues to give the kidnappers the incentive to kill the witness, it is associated with an increase in the chance of surviving the ordeal. The number of kidnapping events is unrelated to the violence committed. While most of the characteristics controls are statistically insignificant, the age of the victim is an important driver of survival.

As a robustness check, rather than pool the kidnapping observations, the time series is considered. The number of reported deaths due to kidnapping in each quarter of the year between 1960 and 2012 is used as the dependent variable. Along with the breaks at 3rd Quarter 1974 and 2nd Quarter 1978, the number of kidnapping events is included as a control variable. The time-series analysis confirms the results: the coefficients on the two policy dates exhibit the same sign as in Table 2 and are statistically significant.

4. Conclusion

The purpose of the note is to provide empirical evidence of the marginal deterrent effect; especially the spillover of increased sanctions for one crime increasing the prevalence of a complementary crime. Kidnapping and the associated murders that can occur provide such an example. By analyzing a unique data set of kidnappings in Sardinia and changes in Italian policy on sanctions for kidnappings, evidence is presented that a reduction in the marginal sanction for the crime with the escalated sanction for kidnapping resulted in more deaths. Given the marginal effect of the 1974 policy change estimated and the number of kidnappings over this period, the law change added almost one more death per year on the island of Sardinia alone.

There exists a tradeoff between deterrence of a crime and marginal deterrence of additional crimes. The evidence suggests that policy aimed at deterring the incidence of kidnapping may need to look beyond simply enhancing sanctions. Detotto, McCannon, and Vannini (2013) investigate anti-kidnapping policies that address the benefits to

[3] In fact, the p-value of the coefficient for *1974* in Column I is only 0.106!

the crime and consider the duration of the kidnapping. Thus, ransom kidnapping is a rather unique crime. In general, though, the confirmation of a marginal deterrent effect provides additional arguments for policymaking to consider such effects when designing enforcement institutions.

References

Carramazza, I.F., U. Leone (1984) Phenomenology of Kidnappings in Sardinia, Fratelli Palombi Editori, Rome.

Casalunga, L. (2007) Anonima Sequestri Sarda, Frilli, Rome.

Detotto, C., B.C. McCannon, M. Vannini (2012) Understanding ransom kidnappings and their duration, Working Paper CRENoS No. 201219.

Detotto, C., M. Pulina (2013) Assessing substitution and complementary effects amongst crime typology, European Journal of Criminal Policy and Research, forthcoming.

Ekelund Jr., R.B., J.D. Jackson, R.W. Ressler, R.D. Tollison (2006) Marginal deterrence and multiple murders, Southern Economic Journal 72, 521-541.

Franckx, L. (2004) Marginal Deterrence Through Ambient Environmental Sanctions, Scottish Journal of Political Economy 51, 507-527.

Friedman, D., W. Sjostrom (1993) Hanged for a sheep: the economics of marginal deterrence, Journal of Legal Studies 22, 345-366.

Gouda, M., (2012) Stealing more is better? Marginal deterrence in Islamic criminal law of theft, Working Paper.

Houba, H., E. Motchenkova, Q. Wen, (2011) Antitrust enforcement and marginal deterrence, Tinbergen Institute Discussion Paper No. 2011-166/1.

Kramer, S. (1990) An economic analysis of criminal attempt: marginal deterrence and the optimal structure of sanctions, Journal of Criminal Law & Criminology 81, 398-417.

Koskela, E., M. Viren (1997) An occupational choice model of crime switching, Applied Economics 29, 655-660.

Mookherjee, D., I.P.L. Png, (1994) Marginal deterrence in enforcement of law, Journal of Political Economy 102, 1039-1066.

Ricci, G. (2009) Sardegna Criminale, Newton Compton, Rome.

Shavell, S. (1992) A note on marginal deterrence, International Review of Law & Economics 12, 345-355.

Shepherd, J.M., (2002) Fear of the first strike: the full deterrent effect of California's two and three strikes legislation, Journal of Legal Studies 31, 159-201.

Stigler, G. (1970) The Optimum Enforcement of Laws, Journal of Political Economy 78, 526-536.

Wilde, L.L., (1992) Criminal choice, non-monetary sanctions and marginal deterrence: a normative analysis, International Review of Law & Economics 12, 333-344.

Zagrebelsky, V., V. Pacileo (1999) Codice Penale Annotato: Con La Giurisprudenza, Unione Tipografico Editrice Torinese, Torino.

Table 1: Descriptive Statistics

variable	description	mean
Death	=1 if kidnapping resulted in death	0.179
1974	=1 if crime occurred in 1974-77	0.105
1978	=1 if crime occurred in 1978-2010	0.531
Female	=1 if victim is a woman	0.136
Age	victim's age	41.52
Sardinian	= 1 if victim is from Sardinia	0.784
Italian	= 1 if victim is from Italy (not Sardinia)	0.179
Paid	=1 if a ransom was paid	0.710
Events	# of kidnappings in the 6 months prior[4]	2.46

[4] The standard deviation of *Age* is 16.99 with a minimum value of 7 and a maximum of 83. The standard deviation of *Events* is 2.46 with a minimum of 0 and a maximum value of 14.

Table 2 (probit, dep. var. = *Death*)

	I	II	III	IV	V	VI
1974	0.16 (0.12)	0.19* (0.12)	0.19* (0.12)	0.21* (0.13)	0.17* (0.13)	0.22** (0.14)
1978	-0.15** (0.07)	-0.14** (0.06)	-0.14** (0.07)	-0.13** (0.06)	-0.15** (0.07)	-0.13** (0.07)
Events	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Female	-0.06 (0.06)	-0.06 (0.06)	-0.05 (0.06)	-0.04 (0.06)	-0.06 (0.06)	-0.04 (0.06)
Age	0.004** (0.002)	0.004*** (0.001)	0.004** (0.002)	0.004*** (0.002)	0.003** (0.002)	0.004** (0.002)
Sardinian	-0.24 (0.24)	-0.25 (0.24)	-0.25 (0.24)	-0.24 (0.24)	-0.25 (0.24)	-0.24 (0.24)
Italian	-0.14 (0.06)	-0.14 (0.06)	-0.14 (0.06)	-0.14 (0.06)	-0.14 (0.06)	-0.14 (0.06)
Paid	-0.20*** (0.08)	-0.20*** (0.08)	-0.21*** (0.08)	-0.21*** (0.08)	-0.21*** (0.08)	-0.21*** (0.08)
Controls:						
Occupation?	YES	YES	YES	YES	YES	YES
Seasons?	YES	YES	YES	YES	YES	YES
Provinces?	YES	YES	YES	YES	YES	YES
Pseudo R^2	0.257	0.260	0.265	0.274	0.255	0.272
Wald	38.34***	37.17***	38.17***	37.55***	37.65 ***	37.00***
Log Likelihood	-56.59	-56.33	-55.96	-53.72	-56.44	-53.59
N	162	162	162	159	160	157

*** 1%, ** 5%, * 10%. Marginal effects reported, Robust standard errors reported in parentheses. A constant term is included in each specification.
(I): base model, (II): *1974* and *1978* are lagged 3 months, (III): *1974* and *1978* are leaded 3 months, (IV): dropped all obs. in the range [-3, +3] months of 14 Oct 1974, (V): dropped all obs. in the range [-3, +3] months of 18 May 1978 (VI): dropped all obs. in the range [-3, +3] months of both 14 October 1974 and 18 May 1978.

Ultimi Contributi di Ricerca CRENoS

I Paper sono disponibili in: http://www.crenos.it

13/09 *Riccardo Marselli, Bryan C. McCannon, Marco Vannini*, "Bargaining in the Shadow of Arbitration"

13/08 *Maria Chiara Di Guardo, Emanuela Marrocu, Raffaele Paci*, "The Concurrent Impact of Cultural, Political, and Spatial Distances on International Mergers and Acquisitions"

13/07 *Fabio Cerina, Tadashi Morita, Kazuhiro Yamamoto,* "Integration and Welfare with Horizontal Multinationals"

13/06 *Gerardo Marletto,* "Car and the city: Socio-technical pathways to 2030"

13/05 *Anna Bussu, Claudio Detotto,* "The effect of socio-economic and emotional factors on gambling behaviour"

13/04 *Luc Bauwens, Edoardo Otranto,* "Modeling the Dependence of Conditional Correlations on Volatility"

13/03 *Oliviero A. Carboni, Claudio Detotto,* "The economic consequences of crime in Italy"

13/02 *Pasqualina Arca, Gianfranco Atzeni, Luca Deidda,* "Economics of bankruptcy exemption: Signaling value of collateral, cost of credit and access to credit"

13/01 *Miguel Casares, Luca Deidda, Jose E. Galdon-Sanchez,* "Business cycle and monetary policy analysis with market rigidities and financial frictions"

12/36 *Maria Chiara Di Guardo, Raffaele Paci,* "M&A and knowledge flows in the European Union's Neighboring Countries"

12/35 *Raffaele Paci, Emauela Marrocu,* "Tourism and regional growth in Europe"

12/34 *Fabio Cerina,* "Endogenous Growth and Sustainable Tourism"

12/33 *Michele Battisti,Filippo Belloc, Massimo Del Gatto,* "Unbundling technology adoption and tfp at the firm level. Do intangibles matter?"

12/32 *Massimo Del Gatto, Filippo di Mauro, Joseph Gruber, Benjamin Mandel,* "The "Revealed" Competitiveness of U.S. Exports "

12/31 *Marinella Cadoni, Roberta Melis, Alessandro Trudda,* "Financial Crisis: a new measure for risk of pension funds assets"

12/30 *Oliviero A. Carboni, Paolo Russu,* "Global Indeterminacy in a Tourism Sector Model"

12/29 *Oliviero A. Carboni, Paolo Russu,* "A Model of Economic Growth with Public Finance: Dynamics and Analytic Solution"

12/28 *Maria Giovanna Brandano, Claudio Detotto, Marco Vannini,* "Comparative efficiency of producer cooperatives and conventional firms in a sample of quasi-twin companies"

12/27 *Bianca Biagi, Maria Giovanna Brandano, Dionysia Lambiri,* "Does tourism affect house prices? Some evidence from Italy"

12/26 *Gabriele Cardullo, Maurizio Conti, Giovanni Sulis,* "Sunk Capital, Unions and the Hold-Up Problem: Theory and Evidence from Sectoral Data"

12/25 *Fabio Cerina, Fabio Manca,* "Catch me if you learn: development-specific education and economic growth"

Finito di stampare nel mese di Agosto 2013
Presso **Copy…Right! studio grafico & stampa digitale**
Via Turritana 3/B – Tel. 079.200395 – Fax 079.4360444
07100 Sassari

www.crenos.it

ISBN 978-88-84-67-825-6