On the Interplay between Extortion and Punishment. An Agent Based Model of *Camorra*

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Abstract. This paper presents an ABM aimed to reproduce the demographics, economic and employment variables of a Southern Italian region (Campania) where one specific variant of Extortion Racketeering Systems (ERSs), *Camorra*, is highly active and prosperous. Preliminary results of a set of simulations show the effects of varying levels of extortion and punishment on the rates of inactivity, employment, etc. of a population of agents endowed with social learning mechanisms.

Keywords: agent-based model, extortion racket system, punishment.

1 Introduction

The diffusion of illegality is one of the hardest problems of complex human societies, which becomes harder with the enlarging of social groups. Illegality includes not only organized crime – extortion racketeering, illegal trafficking, and terrorism - but any violation of legal norms, such as financial frauds, corruption, briberies, cybercrime, tax evasion, private violence, crimes against property, harassment, mobbing, etc. as well as politically incorrect or socially and environmentally irresponsible behaviours.

Whether illegality is growing or not at a global or local level is an issue beyond the scope of this paper. What is on the increase is the diffusion of organized crime, especially in the form of Extortion Racket Systems (from now on, ERSs; to cite but one very well documented text on the phenomenon known as Mafia export, see [1]). Predatory illegal systems spread so fast and far in the last two decades or so, that we can now legitimately speak of ERSs as evolving systems, not only because they are highly prosperous [2], with revenues comparable to the GDP of small countries, but also highly dynamic systems always in search for new markets to invest in and affluent societies to exploit.

Such a fast growth of ERSs poses a challenging research question to the social scientists: why do ERSs spread so wide and so fast? What is the secret of their success? To answer these questions, we need a new way of looking at ERSs as systems bringing about a sort of "social order" [3], based on a credible dominance

hierarchy maintained through a consistent use of punishment, “protection” provision, and the delivery of social services - such as legal assistance to affiliates in jail and/or pensions to their relatives. Depending on their capacity to achieve consensus and credibility, ERSs start to replicate under slightly or radically new variants. In Italy, for example, variants include *Mafia*, *Camorra,’Ndrangheta*, *Sacra Corona Unita*, *Basilischi*, etc., although only the first three have spread beyond their local boundaries. The fittest mutations accumulate large profits that must be reinvested in new regions, where investments are expected to be fruitful. Consequently, it seems possible to predict the targets of ERSs migration, as affluent societies and rich markets can easily be identified. However, as geocriminal maps [1] show a different distribution of organized crimes in rich Western countries, cultural, economic, social and institutional factors must also play an important role.

To investigate the dynamics of ERSs, innovative instruments should be developed. First, we need instruments allowing hypotheses to be clearly formulated and tested experimentally. As this cannot be done in the real world, it needs be done in silico by means of simulation methods, models and techniques. But we must also get rid of some politically correct assumptions: by the time intellectuals and operators finally realized that poverty is no longer the main breeding ground of extortion racketeering, ERSs had already moved to world conquest.

In the next Section, we will discuss the necessity of an ABM approach to the study of ERSs’ dynamics. In Section 3 we will contextualize our work in a theoretical framework. In Section 4 the objectives of our research are outlined. In the two successive sections, the model developed and the simulation experiments carried out are described, and the related results are discussed. We present conclusions in Section 7.

2 Agent Based Modelling and Simulating Organized Crime

ABM nicely fits the study of widespread illegality for a number of reasons.

First, widespread illegality is characterized to a high degree by a multi-level and bidirectional social dynamics, including *emergence* and *immergence* [4], [5]. By emergent effects, we mean that a large part of the *observed* phenomena result from interactions among micro-level units (for example, individuals). By immergence, we mean the process by which the emergent macro property retroacts on the lower levels, the producing units, modifying their cognitive mechanisms so as to increase the probability that the emergent effect is further replicated. In other words, the macroscopic properties of the system, which emerged during the interaction, end up with "immerging" themselves into the agents’ minds, acting on their mental representations and operations (reasoning, planning, decision-making), thus creating the conditions for replicating at the macro-level. That the dynamics of illegality is a case of *emergence/immergence* is clearly shown by ERSs, where: (a) individual risk propensity concerning honest Vs illegal activity affect people’s evaluations about what is more convenient for them to do. In turn, interactions among micro-level evaluations produce some macro variable, for example the *perceived crime rate*, that is, the amount of illegal activity individuals on average believe to occur within their

social environment. (b) The perceived crime rate affects individual assessment: in presence of a high perceived crime rate, people may evaluate to start a micro-enterprise as more risky than engaging in criminal activities.

Second, "widespread-illegality" involves many intertwined layers of society. The lower layer concerns individual characteristics: risk-attitude, expected utility, etc. The meso-level concerns the micro-economy world: how much income firms yield to employers compared to employees' earnings. At this layer, a large amount of aggregate data is present: employment capacity, business risk inclination and the micro-business amount. The higher layer is one of the macro-social entities: a minor part of micro-business incomes is collected centrally by the public administration. This leads to the implementation of public services, such as crime clampdown, firm public aids etc.

The model here presented has been implemented on a NetLogo environment tool, which offers a brand new method of research in comparison to traditional ones: the software application is a platform ready to represent heterogeneous situations and phenomena like quarry-predator co-evolution, economic interaction among companies, bank-firm financial correlation. The tool allows very open models to be implemented and the researcher to easily insert dynamic-booster mechanisms (like genetic algorithms for system performance evaluation or programming functions to network representation).

3 Camorra

We intend to investigate the scope, mechanisms and directions of evolution of a particular ERS system, ie., *Camorra*, recently popularized by Roberto Saviano's famous book [6].

Recent deeds of *Camorra*'s are sadly popular in the four corners of the planet. In the last few months, gloomy images of the city of Naples, buried under meters of garbage, have been travelling on the Internet and shown on the tv to large populations almost everywhere. But what is *Camorra*, and how did it manage to become so powerful as to control and paralyse the garbage disposal system of an entire region of a developed country?

Camorra represents a particularly efficient and modernised variant of *Mafia* [7]. While *Mafia* extends its dominance over *Sicily*, *Camorra* has established an unopposed control on *Campania*, the region around *Naples*. The pervasive presence of *Camorra* severely affects the firms' activity and the risk propensity of entrepreneurs, the efficiency of public services, and the quality of life of the citizenship, rendering it one of the most problematic areas in Italy.

Unlike the rest of the country, *Campania* is characterized by a constantly increasing demographic trend by no means matched by the productive capacity of the regional economic system, nor by the job opportunities available to the population. According to UnionCamere and the Institute Tagliacarne, Campania's GDP in 2009 was calculated in 95 billions euros, showing a 3 pt. decrease with regard to the previous year. In 2008 and 2009, the financial crisis had strong repercussions on the region's growth rate. While public administrations and services continue to ensure the highest share (28,2%) of the value added, with a stronger weight than in the period

2000-2007, industry and trade drastically collapsed to 1,1% and 2% respectively, to the advantage of transports, finance, and building, sectors traditionally strategic for the organized crime.

As to the labour market, the number of employed, set on a stable value of 1.700.000 until 2007, in 2008 lost about 43.000 units, to undergo a further and more severe reduction during 2009, when the employed population lost 73.000 units with regard to the previous year. The rate of unemployment increased only in one year of 12 thousand units, bringing its rate to 13,9%. What is of particular interest in the economy of the present work is the severe contraction of the number of persons searching for a job (from 351.000 in 2004 to 256.000 in 2009).

As a result of the combined effect of demographic trends and structural inadequacy of the economic system, organized crime started to be regularly and increasingly fed by the new labour force, leading to the replication of criminal families or *clans* (*Clan dei Casalesi*, *Alleanza di Secondigliano*, *Scissionisti di Secondigliano*, *Clan di Lauro*, *Lo Russo*, *Licciardi*, *Russo dei Quartieri Spagnoli*, etc.), which invaded the whole region in a relatively short period of time. Unlike *Mafia*, which goes back to the 17th century, *Camorra* is a relatively young organization, which received impulse after the second world war, and became highly prosperous in the last quarter of the century.

4 Exploring the Dynamics of Extortion and Punishment

We have implemented a case study, resembling as far as possible the Camorra phenomenon in Campania, aiming to observe, on one hand, the interaction between the micro-economic behavior, and, on the other hand, the social dynamics of the population.

We anchored our simulation model to real-world data as provided in [2], [7]. These data sources show that in the context of organized crime it is possible to identify different types of illegality that vary in the operational methods applied by organized crime and in their economic consequences on the different territories. The literature also shows that *Mafia* is to *Sicily* what *Camorra* is to *Campania*: similarities and differences between Sicily and Campania are met by similarities and differences between Mafia and Camorra concerning their morphological characteristics, their behaviors, and modalities of action. Both criminal organizations practice extortion racketeering but the forms extortion may take diverge. In particular, two specific types of extortion can be identified: *predation*–extortion and *protection*-extortion. These differ as to the relationship established by the criminal organization with the victims, the duration and the structure of the relationship. These extortion types are not specifically and exclusively characteristic of specific regions and zones.

Protection-extortion establishes a solid and enduring relationship between the boss and the victims. For this reason, a strong hierarchical and centralized organization is required, in order to carefully map and strictly control the economic background.

Instead, *predation*–extortion is not based on rigid configuration structure, consequently a complex and rigid organization is not needed to put it in execution. Actions can easily be performed by criminal clans on a network-base.

In Campania, organized crime is fragmentary and granular; a great deal of clans exist which do not belong to a unitary structure. Camorra has always been a loose confederation of different, independent groups or families, each one controlling economic activities that take place in its particular territory. Mutual interference is avoided by some minimal coordination. The *predation*-extortion model then fits better the activity of groups operating in Camorra [7].

After revising this literature, we have proceeded to collect and analyze empirical data drawn from specific official data sources (ISTAT, Eurispes, Department of Treasury, Bank of Italy) that characterize the chosen region [8], [9], [10], [11]. In particular, the analyzed data refer to: job and salary, regional and national accounts (national and regional GDP), taxation, rates of non-regular employment.

The Camorra case study is aimed at exploring the interplay among extortion, punishment and imitation.

The specific research question refers to the possibility of comparing cultural and economic factors. In particular, in a complex evolving system like ERS, the modeled agents adjust different aspects: risk propensity, social acceptance of punishment, their economic status.

What are the social and individual dynamics that make agents either change role and become criminals, or vice versa quit the criminal activity? The answer depends on the combined effect of individual factors (evaluation of risk propensity and payoff) and socio-economic factors (if the model parameters change, there are changes in the settlement represented in the model in terms of workforce and economic structure?).

Could our model identify strategic points, enabling to improve intervention by means of effective and efficient policy and legislation, and suggesting whether it's better to intervene on factors that affect cultural factors (related to risk perception and risk propensity) or economic consideration (how much I am willing to risk in order to increase my payoff).

5 The Model[1]

The model reproduces real-world data – as drawn from the abovementioned official reports – about Campania, the region around Naples, concerning population dimension, rates of inactivity, employment, unemployment, and irregular job in the tertiary sector. The data refer to the years 2007-2008. The statistical data (considering the economic, demographic and employment variables) represent the structural part of the model. The tertiary sector is represented here because micro-firms and self-employed are likely victims of predation, more than are the medium and large firms.

The necessity to refer the model to real-world data is suggested by the finality of this kind of ABM. In particular, empirically ungrounded models yield no hints for policy nor for other types of intervention.

Every time-unit (tick) represents a month and the "go" procedure is repeated 12 times, in order to simulate approximately one year. In fact, we believe that important

[1] The code is available at the following address: https://sites.google.com/site/cecconifederico/downloads/software.

decisions of this kind, involving assessments of cultural, economic, social elements probably require a long time to be established.
What happens in the simulation settlement? In the model we have explored the interaction between employment, racket system and governance.

Agents can act according to one of the following *roles*: self-employed, employee, unemployed, racket affiliate, cop.

All citizens (*agents*) have a specific role and get a *payoff* out of honest or illegal activity that varies during the simulation as an effect of the economic dynamics. They can decide whether or not to pay taxes, whether or not to become criminals and also to change their employment roles.

After appropriate inizializations (creation of the structural part of the model, agents and their properties, etc.) the model aims to explore the combined effects of:

1. Extortion. Affiliates of racket extort self-employed (the agents whom are owner of a micro-firm). Every self-employed can receive only one request of extortion per tournament. The amount of extortion depends on an independent parameter (*LevExtortion*).

2. Punishment. Cops punish racket affiliates. At each tournament the cops randomly punish one member of the racket and get hold of a share of the payoff of the racket affiliate. The amount of punishment depends on two independent parameters (*LevPunish*, *RatePunish*).

3. Imitation. At the end of each turn of simulation, all of the agents compare their payoffs to other agents' and choose whether to change role (all the role transitions due to imitation are showed in figure 1). In order to do so, agents carry out an assessment taking into account: wage (*payoff*); labor market conditions (*economic conditions*); risk perception and inclination *(risk)*. In this dynamic there are two parameters (*flagpayoff*, *flagrisk*) that can influence the evaluation.

BEFORE IMITATION	TRANSITION'S CONDITIONS	AFTER IMITATION
	P1 and EC1	Employee
	P1	Unemployed
	If no other change	Self-employed
	P1 and EC2	Self-employed
	P2 and R1	Racket Affiliate
	P1	Unemployed
	If no other change	Employee
	P2 and R2 and EC2	Self-employed
	P2 and R2 and EC1	Employee
	P2 and R2	Unemployed
	If no other change	Racket Affiliate
	P1 and EC2	Self-employed
	P1 and EC1	Employee
	P2 and R1	Racket Affiliate
	If no other change	Unemployed

Fig. 1. Role transitions due to imitation

Let us explain in details the transition paths for each combination and the elements that agents evaluate. Here the conditions that are evaluated for role changes:

Table 1. Agent-assessed variables for the role transitions

PAYOFF	P1	If the payoff of the agent with whom I compare my situation (*target*) is higher than mine
	P2	The probability resulting from the difference between the *payoff* of *target* and my *payoff* OR the result of a Bernoulli trial with *flagpayoff* parameter (obviously if *flagpayoff* = 1 the difference plays no role and the choice will be random)
ECONOMIC CONDITIONS	EC1	If the agents' amount of my same role (in this case employee) is less than the amount of employees provided by the structural limit envisaged in the model (*NDIP + one per cent at most*)
	EC2	If the agents' amount of my same status (in this case self-employed) are less than the amount of self-employed provided by the structural limit envisaged in the model (*NINDIP*)
RISK	R1	The probability resulting from the variable related to *risk* propensity OR the result of a Bernoulli trial with *flagrisk* parameter
	R2	The probability resulting from the inverse variable related to *risk* propensity OR the result of a Bernoulli trial with *flagrisk* parameter

6 Simulations and Results

6.1 Description of the Experiment

The simulation model has been implemented on a NetLogo environment tool. We explored the interplay among these variables by simulation:

Table 2. Independent and dependent variables analyzed in the simulation runs

Independent Variables		Dependent Variables
Level of extortion (*LevExtortion*): payoff share of a self-employed is extorted by a racket affiliate	?	*self-employed* number
Level of punishment (*LevPunish*): payoff share of a racket affiliate is taken by cop		*employees* number
Rate of punishment (*RatePunish*): how often cops punish racket affiliate		*unemployed* number
Payoff flag (*flagpayoff*): flag that indicate if, in the imitation dynamic, the evaluation of economic condition (money) are taken into consideration in order to change status		*racket affiliate*
Risk flag (*flagrisk*): flag that indicate if, in the imitation dynamic, the evaluation of cultural factors (risk attitude) are taken into consideration in order to change status		*payoff*: average wage for all different status
		Public Pool: sum of the taxes paid by agents + racket affiliates' money withdrawn by cops
		RacketBag: average payoff of racket affiliates

We explored the relationship between these set of variables (from the minimal to the maximum levels) checking whether there is any correlation between them. For each parameter set, results are averaged on 20 experiments.

We have analyzed whether the variation of punishment and extortion levels, and the inclination to consider risk and payoff as relevant factors affect the employment status of agents, the micro-business amount. The first interesting question refers to the average level of racket that the world reproduced in the model can support/tolerate, without collapsing. What are the costs and effects of racketeering on an economy of micro-firms and self-employment? What are the effects of different levels of punishment?

6.2 Findings and Discussion

In the following graphs, the levels (*LevPun*) and rates of punishment (*RatePun*) are represented on the horizontal axis. The grayscale series represent the extortion levels (*LevExt*).

In figure 2, the vertical axis shows the average amount of racket affiliates at the last step of the simulation runs. The risk and the payoff flag parameters are equal to 0. We note that, for low punishment levels, racketeering increases according to the extortion level. Even if punishment is a deterrent against extortion, the number of racket affiliates doesn't decrease linearly for increasing levels of punishment.

Results also suggest that if punishment is at the minimal levels, the number of people involved in racketeering increases enormously at each simulation run. On the other hand, a maximal level of punishment results in a waste of resources, since the number of racket affiliates does not diminish accordingly.

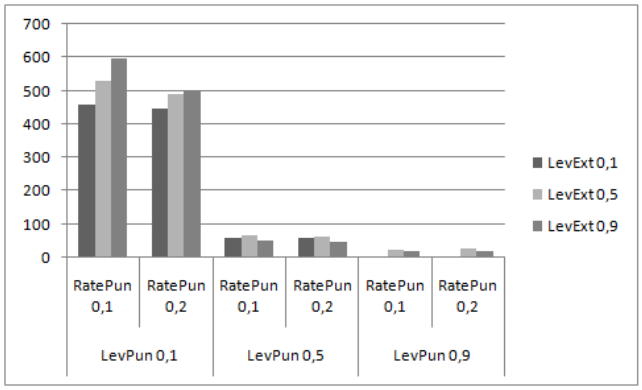

Fig. 2. Amount of racket affiliates per payoff flag = 0 and risk flag = 0

The outline modifies considerably if we change some parameters in the experimental conditions, for example, by varying the two flags' levels. In the imitation dynamic we have explored the conflict between risk and payoff levels. What would happen in the transition to another role if it is the economic or the cultural factor influencing the choice? Figure 3 shows a scenario in which the

transition paths to and from the racket are affected exclusively by risk assessment. Figure 4, instead, shows the effect of payoff evaluation.

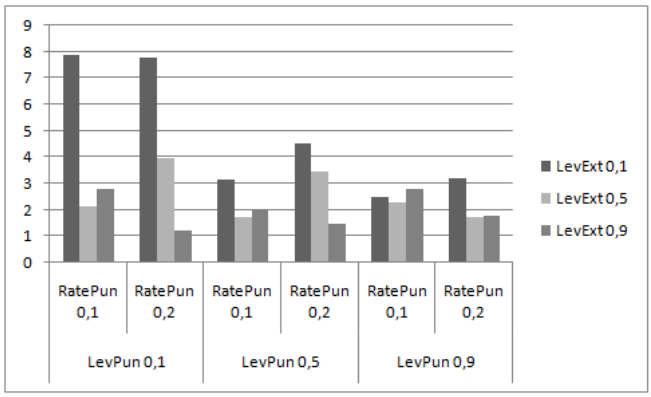

Fig. 3. Amount of racket affiliates per payoff flag = 1 and risk flag = 0

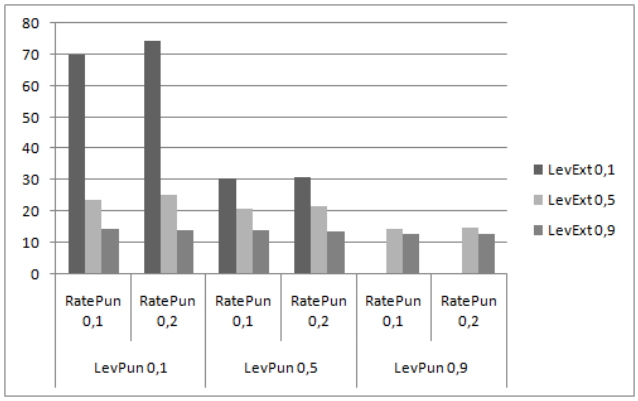

Fig. 4. Amount of racket affiliates per payoff flag = 0 and risk flag = 1

In both figures, the lower the punishment the larger the set of racket affiliates, especially when the amount of extorted money is not too high.

Risk attitude rules behaviors more than economic considerations do. In the first picture above, racket is ten times smaller, even if, overall, the trend of the variables is quite similar in the two graphs. In sum, people abstain from illegal activities based more on risk evaluations, than on payoff and quality of life considerations.

Economic considerations prevail for higher rate of punishment. In fig. 3, the set of racket affiliates tend to 0 when the extortion level is very low. The set enlarges as the extorted money grows. In fig. 2, with the same parameters' combination, the number of racket affiliates remains stable, independent of punishment or extortion levels.

Let us concentrate on the scenario in which both flags (payoff and risk) are considered relevant, which recaps the situation of the Japanese economy described in [12]. Figure 5 shows the amount of self-employed: only a very high level of extortion at a low level of punishment greatly reduces the number of micro-enterprises. This means that micro-firms can survive even under extortion on condition that even a low level of punishment is executed. Our results suggest that an efficient punishment of illegality must be not too low (in order to preserve control), but not too high either (in order not to waste effort). Benefits increase with the transition from a low punishment level to a medium one, while the transition from a medium to a high level does not produce comparable advantages.

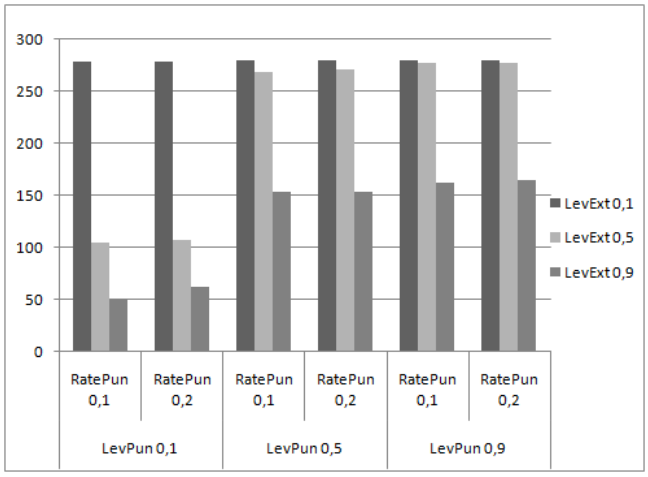

Fig. 5. Amount of self-employed per payoff flag = 0 and risk flag = 0

7 Conclusions

In this paper, we have discussed the necessity of ABM to study the dynamics of illegal systems, and proposed an evolutionary view of a specific form of illegality, ie. Extortion Racket Systems, which appear to be highly prosperous and dynamic systems, spreading wide and fast in current Western societies, where they succeed in bringing about a sort of "social order". The more credible and stable the dominance system they establish, the more prosperous they get and the likelier they are to move to new territories in search of new investments. As a consequence, ERS tend to replicate, new variants appear and compete on the same territory or move to the conquest of new ones.

An ABM-based study of *Camorra* in *Campania*, a Southern Italian region, is described. Based on real data, drawn and analyzed from official data sources' reports, our case study reproduced one of the most successful variants of the more famous *Mafia*, which is stably rooted in *Sicily* [13]. A short characterization of the two ERSs points out micro-firms as the main target of *Camorra*. To find out efficient fighting

measures, we have run a battery of simulations where agents imitate one another based on their respective payoffs, labor market conditions and risk perception. The simulations allowed us to observe the combined effect of levels of punishment (ie., number of criminals caught by Cops) and levels of extortion on agents' decisions to become criminals. Preliminary results suggest some similarities emerged in other studies that are interested specifically in the relationship between corruption and development [12]. If there is not a high diffusion of racketeering, racket systems cannot be an obstacle to development and, therefore, do not lead to a complete elimination of the micro-firms present in the economy.

Our results encourage replications of the present case study especially aimed to compare it with a simulation model of the Mafia system. It would be interesting, for example, to check whether the two systems, with their specific features (type and target of extortion), fit different types of society (economic, demographic and employment situation).

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