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Understanding and Managing Behavioural Risks – The Case of Food Risks Caused by Malpractice in Poultry Production[1]

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Abstract: The probability that actors in economic relationships break rules increases with the profits they thus expect to earn. It decreases with the probability and level of short- and long-term losses resulting from disclosure. It also decreases with the level of social context factors and intrinsic values which shield actors from yielding to economic temptations. This paper assesses the relative merits of various scientific approaches concerned with risks in economic relationships and outlines their contribution to the study of opportunistic rule-breaking. Since the identification of (misdirected) economic incentives faced by firms and individuals represents the starting point for a systematic analysis of opportunism in any field, we also outline a microeconomic approach that systematically provides this crucial information. The approach is applied to the problem of food quality and safety threatened by opportunistic malpractice of food business operators. Its essentials are illustrated through a study which systematically searches for the temptations to break production-related rules in the poultry industries.

Keywords: *asymmetric information, control theories, economic misconduct, game theory, moral hazard, principal-agent model, opportunism, protective factors, relational risks*

JEL Classification: *A13, K32, K42*

1 Introduction

Rule-breaking in economic relationships is often referred to as "white collar crime". It is a term originally coined by SUTHERLAND (1940, 1949, 1979) to denote criminal acts performed by "white collar people" (respected members of the professions) rather than by "lower class underdogs". White collar crime is commonly associated with unlawful activities in the financial sphere such as fraud, bribery, insider trading, embezzlement, money laundering, tax evasion, etc. Rather than resorting to a typology of economic activities or the social status of offenders (or clothing standards for that matter), we use the more general term "deviant economic acts" or "economic misconduct" - or alternatively the game-theoretic term "opportunism" - to denote our object of study. We thus want to express

- that we refer to all types of deviant decisions in otherwise legitimate occupations, businesses and economic activities independent of whether they violate mandatory regulations of various kinds (legislation) or private contract clauses,
- that we refer to all types of regulatory spheres, ranging from anti-trust, anti-corruption, anti-fraud, copyright, patent and tax laws to legislation concerned with production, trading and information standards related to occupational safety and workers' rights, consumer protection (product safety, free and informed choice of consumers), environmental protection, animal welfare, etc. (POVEDA 1992),

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- that, contrary to Sutherland, we refer to economic misconduct independent of whether the offenders are executives of large corporations, small business operators, simple employees, or citizens engaged in various economic activities including tax paying or drawing social benefits (cf. BRAITHWAITE 1985a or SHAPIRO 1990 for a similar classification),
- that deviant economic acts do not always constitute criminal acts in a legal sense (CLARKE 1990) due to "the interpretability of regulations as well as the real-life facts constituting economic crime" (PUONTI 2004: 14),
- that economic misconduct may arise in any field of business, from banking and insurance to the building trade, and from the children's toys industries to the automotive industries, food production, etc. (cf. e.g. BRANTS 1994), and in connection with any kind of economic activity within these fields (from financing, purchasing and employment to production, processing, transport, storage, selling and pricing decisions),
- that economic misconduct may interfere with the rights and well definable interests of single individuals (e.g. deceived business partners) as well as affect large groups of victims with individuals suffering only minor losses because adverse effects (e.g. minor financial losses from fraud such as the sale of underweight products, use/consumption of unsafe or unhealthy goods, environmental pollution, etc.) are often widely dispersed over time and space and thus relatively invisible (CROALL 1993),
- that our understanding of deviant economic acts might be improved if we consider the underlying decisions as being "no different than any other business decision" (SIMPSON 2002: 36), that is, as being purposive decisions of (boundedly) rational economic actors.

The latter point describes the common perception shared by most contemporary analysts concerned with deviant behaviour in competitive environments (rational choice paradigm). Being an intriguing, wide-spread and multi-facetted subject, the study of economic misconduct and opportunistic practices has spawned a large and growing body of work by criminologists (including sociologists and social-psychologists), micro-economists (including game theorists), management scientists, and institutional economists. Subsuming their contribution, one might say that they consider rule-breaking as a relevant behavioural option of economic actors which, in turn, causes relational (or behavioural) risks for their business partners and other stakeholders who might be adversely affected. While having different situational foci and methodical toolboxes, they explicitly view people's choices as being motivated by both material and normative motivations (cf. e.g. ARROW 2000; COLEMAN 1987, 1988; HOFSTEDE et al. 1990; ESSER 1999; KNIGHT et al. 2001; OSTROM 2005; PINSTRUP-ANDERSEN 2005).

Nonetheless, the literature concerned with economic misconduct and crime is still mostly divided along the boundaries of academic disciplines. To illustrate the resulting terminology problems it may suffice to list a few technical terms: regulation models, control theories, protective factors, deterrence (used in criminology), information asymmetry, moral hazard, principal-agent models, incentive-compatibility (used in microeconomics/game theory), incomplete contracts, relational risk management, trust (used in the management literature), social dilemma, institutional change, public choice, transaction costs (used in institutional analysis). One can say that, despite a common object of study and a shared conception of economic man, the relative merits of approaches from different disciplines have yet to be combined systematically to further the understanding of the various aspects of economic misconduct.

The aim of this paper is to contribute to the mitigation of this problem in two ways: first, we aim at highlighting the relative merits of the pre-eminent schools of thought concerned with the study of economic opportunism. Knowing their respective characteristics, predominant objects of study, foci and analytical capacities enables us to identify their potential contribution to applied interdisciplinary studies of economic misconduct in various fields. Such studies facilitate informed choices and are a necessity when trying to cope with the problem.

Second, we describe a microeconomic approach for the systematic identification and analysis of (misdirected) economic incentives faced by firms and individuals in their economic environments. Given the predominantly competitive nature and profit orientation of business decisions, this is the starting point for any applied study of deviant economic behaviour. The approach, which is based on a principal-agent model, is applied to the problem of food quality and safety threatened by potential malpractice of food business operators. Despite a growing societal awareness, little empirical research has been done on the conditions of rule-abiding and, even more important, of rule-breaking behaviour in the field of food production, processing and distribution. Consequently, large knowledge gaps persist on decision-making processes and on identifying and curbing behavioural food risks. The essentials of the approach are illustrated through a study which systematically analyses activities on different levels of the poultry chain (feed and drugs, production, processing, distribution) with regard to temptations to infringe upon production- and trading-related standards (crimes against consumers).

2 Scientific approaches to economic opportunism

2.1 Criminology: regulation models, control theories, protective factors

The criminological conception of "*regulation*" has a strong normative emphasis in that it looks for factors and strategies which contribute to effective *prevention* and/or *law enforcement*, respectively. "At its most general level, it refers to the means by which any activity, person, organism or institution is guided to behave in a regular fashion, or according to rule. In principle, reference may be made to the regulation of any kind of social behaviour, which gives the term a very wide scope indeed. However, it is more particularly used […] in relation to economic activity" (PICCIOTTO 2002: 1).

The regulatory literature can be roughly divided "between those who think that individuals and firms will comply with rules and regulations only when confronted with harsh sanctions and penalties, and those who believe that gentle persuasion and cooperation works in securing compliance with the law" (MURPHY 2004: 2). This has been labelled the *deterrence* vs. the *compliance (accommodative) strategy* (cf. PICCIOTTO and CAMPBELL 2002 for an overview).

In contrast to former approaches focussing almost exclusively on incapacitation and general deterrence, more recent work has included more structural and persuasive means of social control and their relative merits (e.g. BRAITHWAITE 1995). This embrace of compliance strategies and the attempt to use the largely untapped resources of "smart controls" involving "soft", but complex and often highly effective means of regulation (BLACK 1997; FELSON 1998; CLARKE 1992; BRAITHWAITE 1985b, 2003) can be related to a fundamental development in the criminological sciences. One could describe this development as one leading away from the question why people break, to why people obey the law (TYLER 1990). This, in turn, is a result of the fact that the criminological state of the art is being increasingly characterized by so-called

control theories of deviance (HIRSCHI 1969; TITTLE 1995). Control theories conceptualize deviance neither as an expression of individual pathology nor as one of mere ascriptions. Instead, it is seen as a social fact, the emergence of which is due to the inevitability of gaps within the system of formal and informal social control (GOTTFREDSON and HIRSCHI 1990).

Even though the probability of economic misconduct and crime can be conceptualized as varying with its expected material benefits, there are different reactions to identical economic incentives because of different levels of *protective factors* in social contexts - such as value orientations, emotional bonds, peer groups, etc. - shielding actors from deviant acts (cf. LÖSEL and BENDER 2003). The perspective of "protective factors" has proven to fit empirical findings better than former ones and produces good results in traditional criminological research areas (e.g. HOSSER 2001). It can be related to the conception of man's behaviour in modern criminology which is based on the rational choice paradigm as specified by the so-called RREEMM model: The human actor is conceptualized as a "resourceful, restricted, expecting, evaluating and maximizing man" (cf. ESSER 1999: 237-239). Protective factors can be seen as limiting the actors' freedom to break the rules (GOTTFREDSON and HIRSCHI 1990; TITTLE 2000). They can also be viewed as forming the non-monetary components of the actors' preference functions (e.g. ones influenced by value orientations such as fairness or altruism). Utility gains from complying with rules may outweigh economic temptations to break them.

In other words, instead of narrowing the attention to either exclusive material motivations (pure profit seeking) or to alleged personality disorders of individuals which supposedly make them crime-prone, the criminological discourse has become aware of the decisive relevance of situations and, correspondingly, of situational crime prevention. This includes, but is not restricted to, attempts to influence societal norms, value orientations and the social embeddedness (cf. GRANOVETTER 1985); in brief, to influence the protective factors which make people obey the law despite contrary economic incentives (HERMANN 2003). It also includes the acknowledgement of the potentially dysfunctional effects of controls and sanctions for control-averse actors (cf. "self-fulfilling prophecy of distrust", LUHMANN 1968).

There is ample evidence from the regulatory fields of mining and occupational safety (BRAITHWAITE 1985b; SCHOLZ and GRAY 1990), pharmaceutical industries (BRAITHWAITE 1984), nursing homes (BRAITHWAITE et al. 1994), nuclear safety (REES 1994), tax paying (BRAITHWAITE and BRAITHWAITE 2001; MURPHY 2004), medical professions (DAVIES 2002), etc. that both compliance and deterrence strategies have their advantages and disadvantages. Accounting for pros and cons, *responsive regulation* (BRAITHWAITE 2001) advocates a graduated response contingent on the regulatee's behaviour. According to the enforcement pyramid of responsive regulation, non-compliance should be met with a clear disapproval of the fact and increasingly punitive measures, but regulation should always start softly by using the cooperative measures of persuasion and counselling aimed at integrating the offender into the law-abiding community. According to this conception, the harsher the available ultimate sanctions, the more likely compliance will be achieved through persuasion. This has been referred to by AYRES and BRAITHWAITE (1992: 40) as "speak softly, while carrying very big sticks".

2.2 Microeconomics: information asymmetry, moral hazard, principal-agent models

Risk analysis and management are essential issues in the economic literature because all economic decision-making is future-oriented, and the future, in turn, is inherently uncertain.

Risks may arise from many sources. On the one hand, *market and technological risks* may be caused by stochastic environments (e.g. the volatility of prices, or weather risks in farming) and/or unintentional human or technical failures and a chaining of unfortunate events. On the other hand, *behavioural risks* may arise from the misconduct of actors in economic relationships who exploit the fact that - due to *information asymmetries* - their activities as well as resulting outcomes cannot be directly observed by other stakeholders (e.g. their trading partners, consumers, interest groups, or public authorities). The threat of *opportunistic behaviour* (hidden malpractice) has been labelled *moral hazard* by game-theorists, stressing both the basic cause of relational risk and the direction of potential countermeasures.

Following the work by BECKER (1968, 1982) who has given an explanation to rule-breaking behaviour in terms of economic theory, a wide strain of economic literature on deviance has evolved. The microeconomic state of the art regarding problems linked with information imperfections, conflicting interests and opportunism is characterized by an extensive game-theoretic literature on moral hazard and incentive problems which are also known as *principal-agent problems* (PA-problems; cf. e.g. GROSSMANN and HART 1983; KREPS 1990; MIRLEES 1999; PRATT and ZECKHAUSER 1991; RASMUSEN 1994). Moral hazard problems have been studied for quite a while and in a wide variety of contexts, such as labour contracting (e.g. EPSTEIN 1991), insurance (e.g. ARNOTT and STIGITLZ 1991), delegation of decision-making (e.g. MILGROM and ROBERTS 1992), environmental crime (e.g. COHEN 1992), and finally transactions concerning products with (uncertain) *credence qualities* (e.g. AKERLOF 1970; STIGLITZ 1987).

Drawing on *formal* game theory, PA-models focus on the information and incentive structure and represent relational risks as games with uncertain and asymmetric information. That is, they consider that there may be stochastic influences from the environment, and that one player may have more information than the other. Commonly one assumes in PA-models that one player (principal) knows the behavioural characteristics (i.e. the set of choices, utility function, etc.) of the other player (agent) who performs a task on his behalf (game of complete information)[2]. Both maximize their expected utility. The principal is less informed in that he is not able to observe the agent's actions. But he is decisive in that he is the one who offers a contract to the agent and takes account of the agent's expected response strategy when designing the contract. The principal is assumed to design the contract upon the rationale that, given feasible opportunities for rule-breaking, the agent will not comply if he can thus earn profits (individual rationality). "This situation may be viewed as a noncooperative game in which a strategy for the principal consists of a choice of a fee schedule [i.e. a contract with controls and enforceable clauses] granting specified payments for specified outcomes" (cf. WEISS 1995: 72). The economic incentives are influenced by - what WILLIAMSON (1985) called - "private ordering" and "legal ordering". Private ordering refers, e.g., to pledges and guarantees used by deceived trading partners for ex post sanctioning after the disclosure of opportunism. Legal ordering refers, e.g. to legal penalties and fines for the offender. The

[2] In a broad sense, the term PA-model is sometimes also used for Bayesian games of (uncertain and asymmetric as well as) incomplete information where the players' types (e.g. the available set of choices and the payoff functions) are not known to the players in the beginning ("nature moves first", cf. RASMUSEN 1994: 47). Commonly, however, the term PA-model is more particularly applied, as in this paper, to games of uncertain and asymmetric but complete information. It is thus used synonymous with moral hazard models.

game theoretic analysis of economic misbehaviour can thus be related to law and economics (cf. COASE 1960 and CALABRESI 1961 as early precursors of this work) and its study of the "impact of legal rules on the market equilibrium" (PARISI 2004: 260) and "the role of the law as a means for changing relative prices attached to individual actions" (ibid.: 262).

Formal PA-models are suited to analyse the incentive situation of economic actors resulting from the decision framework in actual situations with asymmetric information. They can be likewise used to study how to design *incentive compatible contracts* that induce the desired behaviour on the part of the agents. Optimal incentive compatible contracts represent equilibria in that neither player would be better off by choosing an alternative strategy. Thus, PA-models are well suited to provide insights into the structure of relational risks in general. They can help answer key questions as to why individuals and firms comply (or do not comply) with rules, regulations and contracts, and how to make them comply. Briefly summarized, one might say that the PA-perspective with regard to economic misconduct is to "*get the* [economic] *incentives right*". This implies realizing that the challenge of full systems analysis (including the analysis of the preference functions of individuals in their social contexts) is far too large and complex to be solved in a single-handed effort (or to be fully incorporated in a mathematical model for that matter). A well-known solution to the complexity problem is to subdivide the analytical task into manageable sub-tasks. In the context of relational risks this means starting with a *partial analysis* which focuses on economic incentives.

2.3 Management sciences: incomplete contracts, relational risk management strategies

Besides the quantitative game-theoretic analysis of economic incentives, there is a growing body of applied economic research which draws on the social sciences and focuses on the role of trust and benevolence in economic relationships. While viewing opportunistic acts of business partners as potential risks, this work can be seen as relying on social exchange theory (cf. BLAU 1964; CROPANZANO 2005; MICHENER 2004) and social capital theory (cf. e.g. COLEMAN 1987, 1988; DASGUPTA 1988; PUTNAM 2001). It emphasizes that, even in competitive markets, people's choices are not only motivated by material, but also by non-material considerations such as empathy, identification, shared value orientations, routinization, and the intrinsic value of the relationship itself (LYONS and MEHTA 1997). It also stresses that *incomplete contracts* - i.e. ones leaving some scope for self-interested decision-making - may be superior (have a better cost-benefit relationship), if people are guilt-averse and if fairness and reciprocity (cf. GOULDNER 1960) form relevant components of their utility functions (DYER 1997; HILL 1990, SHAPIRO et al. 1992). More complete contracts may evoke conflict and defensive behaviour as people are control-averse, thus crowding out positive intrinsic motivation (see FREY and JEGEN 2001 for an overview of "crowding out theory", but also ALLEN and GALE 1992; FEHR and ROCKENBACH 2003; HIRSHMAN 1984; OSTROM and WALKER 2003).

Trying to accommodate empirical evidence and findings from experimental economics which are in line with social exchange theory but contradict axiomatic game theoretic predictions (i.e. ones that resort solely to material motivations), some researchers add arguments for non-material motivations such as fairness and inequity-aversion to formal utility models (cf. e.g. BOLTON and OCKENFELS 2000; FEHR and GÄCHTER 1998; FEHR and SCHMIDT 1999). Another approach is found in applied management science. Looking at *relational risk management strategies* in firms, NOOTEBOOM and BERGER (1997) stress the mixed empirical evidence for

the superiority of different types of contract and different strategies to cope with relational risks. Trying to guide empirical research on relational risk management, NOOTEBOOM (1996) distinguishes three sources of relational risk: (i) the physical opportunities for opportunism, (ii) the economic incentives (temptations) in force, and (iii) the propensity to yield to existing temptations (or the level of benevolence). These three sources also indicate the components that can be combined to form relational risk management strategies: (i) physical opportunity control, (ii) economic incentive control, and (iii) enhancement of the other's benevolence[3].

Drawing on game theory *conceptually* and viewing economic actors as players with opposed interests in a game, management scientists focus on relational risk management strategies seen as complex bundles of measures (cf. e.g. BARNEY and HANSEN 1994; DYER and SINGH 1998). While positing that no universally optimal mix can be specified (WILLIAMS 1988), management scientists analyse the behavioural effects (performance) of observed corporate relational risk management strategies and organizational cultures in empirical contexts (e.g. through case studies, interviews, etc.). This does not usually involve an analytical reconstruction of the opposing player's decision situation and a quantification of his economic incentives. In this regard, the management literature is close to the regulatory literature from criminology, but different from formal game-theoretic analysis.

2.4 Institutional economics: social dilemma, institutional change, public choice

Similar to the management literature, institutional analysis draws on game theory *conceptually*, but does not commonly engage in a quantitative microeconomic analysis and a formal PA-modelling of the players' incentives. One branch of institutional literature, which is often associated with the label "organizational or new institutional economics", is concerned with the impact of imperfect information in food chains and analyzes coordination problems and the evolution of industry structures in the agrifood sector. An overview of this branch of research is e.g. given by MÉNARD and KLEIN (2004). Based on transaction cost theory, organizational economists consider institutional change (e.g. increasing vertical integration) as a result of choices made by economic actors who economize on *transaction costs* (cf. WILLIAMSON 1988; MÉNARD and VALCESCHINI 2005). However, institutional analysis also expands the economic analysis of organizational and individual choices in markets (and within a given legal framework) to choices in non-market institutions (such as the political and legal system), and to the analysis of how these choices affect societal goals such as wealth maximization and justice. In this regard it is related to the law and economics study of "the economic structure of basically every aspect of a legal system: from its origins and evolution to its substantive, procedural, and constitutional rules" (PARISI 2004: 260).

The institutional scope of analysis goes beyond private contracts and business-to-business (buyer-to-seller) relationships within corporate risk management strategies. It also goes beyond the dichotomous distinction of relationships as being either business-to-business or authority-to-business and attacks the problem of networks (cf. POSNER 2000). It also considers that rules themselves may be insufficient to avoid adverse outcomes and *social dilemmas* (OSTROM 2005), and that they may be subject to change over time. In other words, *institu-*

[3] These three components of relational risk management strategies can be directly related to the regulatory measures of incapacitation, deterrence and accommodation described in the criminological literature.

tional change and the chances for various actors on various levels of social choice to influence relevant institutions and governance structures are considered. This includes economic theories of institutional change which view competition as the predominant institutional selection principle (cf. e.g. COASE 1960; EGGERTSSON 1990, NORTH 1990; WILLIAMSON 1985), as well as *public choice theory* (cf. e.g. RIKER 1986; SENED 1997) which explicitly analyses the role of government and the roles of political entrepreneurs such as lobbyists and politicians.

In a very general way one could say that the objects of institutional analysis are the failing or successful institutional solutions to externality problems (e.g. rules preventing harmful practices) and social dilemmas (OSTROM 2005). One could also say that institutional analysis uses a political economy perspective (cf. SCHMID 1994) and incorporates different levels of social analysis. It does not only look at the reactions to the rules in use in the day-to-day decisions (e.g. production and exchange of goods), but also at the making of rules and their implementation on various tiers of choice. It thus captures a comprehensive perspective of change in an analysis which ties to show how rules have been, or can be, changed over time by different actors.

2.5 Commonalities and differences between the different schools studying opportunism

The above-described schools of thought share an overall conception of human behaviour in that they assume that purposive action in conjunction with the individual's goals and social context factors are responsible for his behaviour. Criminologists, on the one hand, understand deviance as behavioural strategies of coping with strain and personal goals. Economists, on the other, focus on economic goals, but have adopted the concepts of imperfect information, bounded rationality, opportunism, and multi-goal decision-making (cf. HSIUNG 2004, for a general discussion of the commonalities between law and economics).

With regard to economic actors, this common perception can be pictured through the following typology of decision-makers: (i) on the one extreme is the actor who is utterly trustworthy. Because of his personal set of preferences he resists every perceived economic temptation to break the rules. (ii) On the other extreme is the actor who is only trustworthy if, given his exclusive objective of maximizing profits, the perceived situational incentives of the contract are "right". (iii) Between these two extremes is the mixed-type actor who accepts a certain profit trade-off in exchange for the avoidance of social disapproval and for a feeling of moral integrity resulting from his decision to abide by the rules. He might yield to rule-breaking behaviour, however, if the additional profits to be gained exceed his personal resistance (cf. POSNER 2000 for an integrative view of the determinants of human behaviour).

Sharing a common perception of economic man implies agreeing that, for various reasons, it is the mixed-type actor whom we will meet in reality. It also implies agreeing that social reality at its aggregate (or macro-) level is to be understood, on the one hand, as the result of choices made by individuals pursuing their goals according to their perception of reality (methodological individualism). On the other hand, it is understood that the macro-level of social reality determines the micro-level of individuation and individual choices (cf. HESS and SCHEERER 2004; SAMUELS 1990).

Despite this common conceptual background, various attributes can be used to distinguish among the different schools of thoughts and approaches. When dichotomizing these attributes they can be described by ideal types such as partial-analytical vs. systems perspective, quanti-

tative vs. qualitative approach, focussing on authority-to-business relationships (regulation) vs. focussing on business-to-business relationships (contracts). While each school of thought concerned with economic crime and opportunistic acts can be seen as occupying a range on a continuum between these ideal types, we use these dichotomies in Table 1 to array the different approaches according to their predominant focal points in contemporary research.

Table 1: The perspectives and focal points of various schools of thoughts concerned with opportunism

<table>
<tr><th></th><th>Systems perspective
(predominantly qualitative approach)</th><th>Partial-analytical perspective of economic incentives
(predominantly quantitative approach)</th></tr>
<tr><td>Focus on authority-to-business relationship</td><td>Criminology
(regulation models)</td><td rowspan="2">Microeconomics/Game theory (PA-models: formal representation of the information and incentive structure)</td></tr>
<tr><td>Focus on business-to-business relationships</td><td>Management sciences (relational risk management strategies)</td></tr>
<tr><td>Focus on various levels of social relationships and choice</td><td colspan="2">Institutional analysis
(institutional solutions to social dilemmas)</td></tr>
</table>

The characterization of disciplines in Table 1 may face critique as an inappropriate simplification of the true nature and scope of the respective disciplinary approaches. It helps, however, to identify which approach qualifies for which tasks within applied studies which account for the complexity and multiple facets of economic misconduct. Thus, the stereotypical array of Table 1 represents an attempt to specify a fruitful division of work within a joint research concept rather than an attempt to classify or constrict the work of the respective disciplines.

Given the predominantly competitive nature of economic decisions, a thorough understanding of the economic incentives arising in the real-life decision environments of firms and individuals is the indispensable starting point when studying economic misconduct in any one field. This requires a decision-oriented microeconomic analysis of incentives *as perceived by the decision-makers*. Once the incentives, or at least their magnitude, are known, research regarding the relevant social contexts and the non-economic motivations of the decision-makers (their benevolence) can be guided and carried out. Empirical information concerning the information available to the actors and their cognitive capacities as well as their material and non-material motivations (cf. GAROUPA 2003; PANTHER 1995) is necessary for informed situational choices and the design of adequate contracts (as game theorists would put it), of consistent preventive measures (as criminologist would), of effective relational risk management strategies (as management scientists would), or of institutional solutions to social dilemmas (as institutional analysts would).

3 Economic incentive analysis: the starting point of research into economic misconduct

While many types of opportunistic economic acts (e.g. tax evasion, insurance fraud, money laundering, etc.) constitute behavioural risks worth analyzing, we focus hereafter on risks that result from non-compliance with production- and trading-related standards.

3.1 Investigation of economic crime versus research of economic misconduct

Police investigation and the prosecution of business crime - as compared to conventional crime - are hampered by two problems: first, economic crime is often ill-defined by legisla-

tion. PUONTI (2004: 15) claims that it has been left deliberately "open in order to guarantee that the law is able to include various criminal actions in various settings". Referring to the original definition of white collar crime as "a crime committed by a person of respectability and high social status" (SUTHERLAND 1949: 9), others point in this context to the role of power in the lawmaking process and to double standards of justice in the implementation of the law to upper- and lower-class offenders (cf. POVEDA 1992). Furthermore, each economic crime has its own specific facets; it often involves many collaborators and comprises many intertwined and seemingly harmless activities and is so complex and changing so fast that it cannot be exactly defined by the law. Authorities have thus often difficulties discerning whether such activities constitute a crime or not.

Second, besides definition problems, economic crime is usually associated with complexity and uniqueness as well as the inherent feature that it remains covert - unlike traditional crime such as assault where the crime itself is evident (cf. e.g. GEIS et al. 1995; SIMPSON 2002) - unless explicit investigations are carried out to find out whether a crime has been committed (Kontrollkriminalität). In other words, it is not only difficult to detect the offender(s), but it is difficult to detect an offence in the first place as well as its date and location, and the level of appropriated benefits and afflicted damages to its victims (GEIS et al. 1995; NELKEN 2002). Thus, even an approximate assessment of dark figures may be an insurmountable problem.

Compared to the police *investigation* of economic crime, the *research* of economic misconduct, and especially research which looks at the incentives resulting from (non-) compliance with production-related rules (as in this paper), exhibits some differences and even easements: for one thing, one does not need to worry about the legal definition of economic crime when defining the object of study "opportunistic economic acts". Quite in contrast, the results of research may even contribute to the identification of loopholes in the law and the reformation of the legislation. Furthermore, rather than investigate a unique crime and trying to detect the offender(s), the aim of economic research is to shed light on the regularities of economic misconduct and its conditions in certain settings. Doing research on and reconstructing the conditions of economic opportunism is likely to be less difficult than investigating economic crime because the essential behavioural determinants such as prices, technologies, market structures, are quantifiable. They exhibit significant regularities in that they are equally valid for large groups of actors in their relevant environments, i.e. the competitive market settings. Research can, and must, use generally available information. Gathering this information from scattered places and systematizing it requires a structured understanding of relevant action situations rather than police methods. In this respect, economic research of opportunism can resort to the game-theoretic principal-agent approach. It can start with an analysis which is partial in that it concerns itself solely with the existing opportunities for opportunism and the economic temptations in force, but does not yet consider the non-economic behavioural determinants.

3.2 Structural analysis of potential misbehaviour

PA-models provide us with a mental map of the structure of our object of study "potential misbehaviour". This refers to the action situations, positions of actors, the information distribution between them, the different types of rules concerned, the physical opportunities for opportunism, the relevant economic parameters, the stochastic influences from the environment, etc. That is, they basically help us to understand the options available to the actors (e.g.

practical offence opportunities) and the kind of parameters and their linkages determining the actors' incentives. After quantifying these parameters, formal PA-models can be used to analyse the empirical incentive situation under consideration.

When applying the PA-approach to economic relationships related to the production and trading of goods, two types of situations (pairings of actors) can be envisaged. On the one hand, the context can be seen as that of a supplier (agent) and a buyer (principal) of a product or service (seller-buyer dyad). The supplier's hidden behaviour (e.g. processing decisions) affects the outcome (e.g. the probability distributions of product properties relevant to the buyer). The buyer, having the coarser information partition, cannot contract contingent on actual actions because he cannot directly observe them (asymmetry of information). Moreover, he cannot directly observe the outcome (i.e. the credence quality) of the product either. Credence qualities may involve both "simple" quality risks (i.e. the risk of being deceived as to a product's quality category) and "serious" health risks (i.e. the risk of using or consuming harmful substances). Price spreads for different quality categories as well as (high) costs of compliance with regulations and contract clauses may be the reason why self-interested suppliers are tempted to exploit such information asymmetries.

On the other hand, the context can be seen as that of firms (agents) and a public authority (principal) which tries to ensure production and trading standards, thus protecting the interests of society (or some groups within it). For one thing, this relates to the many outcomes of production and processing that are not inherent qualities of products sold on the market (e.g. environmental or social impacts, occupational health, or animal welfare). Furthermore, it relates to product-related outcomes of public interest such as product safety or the free and informed choice of consumers. The efforts of public authorities to safeguard the interests of society and consumers by trying to ensure compliance can be seen as an attempt to prevent social dilemmas originating from negative externalities and market failures that would be caused by the breaking of rules. Whereas a firm is both in the position of buyer (principal) and seller (agent) in business-to-business relationships (market transactions), the firm is always to be seen as the agent in the authority-to-business relationship (non-market transactions).

One may summarize that the study of misconduct connected to production-related rules in any industry can be structured by distinguishing the action situations according to (i) the type of the chain and the considered chain level (e.g. the poultry chain with farmers, slaughterhouses, processing industries, retail trade), (ii) the relationship under consideration (market transactions vs. non- market transactions), and (iii) the quality category and domain of regulation (product safety and consumer health, occupational health, animal welfare, environment, etc.).

In each action situation, the physical opportunities of the respective business operators to break relevant rules need to be assessed. In other words, the first step of the analysis is to compile a list of moral hazards in terms of offence-prone regulations and potential offences as seen on the part of the respective agents. Secondary data will usually only be available to a very limited extent for that purpose. Hence, the technological knowledge of experts in the field regarding the technological processes, the prevalent business practices, etc. needs to be gathered (e.g. through expert interviews) in order to find out which physical process (e.g. production activity) could be adulterated in which way by the involved actors. The result of this step is not only a list of offence-prone regulations, but also a precise physical description of potential offences that make sense as seen from a technological point of view.

3.3 PA-model and incentive analysis

Understanding the incentives of economic actors in competitive markets requires not only the assessment of their options of choice, but also the reconstruction of their calculi. That is, one needs to examine whether it is more profitable to comply or not to comply according to the decision-makers' perception. If one finds misdirected economic incentives, one can search for changes of the economic environment that reduce/eliminate the temptation for rule-breaking.

Discrete PA-models, as described e.g. by KREPS (1990: 577 et sqq.), mirror situations where a risk-averse agent engaged by a principal has the choice between well-defined (discrete) actions and corresponding effort (disutility) levels. In stochastic environments, these efforts result - with given probabilities - in discrete outputs. Taking into account that the agent maximizes his utility depending both on the obtained remuneration and his effort, the principal, who cannot observe the agent's efforts, searches for a contract which maximizes his own utility depending on the output and the remuneration costs. Due to the complexity of opportunistic economic decision-making, it is evident that using the utility-based optimization model in applied studies is out of question in most cases. The information requirement (e.g. elicitation of individual risk-utility functions) cannot be met. However, restricting oneself to the positive analysis of (expected) incentives in various empirical contexts translates into the far more feasible check of the incentive-compatibility constraint assuming risk-neutral actors.

A model facilitating informed choices and practical conclusions must be adequate. Furthermore, the available empirical data must meet the model's data requirements. In other words, empirical estimations of relevant parameters such as prices, control frequency, traceability, level of sanctions, capitalized long-term market losses (e.g. due to a loss of reputation), etc. are needed to go beyond conceptual insights and provide information for specific situations and activities. Since expert opinion will be the main source of information for quantifying model parameters in most empirical analyses of economic misconduct, the general discrete PA-model needs to be modified to a "leaner" model which is able to account for the limited availability of data and which facilitates an empirical analysis with reasonable costs (cf. HIRSCHAUER 2004; HIRSCHAUER and MUSSHOFF 2006). The features of the model proposed for the incentive analysis regarding production-related rules can be summarized as follows:

1. We assume risk neutral principals *and* agents in the model.
2. Adopting a binary perspective, we assume that the agent has only the choice between two well-defined actions regarding the concerned rule (*compliance, non-compliance*). We also assume that there are only *two expected outcomes* (desired, undesired). This allows us to use *binomial distributions* (conditional on the two actions) for the uncertain outcome.
3. We use q (r) to represent the *probability of the desired (undesired) outcome* conditional on compliance (non-compliance)[4]. Stochastic action-outcome linkages (equivalent to values $q \leq 100\ \%$ and $r \leq 100\ \%$) exist if a physical (biochemical, hygienic, etc.) product quality is the relevant outcome. Whenever labelling issues (e.g. region of origin) or the very way of behaviour (e.g. production according to ecologically or socially desirable standards) are considered, the linkage is deterministic and q and r can be equated to unity.

[4] Restricting the model to meaningful situations, we assume that the probability of the desired outcome conditional on compliance is greater than the probability of the desired outcome conditional on non-compliance ($q > 1\text{-}r$).

4. Compliance causes *compliance costs K* which usually comprise different components, ranging from increased input costs to opportunity costs caused by a reduction of sales which a compliant agent has to bear.
5. Corresponding to outcome, there are two payoffs. The *payoff P* being paid *for the desired outcome* and the *payoff P-L* being paid *if the undesired outcome is disclosed*. Losses from disclosure may result from various components such as losses in sales, damage compensation, fines, reputational losses (i.e. long-term market losses), etc.
6. We take the very characteristics of the food risk problem into account and consider that observation, being costly, can only take the form of random inspections carried out with an intensity $s \leq 100$ % (probability of random controls). In other words, we consider that an existing outcome irregularity is only identified with a *detection probability* $s \leq 100$ %.
7. Incentive problems resulting from incomplete output information may be aggravated in multiple-agent situations. A *tracing coefficient* $z \leq 100$ % accounts for situations where an undesired outcome is observed at some (downstream) control point, but the responsible originator is only traced with a certain probability. Whenever the observed outcome can be directly attached to a single agent, the coefficient z can be equated with unity.

Assuming that payoffs depend on the outcome, and abstracting from incomplete inspection and tracing for the time being, we can reproduce the decision-maker's calculus as follows:

$$\begin{aligned} \textit{Incentives to comply} &= \textit{expected payoff for compliance} - \textit{expected payoff for non-compliance} \\ \textit{Incentives to comply} &= qP + (1-q)(P-L) - K \quad - \quad (1-r)P + \big(r(P-L)\big) \\ &= (q+r-1)L - K \end{aligned} \tag{1}$$

Eq.(1) demonstrates that we do not need to know the payout level P for the desired outcome, but only the balance L of both payout levels when reconstructing an empirical incentive situation. A negative result of (1) implies that the "incentives are not right" because the agent expects to earn higher profits through non-compliance. A positive result, in contrast, means that it is more profitable to comply than not to comply. Eq.(1) shows that, with complete inspection and tracing (i.e. if the outcome is fully observed and if it is unambiguously attached to the agent), the outcome probabilities conditional on compliance and on non-compliance coincide with the payoff probabilities. In contrast to that, including a detection probability $s \leq 100$ % and a tracing coefficient $z \leq 100$ % in the model changes the expected payoffs. This reflects the fact that, independent of the (hidden) outcome, the payoff P is to be paid whenever the outcome is not ascertained through an inspection. But even if an irregular (undesired) outcome is found through random inspections, offenders may only face a probability $z < 100$ % of being traced and being held responsible. Considering these effects requires using s and z as additional weights when calculating the incentives:

$$\textit{Incentives to comply} = sz \cdot (q+r-1)L - K, \quad \textit{with } 0 < sz \leq 1 \tag{2}$$

While there are only few parameters to be considered in this model, their empirical estimation remains a formidable task. For one thing, the economic determinants represented in (2) by single parameters may comprise many and widely differing components. In empirical contexts, the researcher's main task is to identify these components and realistically estimate their values or, at least, magnitudes. It is not trivial, for instance, to specify damage compensations and the short- and long-term reputational damages which are part of the loss L inflicted in

case of disclosure. Nor is it trivial to specify the probabilities *s*, *z*, *q*, and *r* needed to determine the expected incentives. The detection probability *s* may, e.g., solely reflect the inspection intensity in some situations (cf. STARBIRD 2005). In pooling situations, however, where products are mixed (and residues thinned down) before being inspected, it reflects the joint effect of dilution and incomplete inspection. Furthermore, some situations will exhibit structural complexities such as negative payoffs (e.g. damage compensations) which vary contingent on the source of disclosure: they may be high if undesired qualities are detected through analytical product controls by downstream processors. They may be low or non-existing in the case of a direct disclosure of non-compliant activity through whistle-blowers or on-site controls. Payoffs may also differ depending on whether an undesired outcome arises as a result of non-compliant behaviour or despite compliance. In all these cases, the structure of the above-described formal model needs to be adjusted.

However, having described the general approach and the rationale of the approach and having specified the parameters to be estimated in an empirical analysis, we refrain from presenting further model specifications and refinements. We rather concern ourselves with the empirical evidence regarding moral hazards and the incentives in the poultry chain found in our study.

4 Researching behavioural food risks in the poultry chain

HENNESSY et al. (2003), taking a comprehensive view on food safety and providing a typology of sources for the systemic failure in the provision of safe food, conclude that misdirected incentives and malpractice are a major source of safety risks in the food sector. That is, in numerous situations non-compliance with the food law is more profitable for food business operators than compliance. This may be partly caused by regulatory authorities adopting purely accommodative strategies with innocuous verbal and written warnings, resulting in a situation where only a minority of detected offences are prosecuted (CROALL 1993). Compared to the general food safety perspective taken by HENNESSY et al. (2003) and compared to the wide scope given to the term economic misconduct, we hereafter restrict the analysis to production-related rules in one branch of the food industry (poultry) and to one country (Germany). As regards the object of legal protection, we will not only concern ourselves with "food safety", but also with the "protection of consumers against fraud" (e.g. product information and labelling issues).

4.1 A glimpse on the regulatory background in the European Union

The public task with regard to behavioural food risks as seen by EU authorities is outlined in the definition of the risk analysis process according to regulation EC 178/2002. The regulation states that food law is to be based on "risk analysis [which] means a process of three interconnected components: risk assessment, risk management and risk communication." It also assigns to the authorities the anticipatory task of collecting information for an "improved identification of emerging risks […] with a view to their prevention". This can be linked conceptually to the management literature on strategic surprises, including early warning systems and strategic and graduated response to weak signals (cf. ANSOFF 1976; ANSOFF and MCDONNELL 1990). The term "early warning systems" refers to all scanning, monitoring, and analysing efforts aimed at moving up the cause-and-effect chain, thus generating before-the-fact preparedness and providing additional reaction time, i.e. time to react before "the prob-

lem has become a problem". It is to be distinguished from contingency planning and crisis management such as the existing rapid alert system for food and feed (RASFF) of the EU which aims at an effective communication and after-the-fact responsiveness.

Many food safety experts will associate the term "risk analysis" only with technological hazards (e.g. unintentional technological failures). Based on regulation EC 178/2002 one can argue that risk analysis needs to include moral hazards because non-compliant activities on the part of food businesses, while finally leading to undesired technological outcomes, constitute an independent source of food risks that needs to be tackled differently. If they are not to be neglected, food authorities need to consider behavioural risk analysis as an integral part of an encompassing strategic risk analysis system. Such a system is to facilitate the early identification of risks which might re-emerge due to human misbehaviour. It is also to facilitate early (and graduated) responses that are adequate in the light of the available information.

4.2 Compilation and description of moral hazards on different levels of the poultry chain

In empirical moral hazard analyses, one soon realizes that, due to lacking hard data, expert opinion is an indispensable source of information to understand the actors' decision environments and calculi. Carrying out extensive interviews (first open, then semi-structured), we compiled a list of offence-prone activities on each chain level based on a priori expert judgements. The interviewed expert group comprised mainly members of the respective control fields and law enforcement authorities (feed stuff controllers, public veterinarians, food surveillance officials, public prosecution), but also producers, processors, consultants and interest groups. The rationale guiding these interviews was as follows: first, experts were asked which offences they had observed in the past and which of these offences they assumed to be persisting problems since no significant changes had yet been made to the actors' decision environments. These statements were cross-checked with the available secondary data on documented offences. Second, experts were asked to put themselves in the position of the economic actors and questioned which offences they could envisage as "making sense" from a technological point of view without necessarily having observed them in the past.

Using the evidence from interviews and from an additional survey in the control field, we subjected the identified moral hazards, i.e. the offences that might be imminent according to expert view, to a formal incentive analysis. In order to confine the length of this paper, we present only a selection of the moral hazards identified by the experts. For demonstration purposes, the selection reflects different chain levels from "farm-to-table", different regulatory areas (conventional and organic production), and different outcomes (fraudulent labelling and food safety threats). We illustrate the economic incentives for each moral hazard listed hereafter by defining tangible specifications and scales of these non-compliant activities.

Selected moral hazards on the level of the feed industry and consultant veterinarians

1. *Disregard of mixing ban for contaminated food products:* In order to avoid that highly contaminated cereals enter the food chain, regulation EC 856/2005 rules out to use cereals exceeding specified mycotoxin levels as food or feed components. Considerable temptations to thin down contaminated grain batches by mixing them with batches containing toxins below the maximum level may arise since lower prices are paid for the non-food/non-feed utilization. We look at an illegal use of 50 tons of wheat (as a feed component) which exceeds the maximum DON level of 1250 μg/kg (cf. EC 856/2005).

2. *Breach of cleaning requirement before using equipment on organic farms:* Contractors providing milling and mixing services to organic farmers, who use their own crops as feed, should clean their equipment in order to guarantee segregation of organic products from conventional and GMO products (cf. EC 2092/91; EC 1830/2003; GenTGAend3[5]). Due to cleaning costs and time pressures, a temptation may arise to skip cleaning, thus fostering the translocation of conventional (and potentially of genetically modified) produce to organic farms. Neglecting a potential reduction of the contractor‘s turnover, we look solely at the direct costs that can be saved by skipping 3.5 hour of cleaning time.

3. *Manipulation of drug release documents:* A veterinarian may only hand drugs over to farmers if stock treatment is justified according to his professional judgement. In the case of systemic antibiotics, quantities that may be handed over are restricted to what is needed for a seven days treatment (cf. AMG[6]). Bending these rules saves veterinary expenses for farmers and facilitates a more “liberal” use of antibiotics. While direct financial gains may be non-existent for a veterinarian, he may be “forced” to yield to a farmer’s wishes by competition. We look at a collusive shaping of drug release documents over one year assuming that the veterinarian’s “payoff” is to keep a customer, and thus his income.

Selected moral hazards on the level of poultry farming

4. *Non-compliance with the waiting period after treatment of parasites in chicken:* Chickens affected by parasites are regularly treated with the drug “Levamisol” (active agent: imidazothiazol; approved by regulation EC 2377/90) which requires a waiting period of 14 days. Depending on the date of affection and treatment, compliance may require to exceed the regular production period of 34 days. Not meeting the contracted delivery date and weight reduces the gross margins earned by farmers. We look at a situation where a farmer might be tempted to infringe upon the waiting period by two days for a production lot of 18000 chicken.

5. *Illegal use of Nifursol for the treatment of blackhead (histomonosis) in turkeys:* It was legal to treat turkeys affected by blackhead with “Nifursol” (active agent: nitrofuran) until 2003 when its use was prohibited through amendment of regulation EC 2377/90. Since no effective drugs are legally available on the market, farmers face a total loss of stock affected by blackhead. Farmers may thus be tempted to illegally use Nifursol. We look at a Nifursol treatment of 14000 turkeys assuming that they have contracted blackhead in the ninth week of the production cycle.

6. *Use of conventional feed components in organic poultry feeding:* By way of derogation of regulation EC 1804/99, organic poultry farmers are allowed, with prior permission, to use a maximum proportion of 15 % conventional produce in their animal feed until December 2007. Conventional grain being sold at about half to two thirds of the price of organic grain, a substantial temptation to replace organic components above this threshold may arise for farmers mixing their own feed on the farm. We look at an improper input of five tons of conventional wheat in organic chicken feeding.

[5] Drittes Gesetz zur Änderung des Gentechnikgesetzes (German Genetic Engineering Law; Deutscher Bundestag, Drucksache 16/430).

[6] Arzneimittelgesetz (German Medicines Law).

Selected moral hazards on the level of slaughtering and processing

7. *Use of spoilt processing meat for poultry sausages:* Butchers purchase supplies such as processing meat from wholesalers. According to expert opinion, and evidenced by the 2006 "rotten meat scandals", situations can be envisaged where spoilt processing meat is offered to a butcher. While being unfit for human consumption (cf. EC 178/2002; LFGB[7]), it can - from a technological point of view - be easily used for the production of sausages. Due to cost savings resulting from a (very) low purchase price, the butcher may be tempted to accept such an offer. We look at an illegal use of 200 kg of unfit processing meat in the production of one ton of poultry sausages.

8. *Increase of water contents through manipulation of the air-water cooling system:* The technological management of the air-water cooling system used in poultry slaughterhouses determines the water absorption when freezing poultry. The allowable absorption of additional water is 3.3 % of the chicken's weight (cf. EC 1538/91). The opportunity to earn large additional profits by increasing the water contents may tempt slaughterhouse operators to manipulate their air-water cooling system. We look at an illegal increase of water contents to 4.3 % for a lot of 160000 chicken.

9. *Use of conventional spices in organic poultry produce:* Organically produced spices represent considerable cost drivers in the production of organic poultry produce such as sausages. Economic temptations may thus arise to illegally use conventional spices (cf. EEC 2092/91). We look at an improper use of 2.5 kg of conventional pepper by a butcher who produces one ton of mortadella and sells it as organic produce.

Selected moral hazards on the level of distribution and retail trade

10. *Non-compliance with cooling temperatures:* During transport, frozen poultry must be constantly kept at a minimum -12°C (cf. EC 853/2004; EC 854/2004). Compliance on the part of transport enterprises requires spending money (compliance costs) on the proper maintenance of cooling equipments as well as an on an adequate instruction and motivation of truck drivers with regard to the handling of the appliances. We look at the inner-city delivery of one ton of frozen produce and the (missing) incentives on the corporate level to see to a proper transport temperature.

11. *Marketing of defrosted poultry as fresh poultry:* Selling defrosted poultry (e.g. turkey filets) as fresh produce is a violation both of hygienic and labelling regulations (cf. EC 853/2004; EC 854/2004). Retailers may be tempted to do so because of the cost spread between frosted filets and fresh filets. We look at an illegal sale of 100 kg of defrosted turkey filets as fresh filets to consumers.

12. *Marketing of conventional poultry as organic produce:* Retailers (butcher shops) selling both organic and conventional poultry parts may be tempted to sell conventional poultry as organic poultry because purchase prices for organic poultry are approximately three to four times higher than prices for conventional produce. We look at an illegal sale of 100 kg of conventional turkey filets as organic filets (cf. EEC 2092/91).

[7] Lebensmittel-, Bedarfsgegenstände- und Futtermittelgesetzbuch (German Food, Articles and Feed Law).

For each of the identified offence opportunities, selected experts were consulted concerning the specific decision structures and the parameter values related to each opportunity with the help of structured (manual-guided) oral interviews. Table 2 summarizes the parameter values attached to the offence-prone regulations listed above according to these expert based assessments. Questions addressed for each offence opportunity were:

(a) What are the stochastic action-outcome linkages, i.e. the probabilities of the desired (undesired) outcome conditional on compliance (non-compliance)?

(b) What is the detection probability resulting from the various sources of potential disclosure (neighbours, colleagues, employees, random controls by public authorities, product quality controls by trading partners, etc.). Which factors prevent disclosure? Are there inadequate control points in that irregular qualities such as excessive residue levels are "sufficiently" thinned down before analytical tests are made?

(c) What are the compliance costs? Which costs could be saved and/or which sales could be gained by not complying with the rule?

(d) What are the relevant components of the economic loss in case of disclosure? Is there a threat to lose sales revenues and/or subsidies? Are there legal fines, damage compensations, or disposal costs to be paid? Are long-term market losses expected due to a deterioration of reputation?

(e) Are there traceability problems in that the responsible originator of an adverse effect is only traced with a certain probability?

Due to the reproducible interpretation of the parameters and the limits regarding the length of this paper, we only comment on the parameters of the offence "non-compliance with waiting period" (cf. 4.) in detail: the conventional production period for light-weight chicken (1.55 kg) is 34 days. Chickens affected by parasites are regularly treated with the agent "Levamisol" which requires a waiting period of 14 days to prevent residual drug metabolites from persisting in poultry meat (q = 100 %). If the five-day treatment encompasses, e.g., day 17 to 22 of the production cycle, the producer cannot legally meet the regular delivery date. If a producer infringes upon the waiting period by two days, poultry meat is expected to contain residual metabolites with a probability r = 50 % due to stochastic influences. Since very few specific tests are made for Levamisol, the probability that existing residues are detected is estimated to amount to s = 0.01 %. While facing additional costs, producers have the opportunity to extend the production period to 39 days and deliver heavy-weight chicken (1.955kg). However, the additional variable costs (mainly for feeding) and the opportunity costs of capacity use are not fully compensated by increased sales since prices are down by 0.05 €/kg due to the change of product category as well as due to the producer's not meeting the contracted delivery date. The resulting costs of compliance amount to K = 704 € per production lot of 18000 chicken. In a rare case of detection, all sales would be lost and disposal costs would amount to 7020 €. While having heard no stories of producers being fined for not complying with the waiting period, the interviewed experts expect the fine to amount to 500 €. Additionally they estimate that a regular transfer payment of 10000 € received by the farmer is reduced by 15 % due to the cross-compliance regulation (cf. EC 1782/2003). The probability of being traced if residual metabolites are detected amounts to z = 100 % because different lots are clearly attributed to individual producers through accompanying documents.

4.3 Economic temptations on different levels of the poultry chain

It is to be noted that using limited data sets and averaged data such as those derived from our expert interviews provides only preliminary hints regarding the relevant decision environments and the decision-making processes. In specific circumstances, the reproduction of the calculi of profit-maximizing actors should be replicated (for instance with a more precise and more specific assessment of the respective parameter values). It should also be noted that, in this paper, we restrict ourselves to the analysis of economic temptations, i.e. the first stage of research into economic opportunism. That is, we do not analyse actual behaviour and we do not qualify the actual choices contingent on the regularities of certain social settings and intrinsic motivations. Thus, if we reveal economic temptations to break the rules, this is only to be taken as a first hint where problems might arise. The actual behaviour of food business operators in the light of such temptations, however, is not known.

The figures in bold printing in the lower part of Table 2 indicate the incentives for the examined moral hazards. The first line of this lower part shows whether, according to the parameter values given in the upper part of the table, it is economically superior (+) or inferior (-) to comply. According to the experts' assessment of technological and economic parameters, only two of the examined offence opportunities are unprofitable: the illegal use of conventional feed components for organic poultry (see 6.), and the use of conventional pepper for the production of organic mortadella (see 9.).

In contrast to that, profit maximizing food business operators face economic temptations for the ten remaining non-compliant activities under consideration. In particular it seems that - abstracting from the costs of illegal purchase - a very high temptation arises to illegally use Nifursol if turkeys are affected by blackhead (see 5.). Resorting to demand theory, one can conclude that profit maximising farmers will be prepared to pay high black-market prices for Nifursol. Looking at the details of the two drug-related moral hazards (see 4. and 5.) reveals that the introduction of the EU cross-compliance regulation (involving a reduction/withdrawal of EU subsidies for farmers who do not comply with rules in various domains such as the environment, food safety, animal health, etc.) can be interpreted as an adequate direction of change. However, for both non-compliant activities the assumed reduction of subsidies - 15 % for misuse of Levamisol and 30% for the illegal use of Nifursol - does not suffice to eliminate the economic temptation. The deterrence effect is especially small if farmers expect the detection probability to be very low as in the case of Levamisol.

Looking at the cleaning requirement (see 2.) deserves an extra comment. While organic farmers are not allowed to use GMO feed inputs, there is no operational rule forcing them to conclude a service contract with the contractor specifying that the latter cleans his equipment before he uses it on an organic farm. Both parties can thus easily (and rightly) plead that they ignored such an obligation. Representing a loophole in legislation rather than a formal offence, this case of misconduct does involve no losses in case of detection. The contractor can thus freely economize the cleaning costs.

While a firm's monetary gains attached to non-compliance with the cooling temperature (see 10.) are not really high, the problem is more relevant than what the economic incentive analysis suggests if an inclination towards negligence (e.g. on the part of employees with doors left open etc.) needs to be considered. One can expect that the transport company executives

would try to counteract negligence e.g. on the part of sluggish truck drivers more actively if a considerable economic loss from non-compliant behaviour was to be expected. That is, even the reduction of misdirected incentives on the firm level to zero may not suffice to induce the management to counteract negligence in an effective way.

Analyzing the potential sale of defrosted turkey filets as fresh filets (cf. 11.) reveals that a moderate temptation exists if one has regular frozen produce in mind. The temptation will be much higher than indicated in the table in two situations: first, if one looks at an illegal freezing of fresh poultry products, e.g. quantities remaining unsold before a weekend, which otherwise would have to be disposed of and which are sold as fresh poultry after the weekend; second, if one looks at periods of unexpectedly high demand of fresh produce when the economic gains that can be achieved through misconduct result not only from the price advantage, but also from additional sales that can be realized if the supply problem is "solved".

The overall low detection probabilities are to be seen as a major reason for the high temptations arising for most non-compliant activities. In the interviews with the experts from the control field (public authorities), low inspection intensities were often justified (besides budgetary constraints) by the general trustworthiness of most food business operators. We are not in a position to question such statements. It needs to be recognized, however, that, even if most food businesses rightfully enjoy low inspection intensities due to an existing intrinsic inhibition to commit offences, free riding opportunities for individuals may arise precisely because the considered group is considered trustworthy on the whole, but is in fact (morally) heterogeneous (with at least a few remaining crooks).

Resorting to critical value analyses (see second and third line of the lower part of Table 2) reveals which hypothetical level of losses (inflicted in the case of disclosure) and which hypothetical level of detection (of irregular outcomes) would ensure/maintain incentive-compatible contracts. Since proportionality is a crucial legal issue, it does not seem to be realistic to achieve the high levels of losses (i.e. their ceteris paribus critical level as indicated e.g. for the potential offences 1., 3., 4., and 5.) that are needed to eliminate the actual temptations - at least not by means of administrative sanctioning. Looking over all offence-prone activities reveals that a "realistic" sanction level is only sufficient if, and only if, it is paired with a "reasonable" probability that an irregular outcome is detected; and vice versa. Furthermore, studying the parameters of the various offences shows that significant losses are only provided by market effects. For the potential offence 6 ("use of conventional feed for organic poultry") the loss inflicted in case of detection results mainly from the fact that the farmer would have to sell his poultry as (low-priced) conventional poultry. Representing a serious loss, the detection probability could even fall from the assumed level of 3 % to a level of 1.3 % without jeopardizing the incentive compatibility.

While market effects are also relevant for the two drug-related offences (poultry needs to be disposed of if misuse of drugs is disclosed), the critical value analysis for the two cases emphasizes that even high losses inflicted in case of disclosure are only effective if they are combined with a detection probability which leads to a reasonable expectation value of the loss. In the case of Levamisol (cf. 4.) one would need to push the probability that an irregular outcome is detected from 0.01 % to 4.4 % if the existing level of the loss is to eliminate the temptation. In the case of Nifursol (cf. 5.) even a complete inspection of carcasses and a resulting 100 % probability to detect an irregular outcome (i.e. Nifursol residues in carcasses)

Table 2: Economic decision parameters for offence-prone activities on different levels of the poultry chain

	1. Disregard of mixing ban for contaminated products	2. Breach of cleaning requirement	3. Manipulation of drug release documents	4. Non-compliance with waiting period	5. Illegal use of Nifursol in treatment of blackhead*	6. Use of conventional feed for organic poultry	7. Use of spoilt processing meat for poultry sausages	8 Manipulation of air-water cooling and water contents	9. Use of conventional spices in organic produce	10.Non-compliance with cooling temperatures	11.Marketing of defrosted poultry as fresh poultry	12.Marketing of conventional poultry as organic produce
(a) Action-outcome linkages *q* and *r*												
Probability of desired outcome for compliance (*q*)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Probability of undesired outcome for non-compliance (*r*)	100%	100%	100%	50%	15%	100%	100%	100%	100%	100%	100%	100%
(b) Detection probability *s*												
Probability that an undesired outcome is detected	0.1%	X	0.1%	0.01%	12.2%	3%	7.5%	5%	6%	0.1%	0.1%	6%
(c) Compliance costs *K* (€)												
Costs arising from compliance with the rules	2500	70	2450	704	131273	900	240	2125	25	8	70	202
(d) Losses *L* (€)												
Inflicted losses if non-compliance is proven	3750	X	4000	32186	250304	69004	1571	17000	3134	3500	830	1000
thereof: - short-term losses (from sales)	2750	X	0	23166	207514	44064	850	16000	2634	2800	280	0
- short-term sanctions (fines, subsidy losses, etc.)	1000	X	4000	2000	8000	24940	500	1000	500	500	500	1000
- disposal costs		X	0	7020	34790	0	221	0	0	200	50	0
- capitalized long-term market losses	0	X	0	0	0	0	0	0	0	0	0	0
(e) Tracing coefficient *z*												
The responsible actor's probability of being traced	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Economic inferiority (-) / superiority (+) of compliance (€)	**-2496**	**-70**	**-2446**	**-702**	**-114052**	**1170**	**-122**	**-1275**	**163**	**-5**	**-69**	**-142**
Ceteris paribus critical level of the inflicted loss (€)	**2.5 Mio**	**n.a.**	**2.5 Mio**	**14.1 Mio**	**6.4 Mio**	**30000**	**3200**	**42500**	**417**	**8000**	**70000**	**3367**
Ceteris paribus critical detection probability	**66.7%**	**n.a.**	**61.3%**	**4.4%**	**n.a.**	**1.3%**	**15.3%**	**12.5%**	**0.8%**	**0.2%**	**8.4%**	**20.2%**

* Looking at an illegal use of Nifursol, we need to consider that different losses result from different sources of detection (analysis of trough water, and analysis of residuals in carcasses). Each of the two detection types results in a separate detection probability which is used as weighing coefficient for the respective loss when calculating the total expected loss from detection. The parameter values specified in the table refer only to the analysis of carcasses. The results, however, consider both detection sources.

would not suffice to eliminate the temptation to use Nifursol. This is due to the beneficial effects from the stochastic environment that a non-complying farmer enjoys. Even if the farmer uses Nifursol, the probability that Nifursol residues are present in the poultry carcasses is assumed to amount to $r = 15$ % only. While representing an unacceptable risk from a consumer protection point of view, the corresponding 85 % chance of having no detrimental effects in the product allows for a profitable use of Nifursol. One thus has to conclude that, with the present level of losses inflicted in case of disclosure, the inspection of carcasses would have to be combined with an increased intensity of the on-site inspection of the trough water in order to eliminate the temptation.

When interpreting these critical values, it should be recognized that they only provide technical information regarding the incentive effects of *hypothetical* variations of two selected parameters. Other parameters (e.g. the costs of compliance and the stochastic action-outcome linkages) might be subject to change as well (e.g. due to technological innovation). Furthermore, critical value analyses, while providing preliminary hints for the necessary direction of change, do not yet provide normative information as to which combinations of measures influencing the parameters under consideration are consistent and cost-efficient strategies to manage behavioural risks in various settings. The level of losses is, e.g., determined by administrative fines as well as by direct sales losses, disposal costs and reputational sanctions (long term market losses), all of which can be influenced by different measures.

While not knowing the optimal mix of measures (i.e. the optimal preventive strategy), we know that it will, in many cases, mean to accept an incomplete contract (or leave it deliberately incomplete) and a certain risk of malpractice on the part of business operators. This is based on the expectation that the marginal gains from further efforts for opportunity control (physical incapacitation), incentive control (reduction of economic temptations, deterrence strategy) and enhancement of benevolence (promotion of protective factors, compliance strategy) will be smaller than the costs caused by these efforts (cf. WILLIAMSON 1993). In other words, complete contracts are often not available, or too costly. Hence some level of protective factors is needed which, in turn, is costly to increase. A “full scale” normative analysis, however, is beyond the scope of this paper.

5 Conclusions

The aim of this article has been to assess the relative merits of four scientific approaches concerned with economic misconduct and risks in economic relationships: first, criminology with its predominantly normative account of prevention and the empirical evidence regarding the performance of different regulatory regimes; second, formal game theory with its quantitative analytical account of moral hazards and economic incentives (principal-agent models); third, management science with its normative account of relational risk management strategies and their empirical performance in corporate business; fourth, institutional analysis with its account of social dilemmas and choices on different levels of social interaction.

Designing effective measures against economic misconduct requires information derived from systems analysis approaches which consider all relevant factors that motivate human behaviour. Using production and trading standards for the poultry industry as an example, we have shown in an empirical analysis that principal-agent models are efficient means to reconstruct the decision structure of (food) businesses and to process economic information and

quantify the economic incentives with regard to rule compliance. Economists should acknowledge in this context that the challenging data requirements of standard PA-models often prevent practical applications. However, maintaining adequateness, a reduction of model complexity is possible. Applied behavioural risk analysis requires the analysis of discrete behavioural options rather than solving continuous constrained optimisation problems.

Furthermore, while the consideration of economic incentives is indispensable, it must be recognized that other behavioural determinants such as diverse forms of social control and the actors' intrinsic motivations may represent crucial behavioural determinants even for predominantly profit seeking actors in market environments. Based on the assessment of the relative merits of the various approaches and their potential contribution to interdisciplinary research, our message is that there is a big chance to improve the understanding of economic misconduct if a quantitative game-theoretic analysis of economic incentives is systematically combined with a qualitative analysis of the social contexts and determinants of behaviour.

It seems that, in applied studies, social factors - being intrinsically hard to quantify - should be excluded from formal models even though they are utility relevant. An additional qualitative analysis ensures that social factors - rather than being merely considered as constraints or subordinate objectives - can be adequately taken account of. Useful insights for the design of preventive strategies can be derived from empirical evidence demonstrating the performance of applied regulatory strategies and applied relational risk management strategies depending on the specific contingencies of the situation. While finding the optimal behavioural risk management strategy contingent on specific situational conditions is not easy, operational ways to decrease the probability of rule-breaking by "moving into the right direction" and by increasing the levels of those parameters that promote compliance may thus be conceived.

Regarding the choice of adequate means in behavioural risk management, future research will need to examine under which conditions reputational sanctioning ("name and shame") and the resulting market loss and social disapproval represents an effective means of corporate regulation. It is effective if crowding out can be avoided, i.e. if the reduction of misdirected economic incentives is not thwarted by drawbacks such as a decrease of the actor's intrinsic motivation to comply. Looking beyond the intended incentive effects, the innocence presumption as a crucial principle of justice will also need to be discussed in this context.

Expert statements from the poultry study suggest that regulatory food authorities often rely exclusively on the accommodative model of regulation (this could be referred to as "speaking softly and carrying no sticks"). With placid officers viewing offences purely as difficulties of compliance and showing low disapproval of offences and/or seeing themselves solely as advisers, authorities fail to secure compliance with process-related standards as incorporated in the food law (cf. CROALL 1993 for similar findings). It seems that lessons regarding more effective regulatory regimes may be learned both from criminological research (responsive regulation experience) in other business fields and from the profit-oriented relational risk management practices in corporate business. Last, but not least, the practical chances of different actors to eliminate loopholes in the law (reformation of legislation) or in contracts and to improve the practical enforcement of rules can be identified through an institutional analysis.

Future work should focus on a consistent methodical integration of the various approaches concerned with the study of economic misconduct, with the aim to develop applicable tools to be used by public authorities and other stakeholders for a systematic analysis and prevention of

misconduct in various fields of economic activity. Information regarding the performance of existing approaches to cope with the problem should be derived from comparative social science research, e.g. through interdisciplinary and cross-national studies in Europe. Extending efforts to a systematic and comparative behavioural economic analysis of misconduct in major industries may require that the structure of the above-described PA-model is developed further and extended with regard to its restrictive assumptions (e.g. the binary perspective). It will also require that a criminological part of analysis includes ethnographic perspectives and concepts of "comparative deviance" (NEWMAN 1976) and "cultural criminology" (PRESDEE 2004).

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