Punishing Environmental Crimes:
An Empirical Study from Lower Courts to the Court of Appeal[1]

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Abstract

We analyze judicial policy lines concerning the punishment of environmental crime using a unique European dataset of individual criminal cases, including case-specific information on offenses and offenders. We investigate policy choices made by lower criminal courts as well as their follow-up by the relevant court of appeal. The sanctioning policy of the courts proofs to be varied as well as consistent. Judges carefully balance effective and suspended penalties, most often using them cumulatively, but in specific cases opting to use them as substitutes. Overall, both judges in lower and appeal courts balance environmental law and classic criminal law and aim at protecting individuals and their possessions as well as the environment.

Keywords: Judicial policy; Environmental crime; Criminal sanctions

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I. Introduction.

In a world where firms and individuals do not automatically comply with legislation, monitoring and enforcement strategies are necessary elements of an effective and well-designed environmental policy. As a recent overview by Gray and Shimshack (2011) of the empirical evidence on the effectiveness of environmental enforcement in the US shows, monitoring and enforcement activities generate not only reductions in violations, but also significant reductions in emissions. In general, enforceable regulations are often cited as a dominant factor explaining the substantial improvements in environmental quality in developed countries over the last four decades (see, e.g., Kagan et al. 2003).

Enforcement typically involves a range of policy choices such as monitoring strategies by state or federal agencies (e.g. Rousseau 2007), self-policing by facilities (e.g. Toffel and Short 2011) and the imposition of administrative and criminal sanctions as well as civil sanctions (e.g. Gray and Shimshack 2011). One of the less documented phases of the environmental enforcement process is the sanctioning policy applied by criminal courts. In this contribution, we construct a comprehensive picture of judicial policy lines in the punishment of environmental crime in the Flemish Region (Flanders) in Belgium. Our dataset, a collection of individual criminal cases that is unique in Europe, includes case-specific information on offenses, offenders and imposed sanctions and follows cases up to the appeal phase. To start, we investigate three decisions made by criminal judges in the courts of first instance: first whether a prosecuted defendant should be acquitted; next whether the offense should be punished with an effective penalty, a suspended penalty or a combination of both; and finally what the level of the effective and/or suspended penalty should be. Next, we analyze whether appeal judges confirm or adapt the initial verdicts and, if verdicts are adapted, we study the size and direction of these changes.

Judicial behavior has been extensively studied from a behavioral law and economics viewpoint (e.g. Guthrie et al. 2001). Prior to the emergence of this strand of literature, Marks (1988) was one of the first to state that behavior of judges can be examined in a rationality-based setting. Since the 1980s, a significant body of theoretical research has been developed to understand judicial behavior (see Spiller and Gely (2007) for a US based overview). Yet, most studies are framed within a common law context. Thus not all results, for instance those relating to the importance of judicial precedence (Rasmusen 1994; Levy 2003), carry over to a civil law context. Fon and Parisi (2006), e.g., state that judicial precedent can be a central component of judicial decision making in civil law countries but that its influence depends on the demand for consistency with previous case law. The rule of precedence can even become irrelevant, when the law gives judges broad discretionary freedom. Typically this applies to the determination of sanctions within the criminal law system of civil law countries: judges have extensive discretionary freedom when deciding on the type and level of sanctions in criminal cases, and thus the rule of precedence fades away in this subject area. With regard to Belgium, a civil law country, this analysis is corroborated by a recent study by Monsieurs et al. (2009) who surveyed Belgian judges with criminal case loads and found that the influence of judicial precedent is very limited in the sanctioning decision process.

An overview of the determinants of monetary sanctions imposed in practice following environmental offenses is provided by Rousseau (2009). Based on international empirical evidence, she studies the determinants and levels of administrative, criminal as well as civil fines inflicted for environmental offenses. Three major categories of variables are identified: the circumstances of the offense, offenders' characteristics, and indirect institutional effects. Some general trends emerge: fines increase with the harm caused by the offense (Earnhart 1997; Kleit et al. 1998; Oljaca et al. 1998), and fines are higher for repeat offenders as well as for intentional offenses (Kleit et al. 1998; Oljaca et al. 1998). Also, the studies discussed indicate that institutional factors matter (Earnhart 1997; Ringquist 1998; White 2006).

However, only a couple of empirical studies deal with criminal sanctions for environmental offenses, as opposed to administrative and civil sanctions. In one of the first empirical studies dealing with criminal environmental sanctions, Cohen (1992) analyzed the fines imposed by US federal criminal courts on firms sentenced between 1984 and 1990. He found that the particular type of violated legislation had a sizeable impact on the size of the fine imposed on convicted corporations. Also, large corporations received higher fines than small ones. Further, Billiet and Rousseau (2003) performed an analysis of the jurisprudence of the Court of Appeal of Gent (Belgium) for the period 1990-2000 concerning waste water discharge permits. The fines imposed in first instance were higher when the defendant had a criminal record and for infractions on the Flemish Environmental Permitting Act 1985. As in the rest of the EU, environmental permitting legislation is a centerpiece of environmental regulation in Flanders. Billiet and Rousseau (2003) also found that, contrary to the rulings in first instance, the appeal judges considered both the violator's intentions and the harm caused to third parties. Finally, Blondiau and Rousseau (2010) studied the impact of a judge's objective function on the criminal sanctions (fine or plant closure) inflicted to corporate entities to enforce environmental standards. Using a subset[2] of the dataset used here, they found that judges explicitly take social sanctioning costs into account next to environmental damages.

While the previously discussed studies yield interesting insights into sanctioning decisions for environmental offenses, none of them provides a detailed picture of judicial policy lines in determining criminal sanctions. They do not explicitly take the variety of different judicial policy options available to judges into account, nor do they study the complete path of criminal cases up to the appeal court. Thus our current study analyzes judicial sanctioning decisions in a more general framework by including the different sanctioning possibilities such as the option to postpone a conviction and the use of suspended or effective sanctions, from first instance level to appeal. The analysis allows us not only to identify broad trends in criminal judicial decision making, such as leniency towards offenders that took positive actions to limit damages, but also to investigate the specific factors determining sanctioning decisions for particular offenses, such as violations of environmental permitting requirements. Moreover, we are able to study the use of suspended sanctions by criminal judges: are such sentences used as substitutes for effective sentences or are both types of sentence used cumulatively? For instance, we show that the cumulative use of effective and suspended sanctions is the general policy line when judges deal with corporate entities. Finally, we identify the changes made by appeal judges to first instance rulings and are therefore able to comment on the consistency in sanctioning decisions through the different layers of the criminal court system in Belgium.

In section 2 we describe the legal background to the criminal sanctioning of environmental offenses in Flanders. In section 3 we formulate the hypotheses that will be empirically tested. The data, model and variables used in the analysis are summarized in section 4, while the results are presented in section 5 and discussed in section 6. Section 7 concludes.

II. Background to the criminal sanctioning of environmental offenses in Flanders

Since our empirical analysis deals with the criminal enforcement of environmental legislation in Flanders, Belgium, we provide a short overview of the most relevant characteristics of the criminal sanctioning system in that country[3].

[2] Blondiau and Rousseau (2010) analyze sanctions imposed on corporate entities by lower courts only, while the current study analyses sanctions imposed on individuals and corporate entities by lower courts and appeal court.

[3] We limit the information to the law that applied when the cases in our dataset were handled by the criminal court system. Subsequent changes are not relevant.

2.1 Prosecution decision

Public prosecutors in Flanders decide to prosecute in about 8% of the environmental cases that reach their office[4]. Prosecution guidelines regarding the decision to prosecute and the type and level of sanctions to request from the bench do not exist in Belgian criminal procedure law. In May 2000 the Council of Prosecutors-General did approve a memorandum identifying the environmental offenses that rate priority in the prosecution policy (Environmental Prosecution Memorandum). The prioritized offenses are essentially those that have or might have serious consequences for public health and the environment, have an organized crime character, are committed in a professional context, or concern the exploitation of a facility or activity without the required environmental permits. This memorandum, however, does not bind the prosecutors at all. Thus, the prosecutor's discretion concerning the decision to prosecute or not and, if prosecuting, the selection of sanctions to request, is very broad.

2.2 Criminal sanctioning decision

Criminal court judges have three main options to shape a sanctioning policy. Firstly, if the criminal court finds facts and liability proven, which happens in nine out of ten cases, the court has to choose between a postponement of conviction and an actual conviction. Postponement of conviction, basically a choice not to punish, is subject to a probation period of one to five years in which the offender must not reoffend.

Secondly, if the criminal court opts for a conviction, it has to impose at least one principal sanction. Belgian criminal law knows three principal sanctions, which all have a punitive character: imprisonment, fines and community service[5]. It is legally possible, and common, to impose more than one principal penalty: for instance combining a fine with a prison sentence (Billiet and Rousseau, forthcoming). For each selected principal penalty, the judge also needs to determine the penalty level within the minimum and maximum limits set by the legislator. The range of legally allowed penalties is typically very broad. The statutes used in our dataset provide for fines ranging from minimum 26 euro to maximum 10 000 000 euro and for prison sentences with a minimum of 8 days and a maximum of 5 years (Billiet et al. 2009). Note that the Belgian Criminal Code includes a conversion mechanism of prison sentences to fines that applies whenever the offender is a legal entity. We used this mechanism in our analysis to convert prison sentences imposed on convicted individuals to monetary equivalents[6].

The last main policy choice of the criminal court relates to the possibility to suspend penalty execution, partially or completely. As a postponement of the verdict, a suspension of penalty execution is always linked with a probationary period of maximum 5 years. Both options put a clear emphasis on individual deterrence. Suspension of the execution of penalties is a prevalent option in criminal courts throughout the European Union, where it is commonly seen as a means to prevent recidivism (Commission of the European Communities, 2004).

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[4] Some 60% of the Flemish environmental cases end with a dismissal and 14% with a settlement. About half of the dismissals have a technical motivation such as lack of evidence, while the other dismissals are based on policy reasons, often the motivation that the situation has been regularized. Thus rectifying the illegal situation seems more important to prosecutors than punishing the offending party.

[5] A community service consists of a number of hours that the convicted person needs to work for free for a public or non-profit organization. This sanction is seldom used in Flanders (see Table 1). If used, it most often punishes illegal waste dumping by people in financial distress and usually involves waste clean-up.

[6] We compare differences in maximum fines with differences in maximum prison sentences for different regulations to calculate the implicit monetary value that the legislator assigns to prison sentences. Firms cannot be imprisoned, so there has to be a difference in the legal maxima for the fines that can be imposed on individuals and on firms to secure a non-discriminatory treatment. Using these differences, we derived an (approximate) equivalent monetary value for a prison sentence: $100000 + 100000^{0.497(\text{prison sentence in months})}$ euro.

Also, a criminal judge can impose one or more additional – punitive or remedial – sanctions[7], if and when he has imposed at least one principal penalty, suspended or not. Most often, judges disregard this option and shape their environmental sanctioning policy through principal penalties only, fine-tuning them by using the aforementioned three main options.

Thus, criminal judges develop a policy within very broad legal margins. Moreover, they are not guided by sentencing guidelines, since such guidelines do not exist in Belgian criminal law. Also, criminal judges are not bound by the public prosecutor's sanctioning request nor, as mentioned earlier, by the penalty imposed in previous similar cases. The only decisive factor in the sanctioning decision is the criterion of proportionality with 'the seriousness of the offense': the criminal judge has to punish 'in proportion to the seriousness of the offense'. This basic sentencing criterion[8], which was developed by Belgian Supreme Court and which applies to all types of criminal cases, includes two sub-criteria: the objective gravity of facts *as such* and the culpability of the defendant. The gravity of the facts is rated by the extent to which the unlawful activities harmed or might have harmed the public interest protected by the violated legislation. Looking at Belgian legislation, the public interest that the environmental statutes aim to protect from harm always consists of (an aspect of) the natural environment (water, air, biodiversity, …), which is protected for anthropocentric reasons (with a strong focus on health issues), or because of the intrinsic value of the natural environment, or for both these reasons.

The assessment of and the importance attached to harm by the Belgian Supreme Court are in line with the focus on harm in the existing law and economics literature on optimal penalties (e.g., Polinsky and Shavell 1979, 1992; Garoupa 2001, Rousseau and Telle 2010). Also, the theory of marginal deterrence, developed by Shavell (1992) and Mookherjee and Png (1994), which holds that optimal penalties rise with the harmfulness of acts and should reach the extreme only for the most harmful acts, constitutes an approach that matches the proportionality principle set out by the Supreme Court. To conclude, the actual and potential harm associated with the prosecuted offense as well as the culpability of the offender are two key factors in determining the applicable penalty.

2.3 Some additional key features

Since the 19th century the Belgian Supreme Court has adamantly upheld the requirement of an intentional element (guilt) in order to conclude to an offense that can be punished by criminal law [9]. Strict liability does not belong to the sanctioning logic. Further, legal persons are criminally liable since 1999 and can be prosecuted and punished together with natural persons involved in the same criminal case. Under the Belgian Criminal Code, legal persons incur criminal liability directly as entities on their own. Thus it is not necessary to identify one or

[7] Forfeiture of illegal benefits (the most frequently used punitive additional sanction), and the injunction to cease a business operation (the most frequently used remedial one) are each imposed in only 5% of convictions (Billiet et al. 2009, Billiet and Broeckhoven 2011, Billiet and Rousseau 2012). In Belgium, as in many other EU-countries, remedial sanctions for environmental offenses traditionally belong to the realm of administrative enforcement.

[8] The case law of the Belgian Supreme Court meets a general principle of criminal law with its attachment to this basic criterion. The requirement of proportionality between the criminal offense and the severity of penalties has been enshrined in many fundamental laws and treaties, such as the Charter of Fundamental Rights of the European Union (Pb. 2007, C 303) that is binding since the entry into force of the Treaty of Lisbon on 13 December 2007.

[9] The basic form of guilt, *dolus generalis*, is most often depicted as the requirement to have acted 'knowingly and willingly', meaning that one committed the illegal conduct as such knowingly and willingly; it is not required to also have been knowing and willing concerning the illegal character of the conduct. This concept of 'guilt' is completed by two so-called 'grounds of exclusion of guilt': irresistible constraint and insurmountable erring or ignorance. Together, the idea of guilt and the grounds of exclusion of guilt make that unlawful behaviour committed with negligence is included within the array of punishable behaviour in Belgium.

more natural persons, be it leading persons or employees, who have been committing offenses for the legal person (Van den Wyngaert 2009, Vermeulen et al. 2012).

Individuals as well as corporate entities who consider themselves harmed by the offense under consideration, can become a civil party in the criminal case. If the defendant is convicted, the judge will also rule on civil claims and, if necessary, award damages.

Judgments pronounced by the court of first instance can be appealed by each of the concerned parties with the competent court of appeal. If the prosecutor appeals, which he systematically does when a defendant appeals, the appeal judge is completely free in determining punishment: he can reduce, confirm or increase the verdict pronounced by the judge of first instance.

The Criminal Prosecution Code obliges criminal judges to explicitly motivate the choice as well as the severity of each of the sanctions they impose, whenever they have discretion to choose between two or more sanctions, and to set the level of a selected sanction between a legal minimum and maximum. The motivation is allowed to be short, but must be precise. This obligation typically applies for all principal penalties.

In contrast to some other countries, the Belgian legal system does not have specialized environmental prosecutors nor specialized environmental courts[10]. Yet, as in the rest of Europe and the world (Pring and Pring 2009), there is an increasing demand for such specialization due to the complexity of environmental issues and legislation.

III. Hypotheses

In this section we formulate three hypotheses concerning judicial policy in the punishment of environmental crime. These are then confronted with practice using our dataset for Flanders.

As previously discussed, the criminal judge has to punish in proportion to the gravity of the facts, which primarily aims at the actual and potential harm those facts brought along (see, e.g., US Sentencing Commission 1993, 2008, UK Sentencing Advisory Panel 2000). Actual and potential harm can be measured in several ways. However, not all measures are equally objective and easy to assess. Some measures for harm are easy to grasp, such as whether efforts were made to put an end to the offense or to clean up the pollution caused and the presence of civil parties in the case seeking compensation for harm suffered, while others require a more specialized knowledge such as whether the offense violated noise regulations or not. Also tangible and measurable harm, such as a given amount of waste, can more readily be assessed than some other more hidden types of harm, such as soil and groundwater contamination. Given that Belgian criminal courts are not specialized in environmental crime but deal with a variety of cases, judges might rely more heavily on objective case elements that require little specialized knowledge. Thus, our first hypothesis is:

> ***Hypothesis 1****: When judges have little specific environmental expertise, easily verifiable factors will have more weight on the level of the imposed penalty than less tangible factors.*

Besides the level of the penalty, judges can also choose between effective and suspended penalties. Suspended penalties were introduced in Belgium to solve the practical problems related to short prison sentences (Van den Wyngaert 2009). Problems such as insufficient room in prisons and the difficulty of integrating ex-convicts in society could be mitigated by using suspended sentences instead of effective sanctions without completely compromising the

[10] There exists one exception: the Flemish Environmental Enforcement Act of 2007 created the Environmental Enforcement Court of the Flemish Region, an administrative court that controls the legality of administrative decisions imposing monetary sanctions for environmental offenses.

deterrent effect of the sanction. The use of suspended penalties soon spread from prison sentences to criminal fines. Consistent with the historical roots of suspended penalties, the general idea, supported by the country's high courts (e.g. Constitutional Court 2004/105 and 2008/157) and literature (e.g. Van den Wyngaert 2009), is that the use of suspended penalties expresses leniency: judges would *substitute* effective sanctions by suspended sanctions, which implies a negative link between the level of the effective sanction and that of the suspended sanction. However, this interpretation of the policy tool is not mandatory. Thus, logically, judges might also use effective and suspended sanctions *cumulatively* as two specific parts of an imposed sanction. This leads to a second hypothesis:

> ***Hypothesis 2****: When suspended penalties are considered as a less stringent substitute for effective penalties, the stringency of effective and suspended penalties has to be negatively correlated.*

While in principle institutional factors should not matter, the evidence suggests that in practice they do. For instance, a republican president in power in the US led to lower environmental fines (Ringquist 1998). The sanctioning procedures matters as well, e.g. fines increased with the number of defendants in White (2006). Also, Rousseau and Billiet (2005) showed that the judging decisions in the Court of Appeal of Gent were based on different characteristics than the judging behavior in the lower courts. More than lower courts, higher courts tend to preserve the core principles and goals of the law submitted to them. Throughout all different types of criminality, the hard core of the judicial work of criminal courts is common criminal law. In Belgium, common criminal law centers around 19th century ideas of personal guilt as the reason for punishment and the necessity to limit the right of the state to punish its citizens to the most essential values of society. Besides the security of the nation, the goals our common criminal law recognizes as essential are the protection of individual property and of the individual's life and physical integrity. Rousseau and Billiet (2005) found that this typical criminal law rationale surfaced in the judicial policy of the Court of Appeal of Gent regarding offenses concerning waste water permits, even if the environmental statutes involved aimed at different goals: the protection of the environment for anthropocentric reasons (public health) as well as the intrinsic value of the natural environment as such. Thus, our third hypothesis is:

> ***Hypothesis 3****: When higher courts focus on the preservation of the core principles of law, judgments from the courts of first instance regarding environmental offenses are more likely to reflect the core principles of environmental law, while judgments from the court of appeal regarding such offenses are more likely to reflect the core principles of criminal law.*

These hypotheses are confronted with reality by testing the influence of variables relating to the gravity of the facts, the harm they brought along, the protection of the property and well-being of individuals as well as the culpability of the offender on the type and level of criminal sanctions imposed by the judges.

IV. Data

In this section we first describe the dataset (4.1). Next we discuss the model that is estimated (4.2) and define the dependent (4.3) and the explanatory variables (4.4).

4.1 Description of the dataset

To document the criminal decision process in Flanders, we studied all verdicts at 7 courts of first instance and the Court of Appeal of Gent of the complete environmental case law from

2003 to 2007 (Billiet et al. 2009; Billiet et al. 2011)[11]. The different environmental statutes enforced in the dataset are listed in Appendix A. We collected data on 1034 cases, of which 912 were decided by the courts of first instance, while 122 were concluded in appeal. In total, 1617 defendants were tried in these 1034 criminal prosecutions: 1352 only in first instance and 265 both in first instance and in appeal. Some 80% of the defendants are individuals, while 20% are legal entities. Since each defendant can face several accusations, the cases include 3561 accusations, of which 3004 were dealt with in first instance and 557 in appeal.

A limited number of legislative texts dominate the case law: over two in three accusations involve violations of the Flemish Environmental Permitting Act 1985 and the Flemish Waste Act 1981[12]. The other charges that were brought to court mainly concern violations of manure and noise legislation. Judgments also contain information on the type of pollution or nuisance that took place. Waste problems (34%) and noise nuisance (14%) are most frequently cited, followed by water pollution (9%) and soil contamination (7%). Descriptions of the harm that was caused are scarce. When harm is explicitly mentioned, the decisions refer in general to damage done to public health or the health of third parties (8% combined). Environmental damage to fauna and flora is stated less often (5% in total), while damage to the property of third parties is hardly mentioned at all (less than 1%).

In first instance, judges convict three in four defendants, one in eight is acquitted, and for the remaining defendants the conviction is postponed. The appeal judges convict a similar part of the defendants (three in four), but appear to acquit more defendants (one in six). Looking at the type of sanctions, we find that the monetary fine is by far the most used criminal sanctioning instrument, since it is imposed in over 95% of the convictions. For corporations, the average fines – including the legal correction factor – amount to 14569€ in first instance and 10733€ in appeal. For individuals, the average fines are significantly lower: 3787€ in first instance and 8061€ in appeal. Also, for individuals, it is noteworthy that in 10 to 15% of the convictions a prison sentence (combined with a fine) is imposed (see table 1). The average duration of a prison sentence is 4.4 months in first instance and 6.2 months in appeal.

INSERT TABLE 1 ABOUT HERE

4.2 Description of the estimation

We investigate the main policy choices made by judges once the facts are established and the imputation issue is solved. We analyze sanctioning decisions concerning corporate entities separately from those concerning individual defendants. To correct for a possible sample selection bias, we first estimate a probit model to study the decision to acquit or convict a defendant. Next, we estimate two OLS models to analyze the level of the effective sanction and the level of the suspended sanction respectively, each including the inverse Mill's ratio based on the preceding probit results (see figure 1). To deal with the issue of identification, we use the ratio of proven accusations to the total number of accusations (PROVEN ACC) as an independent variable to explain the decision to acquit or convict a defendant, while this variable is not included to explain the sanction levels since judges cannot base their sanctioning decisions on non-proven accusations. Postponements of verdicts are included in the analysis as a zero effective and zero suspended sanction. Note that the effective sanction is

[11] The data were collected within the SBO-project *"Environmental law enforcement: A comparison of practice in the criminal and administrative tracks"* (2007-2011), see www.environmental-lawforce.be. The dataset concerns Brugge, Dendermonde, Gent, Ieper, Kortrijk, Oudenaarde and Veurne. We collected data for 7 out of the 13 judicial districts in Flanders. All appeals at these 7 courts are dealt with by the Court of Appeal of Gent, one of the five Belgian courts of appeal.

[12] Over half of the accusations dealt with 3 articles of law: the prohibition to discard waste, the environmental permit obligation and the obligation to comply with the exploitation conditions in environmental permits.

included as a random regressor in our specification of the suspended sanction. It was not possible to use an instrumental variable approach or a SUR approach in our analysis since both effective and suspended sanctions are – and legally should be – explained by identical regressors. Legally we cannot identify any reason why effective and suspended sanctions should be determined by even one different factor and thus our model reflect this reality.

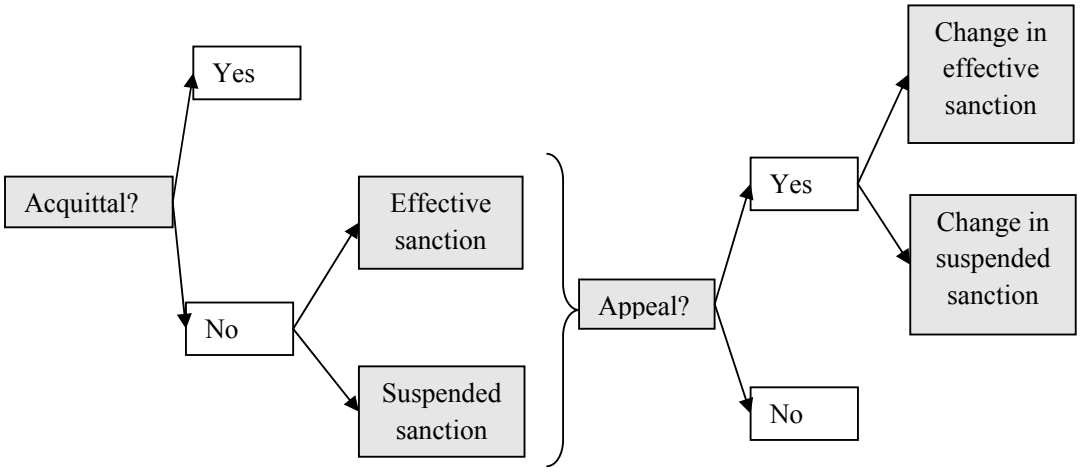

Figure 1: Model description

After the analysis of the sentences formulated in first instance, we estimate the probability that an appeal is initiated, either by one or more of the defendants, by civil parties or by the public prosecutor. Again, the probit estimation of the probability that a verdict was appealed is necessary to correct for a possible sample selection bias through the inclusion of the inverse Mill's ratio in the later estimations. To explain the probability of appeal we include the level and the square of the effective sanction, while these variables are not included in the estimation of the changes in sanction levels. We study how the appeal judges modify the verdicts imposed by lower courts and we explicitly distinguish between the changes in effective sanctions and the changes in suspended sanctions. Thus we estimate six functions in total for each group of defendants, i.e. corporate entities and individuals (see grey coloring in Figure 1).

4.3 Definition of the dependent variables

The dependent variables for the analysis of the judgments in first instance are: CONV expressing whether a judge acquits a defendant (CONV=0) or not (CONV=1), LN(EFFSAN) expressing the logarithm of the effective sanction level; and LN(SUSSAN) expressing the logarithm of the suspended sanction level. To calculate the level of the sanctions imposed by the criminal court, we look at the sum that the offender actually needs to pay, including the legal correction factor. Also, we aggregate fines and prison sentences using the conversion mechanism of jail sentences to fines implied in the Criminal Code (see section 2).

Looking at the appeal phase, we see that the public prosecutor appealed against the first instance judgment in all our appeal cases, either as primary or secondary party. Because of this, the appeal judges faced no additional constraints in modifying the initial verdict: they were free to reduce, confirm or increase the sanction imposed by the lower courts. Thus, the dependent variables for these analyses are: APPEAL indicating whether at least one of the parties appealed the initial verdict (APPEAL=1) or not; DIF-EFFSAN expressing the change (in euro) between the effective sanction in appeal and the effective sanction initially imposed in first instance; and DIF-SUSSAN expressing the change (in euro) between the suspended sanction in

appeal and the suspended sanction imposed in first instance. Since the differences in effective and suspended sanctions between first instance and appeal can be both positive and negative, depending on whether appeal judges increase or decrease the sanction, we can no longer use a logarithmic transformation and use the absolute differences in fine levels.

4.4 Definition of the explanatory variables

To investigate the judicial sanctioning policy in more detail, we analyze the impact of several explanatory variables[13] on the decision processes. To a large extent, these explanatory variables aim at measuring the impact of the seriousness of the offense on the sanctioning policy, including the gravity of the facts (i.e. actual and potential harm) as well as the culpability of the offender. Further, we include some variables concerning the type of offender and to control for differences between courts and for time trends. A summary of the definitions of dependent and explanatory variables can be found in appendix B.

4.4.1 Variables concerning the type of offender

The offender is either a corporate entity, an individual offending during his/her professional activities (PROF=1), or an individual offending during his/her private activities (PROF=0). Our dataset includes 17% corporate entities, 35% 'professional' and 48% 'private' offenders.

4.4.2 Variables concerning the seriousness of the offense

We describe the seriousness of the offense using three categories: a) variables mainly dealing with the gravity of the facts, b) variables that concern both the gravity of the facts and the culpability of the offender, and c) variables mainly concerning the culpability of the offender.

Variables concerning the gravity of the facts

The total number of accusations a defendant has to answer for, is given by the variable COUNT ACC. The variable PROVEN ACC represents the total number of proven accusations incorporated in the verdict. In our analysis only descriptive information concerning proven offenses is used to construct the variables of the sanctioning policy as only those offenses lead to punishment. In first instance (appeal), each offender was held liable on average for 2.1 (2.7) proven accusations. The variable DURATION expresses the length of the longest-lasting offense in days. The average duration of the longest-lasting offense was 505 days in first instance. When the judgment stated that one or more offenses were detected during an audit of the Flemish Environmental Inspectorate, the variable EPA equals one. This holds for 12% of the offenders in first instance. The Agency typically focuses its monitoring activities on facilities that are relatively more damaging to public health and the environment.

Further, we know whether one or more of the offenses committed by the offender classifies as a prioritized offense in line with the aforementioned Environmental Prosecution Memorandum (PRIORITY=1). Some 23% of the offenders committed at least one prioritized offense based on first instance verdicts. The judgments can also describe the damage caused by the offenses. Thus we identify offenses damaging vulnerable ecosystems, fauna or flora (NATURE=1), and offenses damaging public and/or private health (HEALTH=1). In first instance, 3.6% of the offenses were harmful to nature and 8% were harmful to health. In appeal, these percentages increase to 4.6% and 27%, respectively.

The indicator variable CIVIL PARTY represents whether one or more civil parties, seeking compensation for damage caused to themselves or their property, were involved in the case or not. In first instance, one or more civil parties were involved in the case of approximately 15%

[13] Because some variables become highly correlated when the sample sizes decrease for the estimations relating to the appeal decision, not all explanatory variables are included in each of the appeal level estimations.

of the offenders, in appeal the percentage was some 26%. As a rule, civil parties are private individuals, however occasionally they include local or regional public authorities.

Also, we know whether the offender violated the obligation to have a valid environmental permit (PERMIT=1) or the conditions stated in the environmental permit (PERMIT-COND=1). As mentioned previously, permitting is a centerpiece of environmental legislation in Flanders and, generally speaking, the European Union. Looking at the type of pollution associated with the offense, we distinguish six different types by defining the appropriate indicators: offenses related to illegal waste treatment (WASTE), groundwater or soil pollution (SOIL-GROUND), noise pollution (NOISE), odor hindrance (ODOR), air pollution (mostly relating to dust) (AIR-DUST) or surface water pollution (WATER).

Variables concerning both the gravity of the facts and the culpability of the offender

The indicator variable POSITIVE reflects whether the judgment mentioned if the offender took measures to remediate, clean up or solve the damages caused by the offenses. In first instance, some form of positive action was acknowledged for 23% of the offenders.

Variables concerning the culpability of the offender

The judgment can mention whether the offender was previously convicted (RECORD=1) or not for environmental or non-environmental offenses. In first instance some 13% of offenders had a criminal record. To measure the attitude of the offender, we use the indicator INTENT. The variable equals one if the judgment included at least one of the following terms: 'knowingly and willingly', 'unwillingness', 'purposefully', 'determined' or 'purpose'. In first instance, 11% of offenders scored positive on this variable. The judgment often explicitly mentioned if an offender acted in pursuit of gain and financially benefited from the offense. The indicator GAIN-SEEK equals one if the written motivation of the verdict used at least one of the terms 'economic benefit', 'economic gain', 'financial gain', 'pursuit of gain', 'pursuit of profit', or 'profitable'. In first instance, 17% of offenders scored positive on this.

4.4.3 Control variables

Finally, we include a number of control variables to investigate the presence of systematic differences in judicial policies in different courts and in different years. The indicator variables BRUGGE, GENT, KORTRIJK, OUDENAARDE and WESTHOEK respectively reflect whether the case was ruled on by the first instance court of Brugge, Gent, Kortrijk, Oudenaarde or in the Westhoek (i.e. Ieper and Veurne). The reference category is the court of first instance in Dendermonde. Also, the variables YEAR04, YEAR05 and YEAR06 represent whether a verdict was pronounced in respectively 2004, 2005 or 2006 (2003 is used as reference).

V. Results

We now turn to the results of the estimation and investigate the determinants of judicial decisions in Flanders. First we analyze judgments made by the courts of first instance for corporate entities and individuals respectively (5.1) and then we check if and how these judgments are subsequently changed by the appeal court for both groups of defendants (5.2).

5.1 Courts of first instance

To capture several dimensions of criminal enforcement, we study when prosecuted corporate entities and individuals are more likely to be acquitted and, if they were not acquitted, we estimated the level of the effective sanction as well as the level of a suspended sanction.

5.1.1 Probability of acquittal

Unsurprisingly, we find a highly significant negative impact of the fraction of proven accusations compared to the total number of accusations on the probability of being acquitted for corporate entities (see table 2) as well as individuals (see table 3).

Moreover, corporate entities were less likely to be acquitted when prosecuted for an offense relating to the duty to have an environmental permit or conditions imposed by such a permit and when tried in Gent. They were more likely to be acquitted when tried in the Westhoek.

Individuals had a lower probability of acquittal when offending in the course of professional activities and when prosecuted for an offense against environmental permit conditions. Their chances to be acquitted raised with the number of accusations faced and in the Westhoek.

INSERT TABLE 2 AND TABLE 3 ABOUT HERE

5.1.2 Effective sanction

Now we focus on the effective sanction, namely the sum of the effective fine and the monetary equivalent of the effective prison time, for corporate entities (table 2) and individuals (table 3).

Ceteris paribus, corporate entities received significantly higher effective sanctions when they committed prioritized offenses, in cases including civil parties, for waste offenses, offenses causing odor hindrance or water pollution, when they acted with intent or from a financial motive and when tried in Gent. They got lower effective sanctions when they undertook action to put an end to the offense and its negative effects.

The effective sanctions inflicted to individuals were more stringent when sanctioning prioritized offenses, in cases causing negative health impacts or involving civil parties, for breaches of the duty to have an environmental permit, waste offenses and offenses causing odor hindrance and when the offender had a record of previous convictions or acted from financial motives. Individuals got significantly lower effective sanctions when the offended in their professional capacity, took action to put an end to the offense and its negative effects, or were convicted in Brugge or Kortrijk or in the year 2004.

5.1.3 Suspended sanction

Next we investigate the factors determining the level of the suspended sanction. A suspended sanction was added to the effective sanction for 45% of the convicted offenders[14].

Firstly, for corporate entities (see table 2) we find that the higher the imposed effective sanction, the higher the level of the imposed suspended sanction. Thus, when the judge in first instance increases the effective sanction, he will also increase the suspended sanction. This result points to a general cumulative use of effective and suspended sanctions for corporate entities. Moreover, corporate entities received a higher suspended sanction when they took action to put an end to the offense and its negative effects, or when tried in Gent. They were given lower suspended sanctions when facing a higher number of accusations, or for offenses with a negative health impact or involving civil parties.

Regarding individuals (see table 3), we find that judges imposed a significantly higher suspended sanction on offenders acting within their professional capacity. The variables concerning the gravity of the facts have a clear impact: the suspended sanction was significantly higher for offenses that lasted a long time, prioritized offenses, offenses threatening public or private health or involving civil parties, waste offenses and offenses implying soil and groundwater contamination. Intentional offenders and offenders acting from

[14] This documents a marked evolution in sentencing practices in Flanders. Twenty years ago, Faure (1990) knew only of a handful environmental cases where criminal courts pronounced a conviction with suspended sanctions.

financial motives also received higher suspended sanctions. Individuals got lower suspended sanctions for offenses related to permit conditions, or when tried in Brugge or Oudenaarde.

5.2 Court of Appeal

After the verdict in first instance is given, all parties involved have the opportunity to start the appeal process in which case for our dataset the case is brought before the Court of Appeal of Gent. First we discuss the probability that an appeal is initiated by one or more of the involved parties and next we investigate what case characteristics induce the Court of Appeal to modify the original verdict. Remember that the public prosecutor's office is one of the parties appealing the verdict in all our cases, which implies that the appeal judge is free not only to alleviate but also to strengthen the original sanction.

5.2.1 Probability of appeal

While the probability of appeal is not part of the judicial sanctioning decision process, we still need to estimate the probability to correct for a potential sample selection bias (see table 4 for corporate entities and table 5 for individuals).

Regarding corporate entities, we find that verdicts with higher effective sanctions are less likely to be appealed and that this decrease in the probability of appeal becomes larger as sanction levels become higher. Thus it seems that the public prosecutor appeals the (too low) verdicts, rather than the convicted corporations appealing (too high) sanctions. Also, an appeal is significantly more likely for cases that involve a threat to public or private health.

Regarding individuals, the probability of an appeal is significantly higher for cases where the individual offender is acting in his professional capacity, for cases where the offenses threaten the public or private health, cases including civil parties, cases dealing with permit obligations, soil or groundwater pollution and for cases that were tried in the first instance court of Gent. The probability of an appeal significantly decreases for cases concerning prioritized offenses and cases where the offender took measures to put an end to the offense and its negative effects. Also there seems to be a decreasing probability of appeal over time[15].

INSERT TABLE 4 AND TABLE 5 ABOUT HERE

5.2.2 Changes in effective and suspended sanctions

We now analyze the changes that the appeal court made to the sanctions imposed by the courts of first instance for corporate entities (see table 4) and for individuals (see table 5).

Several of the judicial policy lines followed by lower courts are implicitly confirmed by the appeal judge, since these policy lines are not modified in appeal. Specifically for corporate entities these include: 1) the general cumulative use of suspended and effective sanctions, 2) the higher effective sanctions in cases that include civil parties, for intentional offenders, for gain seeking defendants, and for cases tried by the lower court of Gent; 3) the lower effective sanctions imposed on defendants who took action to end the offense and its negative effects; 4) the higher suspended sanctions imposed on defendants who made efforts to end the offense and reduce its negative effects; and 5) the lower suspended sanctions for offenses with a negative health impact. Further for individuals these include: 1) the higher effective sanctions for prioritized offenses, offenses with a negative health impact, breaches of the environmental permitting obligation, waste and odor offenses, and gain seeking defendants; 2) the lower effective sanctions imposed on professionals and on defendants who took action to end the offense and to reduce its effects; and 3) the higher suspended sanctions imposed on

[15] This observation might be due to a bias in our data collection since the appeal procedure of the later cases might not have been finished in 2007 and would then not be included in our dataset.

professionals, offenses with a negative health impact, waste offenses, offenses related to soil and ground water pollution and intentional offenders.

Several other judicial policy lines followed by the lower courts are modified – strengthened or weakened – by the appeal judge. For corporate entities we find that the effective sanction increased for prioritized offenses, for waste offenses, noise hindrance and offenses related to soil and groundwater pollution. The effective sanction for corporate entities reduced for offenses that caused harm to vulnerable habitats, fauna and flora, and for water pollution. Also, the suspended sanction for corporate entities increased for prioritized offenses, noise hindrance, air pollution, water pollution, and gain seeking offenders. It decreased for offenses detected by the Flemish Environmental Inspection Agency, cases including civil parties, waste offenses, offenders with a criminal record, and for cases tried by the lower court of Gent.

For individuals we find that the changes in suspended sanction are negatively correlated with the changes in effective sanction made by appeal judges. This points to a general use of suspended and effective sanctions as substitutes, contrary to the results found in first instance where judges seem to use both types of sanctions independent of each other. Further, we observe that the effective sanction is increased by the appeal judge for violations of the permitting obligations, noise pollution, offenders with a criminal record and intentional offenders. Effective sanctions are reduced for cases including civil parties. Also, the suspended sanction for individuals is increased in appeal for offenses that caused harm to vulnerable habitats, fauna and flora and for gain seeking offenders. It is decreased for offenses detected by the Flemish Environmental Inspection Agency, for prioritized offences, cases including civil parties, offenses against permit conditions and for offenders with a criminal record.

VI. Discussion

The series of estimations described in the previous sections provide a unique picture of judicial policy lines developed by criminal courts in Flanders concerning the punishment of environmental offenses. The policy lines we were able to positively identify are not necessarily the result of deliberate policy choices by the judges, they might also be the result of unintentional – but real – sanctioning strategies. The estimated policy trends allow us to comment on the validity of the hypotheses formulated in section 3.

6.1 First hypothesis

The first hypothesis states that the effect on the imposed penalty of easily verifiable characteristics related to the gravity of the facts is expected to dominate more subjective or less tangible case characteristics. We find evidence to support this hypothesis. First instance courts impose higher effective sanctions to corporate entities committing offenses involving civil parties and for offenses of which the environmental impact is directly observable, such as those related to waste and surface water pollution. For individuals the same holds regarding cases involving civil parties and for waste offenses. Also, corporations as well as individuals got lower effective sanctions when they took action to end the illegal situation and limit its impact. Moreover, the appeal court confirms or even strengthens most of these policy lines. The lack of environmental specialization in Flemish courts might contribute to these results. Thus, our findings possibly connect with an internationally debated policy question, namely the need for specialized environmental courts (e.g. Pring and Pring 2009).

6.2 Second hypothesis

Our second hypothesis states that, as suspended penalties are considered as a less stringent substitute for effective penalties, the stringency of effective and suspended penalties has to be negatively correlated. Surprisingly, our results contradict this hypothesis. We find that

suspended sanctions are commonly used in two ways: to soften the stringency of the punishment through a substitutive use with effective penalties and to increase the stringency of punishment through a cumulative use with effective penalties. We find this insight for the first instance courts as well as the appeal court. Our results display an array of policy strategies in the combination of a substitutive and a cumulative use of effective and suspended sanctions.

For corporate entities, we find a general positive correlation between effective and suspended penalties in the judgments of the courts of first instance that is confirmed in appeal, where it is even strengthened for prioritized offenses and offenses creating noise hindrance, air pollution or dust hindrance. This points to a common cumulative use of effective and suspended penalties for this group of offenders. This bottom line in the sanctioning policy is nuanced by a substitutive use for specific offenses and offenders. Courts of first instance use suspended penalties as a means of leniency for offenses harming public or private health, cases involving civil parties, offenders that took action to limit the resulting damage and offenders acting from gain seeking motives. The Court of Appeal of Gent confirms this substitutive use for offenses with a negative health impact and for offenders that took positive action. Additionally, the appeal judges use effective and suspended sanctions as substitutes for offenses relating to waste and to surface water pollution. For corporations offending from gain seeking motives, they modify the substitutive use to a cumulative use of both sanctions.

For individuals, we find at first instance level neither a general cumulative nor a general substitutive use of effective and suspended sanctions. However, we do find specific instances of each type of use of both sanctions. At the appeal level, interestingly, there appears to be a general negative correlation between the change in effective and suspended sanctions pointing at a common substitutive use of both sanctions by the appeal judges. The common use of suspended sanctions as a means of leniency by the appeal court is nuanced by results that display a cumulative use of both sanctions. This striking difference in sanctioning policy for corporations and individuals fits the historical roots of the suspended sanction, namely its origin as a substitute for effective prison sentences to avoid an overcrowding of prisons and reintegration problems with former convicts. This historic rationale does not apply for corporations and is thus more easy to disregard for such offenders than for individuals. While at first instance level, we do not find a general trend of a cumulative use of effective and suspended penalties, we do observe that the first instance judges quite commonly use both types of sanctions cumulatively, namely for long lasting offenses, prioritized offenses, offenses with negative health impacts, cases involving civil parties, waste offenses, offenses causing soil and groundwater pollution, intentional offenders and gain seeking offenders. On the other hand, they use effective and suspended sanctions as substitutes for professional defendants and for offenses breaching environmental permit conditions. The cumulative use is confirmed or strengthened by the appeal judges in most of the aforementioned instances, the cases involving prioritized offences and civil parties excepted. Further the appeal court introduces a cumulative use of both types of sanctions for offenses harming ecosystems, fauna or flora. Moreover, the appeal court confirms the use of effective and suspended sanctions as substitutes for professional offenders and strengthens such use for offenses breaching environmental permit conditions. Also, it opts for such sanctioning policy for offenses detected by the Environmental Inspection Agency, for prioritized offences, hereby reversing a cumulative use at first instance level, and for repeat offenders.

6.3 Third hypothesis

The third hypothesis states that judgments from the courts of first instance are more likely to reflect the core goals of environmental law, namely the protection of the environment for anthropocentric reasons (public health), the intrinsic value of the natural environment as such, or both these motives. Judgments from the court of appeal, on the other hand, would be more

likely to reflect the core goals and principles of criminal law, namely the protection of the individual's life and physical integrity, the protection of individual property and personal guilt as justification for punishment.

Looking at the measures for the gravity of the facts, we find that the environmental case law created by the courts of first instance for both corporate entities and individuals reflects the dominant trends in environmental policy: 1) the gravity of the facts in terms of harm for the individual and the environment weighs heavily on the sanctioning decision 2) prioritized offenses such as the environmental permit obligation are strictly convicted, and 3) positive actions to end an illegal situation and to limit the associated harm are highly encouraged. These policy lines are all the more striking because achieved by a dominantly cumulative use of effective and suspended penalties that breaks with the historical rationale of both sanctions. Looking at the measures for guilt, gain-seeking reasons for offending are the most rigorously deterred, reflecting an instrumental approach of guilt. Thus, we find that the verdicts of the courts of first instance reflect the core goals of environmental policy and law, namely protection of the environment for the sake of individuals and of nature as such, more closely than those of criminal law.

Looking at the sanctioning decisions of the appeal court, we find a different focus since the basic criteria related to the seriousness of the offense are interpreted differently. Regarding the gravity of the facts, there is evidence of a more pronounced anthropocentric emphasis than in lower courts. Waste problems, which often are physically offending for the local population, and classical nuisance problems such as noise and dust (large part of air pollution cases) are punished more severely, while damage to nature leads to lower effective sanctions. On the other hand, also prioritized offenses and breaches of permit conditions are punished more severely than in first instance. Thus, the judicial policy of the appeal judge shows recognition of the core values of environmental law in its protection of individuals against damage and nuisance. However, this policy also relates strongly to one of the core values of classic criminal law, namely the protection of the physical integrity of the citizen. The environmental case law produced by the court of appeal can be situated at the exact point where environmental and criminal law have synergies. Turning to the measures of culpability, these findings are confirmed. Previous convictions and intentional offending enhance the penalties in appeal as compared to first instance on the one hand, thus demonstrating that appeal judges attach even more weight to the classic standards for the defendant's specific guilt in the case under consideration than the judges in first instance. Yet, on the other hand, the gain seeking motive is punished even more severely in appeal than in first instance, which indicates appeal judges consider this more instrumental measure for guilt too.

For the sum of these reasons, our analysis paints a picture of judges of first instance as criminal judges enforcing environmental law. However, at the appeal level, classic criminal law indeed is more present, even if, interestingly, it is affirmed in a way that achieves a synthesis of environmental and classic criminal law goals. Thus, we can confirm of our third hypothesis.

6.4 Some additional findings

The attention paid to actual as well as potential harm is completely in line with law and economic insights on the determinants of the optimal penalty (e.g. Polinsky and Shavell 1992) and with principles underpinning sound environmental policy worldwide, such as the principle of preventive action, endorsed e.g. by Article 192(2) of the Treaty on the Functioning of the European Union. On the other hand, the anthropocentric focus combined with the disregard of the intrinsic value of the natural environment reveals preferences in punishment practices that are not in line with the policy aims of the enforced environmental legislation.

Next, the mild treatment of individuals who committed offenses within their professional capacity is noteworthy, especially when confronted with the observation that they are treated milder than individuals committing similar offenses in their private capacity. This might be explained by the fact that individuals offending in their professional capacity are more likely to be simultaneously prosecuted with a corporate entity (49% versus 13%), suggesting a trade-off in punishing more than one offender simultaneously.

Also, our data do not reveal temporal trends, while we do observe marked differences in sanctioning decisions over judicial districts. Offenders judged in Brugge or Kortrijk are clearly better off, while those judged in Gent receive significantly higher sanctions. Even though the relatively stricter verdicts of the court in Gent are appealed to more often, the Court of Appeal of Gent seems to confirm these stricter sanctions in general.

VII. Conclusion

Judicial decision making is often treated as a black box and empirical evidence on criminal environmental sanctioning decisions from both lower courts and appeal courts is very scarce. Our analysis of environmental case law in Flanders paints an intriguing and insightful picture of judicial policy lines. The sanctioning policy of judges is varied as well as consistent. Judges carefully balance effective and suspended penalties: mostly using them cumulatively, but in specific cases opting to use them as substitutes. Overall, both lower courts and the appeal court balance environmental and criminal law and aim at protecting individuals and their possessions as well as the environment. The appeal court, however, seems to be influenced more by classic criminal law as shown, for instance, by its treatment of culpability.

Also, the results provide evidence of several predictions from existing (law and) economic literature on the punishment of offenses (Polinsky and Shavell, 1994; Garoupa, 2001; Cohen, 1992). Penalties are increasing with the level of harm caused, be it that some types of harm matter more than others. Repeat offenders and intentional offenders receive higher penalties.

However, the results also provide insights that are not generally incorporated in the literature, specifically regarding the judicial use of suspended and effective penalties as instruments to imposed milder as well as stricter punishment. Suspended penalties are a sanctioning option within the criminal law of many countries. The use of suspended penalties is especially intriguing and deserves more attention in future work. Suspended penalties are generally considered as a sign of leniency when they replace effective penalties, however they still deter future offenses. Interestingly, suspended penalties can also be used to increase the stringency of the imposed penalty through a cumulative use of both suspended and effective penalties. The role of suspended sanctions as either carrot or stick certainly values additional research.

To conclude, the current study provides a unique view of punishment policy by criminal judges. The generality of the results is corroborated by the evidence we provide on generally used assumptions and models. However, it would be very interesting to see a similar analysis of environmental case law in other jurisdictions to distinguish between general and specific results. Also, the analysis points at an internationally discussed policy question, namely the need for specialized environmental courts. It would be interesting to investigate which findings result from the lack of specialization of the Flemish courts and how judicial policy might change if specialization occurred. Further, the strong focus put by Flemish criminal judges on remedial action by defendants when deciding on punishment, contrasted with the scarce use of remedial sanctions, intrigues as an element in the study of restorative justice. Could it, for instance, be presumed that restorative environmental justice by means of remedial orders somehow does not fit in the criminal sanctioning system? Finally, it would be interesting to look at the interaction between the public prosecutor and the criminal judge. At least two

dimensions seem relevant: firstly, the relation between the type and level of the sanction requested by the public prosecutor and the type and level of the sanction imposed by the criminal judges and secondly, the impact of actual judicial policy relating to environmental sanctioning on the prosecution policy.

Appendix A: Legislation included in the dataset

Our study focuses on environmental pollution legislation. The selection of environmental case law in the period 2003 – 2007 includes all cases where at least one accusation concerned a breach of one of the following parliament acts or associated implementing government orders: Air Pollution Act 1964, Pesticides Act 1969, Surface Water Act 1971, Noise Pollution Act 1973, Flemish Waste Act 1981, Flemish Groundwater Act 1984, Flemish Environmental Permitting Act 1985 and Flemish Environmental Policy Act 1995. Breaches of exploitation permits based on the Labor Safety Order 1946 (Title 1. *Regime of installations categorized as dangerous, unhealthy or hazardous.* B.R. 11 February 1946 on the General Code of Labor Protection) are also included since this legislation precedes the current environmental permit based on the Flemish Environmental Permitting Act 1985; in 2003-2007 a large number of firms in Flanders still worked with such Labor Safety permits. The study also includes legislation that was recently cancelled, namely the Flemish Manure Act 1991 and Flemish Soil Cleanup Act 1995. Those acts were replaced by, respectively, the Flemish Manure Act 2006 and the Flemish Soil Act 2006, whom both are strongly inspired by the older laws they replace.

APPENDIX B: Definition of dependent and explanatory variables

VARIABLE NAME	DEFINITION
Dependent variables	
CONV	=1 if judge does not acquit defendant; =0 else
LN(EFFSAN)	= logarithm of the level of the effective sanction
LN(SUSSAN)	= logarithm of the level of the suspended sanction
APPEAL	=1 if at least one party appealed the initial verdict; =0 else
DIF-EFFSAN	= difference between effective sanction in appeal and effective sanction in first instance (in euro)
DIF-SUSSAN	= difference between suspended sanction in appeal and suspended sanction in first instance (in euro)
Explanatory variables	
Type of offender	
PROF	=1 if offender is individual offending during professional activities; =0 else
Gravity of the facts	
COUNT ACC	= count of total number of accusations
PROVEN ACC	= fraction of proven accusations compared to total accusations
DURATION	= length of longest-lasting offense expressed in days
EPA	=1 if offense detected by environmental inspection agency; =0 else
PRIORITY	=1 if offense classified as a prioritized offense; =0 else
NATURE	=1 if offense damaged ecosystem, fauna or flora; =0 else
HEALTH	=1 if offense damaged public and/or private health; =0 else
CIVIL PARTY	=1 if civil party (parties) are involved in the case; =0 else
PERMIT	=1 if offense involved a breach of obligation to have a valid environmental permit; =0 else
PERMIT-COND	=1 if offense involved a breach of conditions of environmental permit; =0 else
WASTE	=1 if offense related to illegal waste treatment or disposal; =0 else
SOIL-GROUND	=1 if offense related to soil or groundwater contamination; =0 else
NOISE	=1 if offense related to noise pollution; =0 else
ODOR	=1 if offense related to odor nuisance; =0 else
AIR-DUST	=1 if offense related to air pollution or dust nuisance; =0 else
WATER	=1 if offense related to water pollution; =0 else
Gravity of the facts and culpability of the offender	
POSITIVE	=1 if offender took positive action to limit damage; =0 else
Culpability of the offender	
RECORD	=1 if offender was previously criminally convicted; =0 else
INTENT	=1 if offender was mentioned to have offended intentionally; =0 else
GAIN-SEEK	=1 if offender was mentioned to have offended in pursuit of gain; =0 else
Control variables	
BRUGGE	=1 if verdict of court of first instance of Brugge; =0 else
GENT	=1 if verdict of court of first instance of Gent; =0 else
KORTRIJK	=1 if verdict of court of first instance of Kortrijk; =0 else
OUDENAARDE	=1 if verdict of court of first instance of Oudenaarde; =0 else
WESTHOEK	=1 if verdict of court of first instance of Ieper or Veurne; =0 else
YEAR04	=1 if verdict was pronounced in 2004; =0 else
YEAR05	=1 if verdict was pronounced in 2005; =0 else
YEAR06	=1 if verdict was pronounced in 2006; =0 else
LAMBDA	= inverse Mill's ratio

References

Billiet, C.M., T. Blondiau and S. Rousseau. 2011. Milieucriminaliteit in het beleid van de strafrechter: bestraffen tussen Haus en Brundtland. *Rechtskundig Weekblad* 74(22): 898-93.

Billiet, C.M. and N. Broeckhoven. 2011. De milieustrafrechter en toekomstbeveiliging: praktijkprofiel van het exploitatieverbod. *Nullum Crimen* 6 (2-3): 101-126.

Billiet, C.M. and S. Rousseau. 2003. De hoogte van strafrechtelijke boetes. Een rechtseconomische analyse van milieurechtspraak (1990-2000) van het Hof van Beroep te Gent. *Tijdschrift voor Milieurecht* 12(2):120-134.

Billiet, C.M. and S. Rousseau. 2012. Milieucriminaliteit: verbeurdverklaring van wederrechtelijk verworven vermogensvoordelen in cijfers. *Tijdschrift voor Strafrecht* 13 (4): 195-205.

Billiet, C.M. and S. Rousseau. Forthcoming. How real is the threat of imprisonment for environmental crime? *European Journal of Law and Economics,* doi:10.1007/s10657-011-9267-2

Billiet, C.M., S. Rousseau, A. Balcaen, R. Meeus, K. Styns, G. De Meyer, T. Vander Beken, and L. Lavrysen. 2009. Milieurechtshandhaving: een databestand voor onderzoek naar de penale en bestuurlijke sanctioneringspraktijk. *Tijdschrift voor Milieurecht* 18 (2):128-150.

Blondiau, T. and S. Rousseau. 2010. The impact of the judicial objective function on the enforcement of environmental standards. *Journal of Regulatory Economics* 37(2):196-214.

Cohen, M.A. 1992. Environmental crime and punishment: Legal/economic theory and empirical evidence on enforcement of federal environmental statutes. *Journal of Criminal Law and Criminology* 82(3):1054-1108.

Commission of the European Communities. 2004. *Green paper on the approximation, mutual recognition and enforcement of criminal sanctions in the European Union*. Brussels, COM(2004)334 final, 94 p.

Earnhart, D. 1997. Enforcement of environmental protection laws under communism and democracy. *Journal of Law and Economics* 40: 377-402

Faure, M. 1990. *Preadvies milieustrafrecht*. Antwerpen – Apeldoorn: Maklu Uitgevers.

Fon, V. and F. Parisi. 2006. Judicial precedents in civil law systems: A dynamic analysis. *International Review of Law & Economics* 26:519-535.

Garoupa, N. 2001. Optimal magnitude and probability of fines. *European Economic Review* 45:1765-1771.

Gray, W., and J. Shimshack. 2011. The effectiveness of environmental monitoring and enforcement: A review of the empirical evidence. *Review of Environmental Economics and Policy* 5(1):3-24.

Guthrie, C., J.J. Rachlinski, and A.J. Wistrich. 2001. Inside the judicial mind. *Cornell Law Review* 86(4):777-830.

Kagan, R., N. Gunningham, and D. Thornton. 2003. Explaining corporate environmental performance: How does regulation matter? *Law & Society Review* 37:51-89.

Kleit, A.N., M.A. Pierce and R.C. Hill. 1998. Environmental protection, agency motivations and rent extraction: the regulation of water pollution in Louisiana. *Journal of Regulatory Economics* 13:121-137

Levy, G. 2003. Careerist judges and the appeals process. *RAND Journal of Economics* 36(2):275-297.

Marks, B.A. 1988. A model of judicial influence on congressional policy-making: *Grove City College v. Bell. Working Paper in Political Science P-88-7*, Hoover Institution.

Monsieurs, A., J. Rozie and M. Vanderhallen. 2009. Consistente bestraffing: utopie of realiteit? *Rechtskundig weekblad* 10:90-103.

Mookherjee, D. and I.P.L. Png. 1994. Marginal Deterrence in Enforcement of Law. *The Journal of Political Economy* 102(5):1039-1066.

Oljaca, N., A.G. Keeler and J. Dorfman. 1998. Penalty functions for environmental violations: Evidence from water quality enforcement. *Journal of Regulatory Economics* 14:255-264

Polinsky, A.M. and S. Shavell. 1979. The optimal tradeoff between the probability and magnitude of fines. *American Economic Review* 69(5):880-891.

Polinsky, A.M. and S. Shavell. 1992. Enforcement costs and the optimal magnitude and probability of fines. *The Journal of Law and Economics* 35:133-148.

Pring, G. and C. Pring. 2009. *Greening justice: Creating and Improving Environmental Courts and Tribunals*, World Resources Institute – TAI.

Rasmusen, E. 1994. Judicial legitimacy as a repeated game. *Journal of Law, Economics, and Organization* 10:68-83.

Ringquist, E.J. 1998. A question of justice: Equity in environmental litigation, 1974-1991. *Journal of Politics* 60(4):1148-1165.

Rousseau, S. 2007. Timing of environmental inspections: Survival of the compliant. *Journal of Regulatory Economics* 32(1):17-36

Rousseau, S. 2009. Empirical Analysis of Sanctions for Environmental Offenses. *International Review of Environmental and Resource Economics* 3(3):161-194.

Rousseau, S. and C.M. Billiet. 2005. How to determine fining behaviour in court? Game theoretical and empirical analysis. In *Selecting environmental policy instruments in the presence of incomplete compliance* edited by S.Rousseau, FETEW, KU Leuven.

Rousseau, S. and K. Telle. 2010. On the existence of the optimal fine for environmental crime. *International Review of Law and Economics* 30(4):329-337

Shavell, S. 1992. A note on marginal deterrence. *International Review of Law and Economics* 12:133-149

Spiller, P.T. and R. Gely. 2007. Strategic judicial decision making" *NBER Working Paper Series*, N13321.

Toffel, M.W. and J.L. Short. 2011. Coming clean and cleaning up: Does voluntary self-reportin indicate effective self-policing? *Journal of Law and Economics* 54(3):609-649

UK Sentencing Advisory Panel 2000. *Sentencing guidelines: Environmental offenses*. www.sentencing-guidelines.gov.uk/advice/index.html#enviro

US Sentencing Commission 1993. *Report of the advisory group on environmental sanctions*. www.ussc.gov/publicat/ENVIRON.PDF

US Sentencing Commission 2008. *Federal Sentencing Guidelines Manual.* Chapter 2 Q.

Van den Wyngaert, C. 2009. *Strafrecht, strafprocesrecht & internationaal strafrecht in hoofdlijnen*. Antwerpen – Apeldoorn: Maklu.

Vermeulen, G., W. De Bondt and C. Ryckman. 2012. *Liability of legal persons for offences in the EU*. Antwerpen – Apeldoorn: Maklu.

White, M.J. 2006. Asbestos litigation: Procedural innovations and forum shopping. *Journal of Legal Studies* 35: 365-398

Table 1 : Main criminal sanctions (individuals)

Main criminal sanctions	*First instance*		*Appeal*	
	Number of convicts	% of convicts	Number of convicts	% of convicts
Only fine	895	87.49 %	117	82.40 %
Only prison sentence	1	0.10 %	3	2.11 %
Prison sentence *and* fine	102	9.97 %	18	12.68 %
Community service	17	1.66 %	1	0.70 %
Other	8	0.78 %	3	2.11 %
Total number of convictions	1023		142	

Table 2: Estimation of criminal sanction in first instance for corporate entities

CORPORATE ENTITIES	*CONV*			LN(EFFSAN)			LN(PROBSAN)		
	Coeff	*st.dev.*	*P-value*	*Coeff*	*st.dev.*	*P-value*	*Coeff*	*st.dev.*	*P-value*
constant	**-1.0643**	**0.3604**	**0.0030**	5.7380	0.7084	0.0000	-0.5690	1.0244	0.5790
ln(effsan)							**0.4980**	**0.0865**	**0.0000**
proven acc	**2.3649**	**0.3657**	**0.0000**						
count acc	-0.0135	0.0785	0.8630	-0.0894	0.0908	0.3240	**-0.2468**	**0.1115**	**0.0270**
duration	0.0001	0.0002	0.6280	0.0001	0.0003	0.6180	0.0002	0.0003	0.5430
EPA				-0.0191	0.4522	0.9660	-0.1816	0.5783	0.7530
priority	-0.2100	0.3379	0.5340	**1.3443**	**0.4805**	**0.0050**	0.1671	0.6039	0.7820
nature				-0.6645	1.0998	0.5460	0.7650	1.4332	0.5930
health				-0.9145	0.7495	0.2220	**-2.3568**	**0.9366**	**0.0120**
civil party	0.4676	0.5020	0.3520	**0.8938**	**0.5065**	**0.0780**	**-1.4127**	**0.6209**	**0.0230**
permit	**0.5938**	**0.3424**	**0.0830**	0.2803	0.4669	0.5480	-0.0880	0.5776	0.8790
permit-cond	**0.6377**	**0.3298**	**0.0530**	-0.0881	0.4601	0.8480	0.0376	0.5711	0.9470
waste				**1.0288**	**0.5164**	**0.0460**	0.8411	0.6620	0.2040
soil-ground				0.9778	0.6162	0.1130	1.1603	0.8019	0.1480
noise				**1.0168**	**0.5383**	**0.0590**	0.5452	0.6917	0.4310
odor				**2.0242**	**0.7617**	**0.0080**	0.4682	0.9881	0.6360
air-dust				-2.3580	1.6953	0.1640	-0.5574	2.1115	0.7920
water				**1.2927**	**0.6210**	**0.0370**	-0.3483	0.8090	0.6670
positive record				**-1.5236**	**0.4383**	**0.0010**	**1.6088**	**0.5768**	**0.0050**
				0.7870	0.9560	0.4100	1.3688	1.2528	0.2750
intent				**1.0174**	**0.5298**	**0.0550**	0.3632	0.6753	0.5910
gain-seek				**0.9287**	**0.4789**	**0.0520**	**-1.0788**	**0.6167**	**0.0800**
Brugge	0.6344	0.6492	0.3280	-0.9879	1.0051	0.3260	-1.4525	1.2524	0.2460
Gent	**0.7407**	**0.4133**	**0.0730**	**1.2013**	**0.5742**	**0.0360**	**1.6195**	**0.7217**	**0.0250**
Kortrijk	0.1564	0.5644	0.7820	0.4291	0.8737	0.6230	1.0275	1.0884	0.3450
Oudenaarde				0.0578	0.8361	0.9450	-1.3877	1.0952	0.2050
Westhoek	**-0.5759**	**0.3449**	**0.0950**	-0.6822	0.7343	0.3530	0.0931	0.9255	0.9200
year04				0.1399	0.5849	0.8110	0.1548	0.7495	0.8360
year05				0.3733	0.5606	0.5050	0.2964	0.7227	0.6820
year06				-0.3673	0.5044	0.4660	-0.1336	0.6446	0.8360
lambda				**-2.6384**	**0.8401**	**0.0020**	-0.9419	1.2342	0.4450
# obs	253			220			220		
Wald chi2				101.36			90.73		
Prob > chi2				0			0		

Table 3: Estimation of criminal sanction in first instance for individuals

INDIVIDUALS	*CONV*			LN(EFFSAN)			LN(PROBSAN)		
	Coeff	*st.dev.*	*P-value*	*Coeff*	*st.dev.*	*P-value*	*Coeff*	*st.dev.*	*P-value*
constant	**-0.7446**	**0.1628**	**0.0000**	**4.7979**	**0.3333**	**0.0000**	**1.8441**	**0.4651**	**0.0000**
ln(effsan)							-0.0420	0.0383	0.2730
professional	**0.2452**	**0.1447**	**0.0900**	**-0.8421**	**0.2168**	**0.0000**	**0.6855**	**0.2800**	**0.0140**
proven acc	**2.6665**	**0.1499**	**0.0000**						
count acc	**-0.0752**	**0.0343**	**0.0290**	0.0079	0.0603	0.8950	0.0663	0.0773	0.3910
duration	-0.0001	0.0001	0.4960	0.0001	0.0001	0.3170	**0.0005**	**0.0002**	**0.0030**
EPA				0.1918	0.3169	0.5450	0.0772	0.4064	0.8490
priority	0.0374	0.1863	0.8410	**0.7532**	**0.2709**	**0.0050**	**0.8382**	**0.3488**	**0.0160**
nature				-0.3501	0.4743	0.4610	-0.3882	0.6081	0.5230
health				**0.8181**	**0.4411**	**0.0640**	**1.4297**	**0.5664**	**0.0120**
civil party	0.4826	0.2968	0.1040	**0.5236**	**0.2661**	**0.0490**	**0.5733**	**0.3421**	**0.0940**
permit	0.0175	0.1841	0.9240	**0.7401**	**0.2620**	**0.0050**	0.1674	0.3374	0.6200
permit-cond	**0.4306**	**0.2192**	**0.0500**	-0.0272	0.2639	0.9180	**-0.8428**	**0.3386**	**0.0130**
waste				**0.8657**	**0.2670**	**0.0010**	**0.6485**	**0.3439**	**0.0590**
soil-ground				-0.4566	0.3457	0.1870	**1.1052**	**0.4434**	**0.0130**
noise				0.4414	0.3396	0.1940	0.3680	0.4358	0.3980
odor				**0.9598**	**0.5143**	**0.0620**	0.8283	0.6603	0.2100
air-dust				0.4692	0.5589	0.4010	0.3213	0.7165	0.6540
water				0.1133	0.3312	0.7320	0.4221	0.4246	0.3200
positive				**-1.4256**	**0.2380**	**0.0000**	0.3610	0.3099	0.2440
record				**1.4687**	**0.2514**	**0.0000**	-0.0689	0.3271	0.8330
intent				-0.3016	0.3026	0.3190	**0.8536**	**0.3881**	**0.0280**
gain-seek				**1.9568**	**0.2805**	**0.0000**	**0.7969**	**0.3674**	**0.0300**
Brugge	-0.0423	0.2311	0.8550	**-1.2688**	**0.3429**	**0.0000**	**-1.2740**	**0.4426**	**0.0040**
Gent	0.0228	0.1608	0.8870	0.0397	0.2265	0.8610	-0.2209	0.2906	0.4470
Kortrijk	0.3011	0.3138	0.3370	**-0.8844**	**0.3619**	**0.0150**	-0.5303	0.4656	0.2550
Oudenaarde				-0.0515	0.3777	0.8910	**-0.9175**	**0.4843**	**0.0580**
Westhoek	**-0.3858**	**0.1963**	**0.0490**	0.0296	0.3425	0.9310	-0.5925	0.4393	0.1770
year04				**-0.4655**	**0.2643**	**0.0780**	-0.0827	0.3393	0.8070
year05				0.2012	0.2527	0.4260	-0.0169	0.3241	0.9580
year06				-0.2799	0.2526	0.2680	-0.4527	0.3240	0.1620
Lambda				-0.2611	0.4422	0.5550	-0.6109	0.5652	0.2800
# obs	1266			1123			1123		
Wald chi2				430.04			157.93		
Prob > chi2				0			0		

Table 4: Estimation of change in criminal sanction in appeal for corporate entities

CORPORATE ENTITIES	APPEAL			*DIF-EFFSAN*			*DIF-SUSSAN*		
	Coeff	*st.dev.*	*p-value*	*Coeff*	*st.dev.*	*p-value*	*Coeff*	*st.dev.*	*p-value*
constant	**-0.8551**	**0.3890**	**0.0280**	**-34582**	**18777**	**0.0660**	**5401**	**2779**	**0.0520**
ln(effsan)	**-0.3464**	**0.1555**	**0.0260**						
ln(effsan)²	**0.0433**	**0.0169**	**0.0100**						
dif-effsan							-0.0436	0.0272	0.1090
EPA				21623	16608	0.1930	**-6343**	**2386**	**0.0080**
priority	-0.5974	0.5377	0.2670	**22846**	**13628**	**0.0940**	**5792**	**2010**	**0.0040**
nature	-1.6927	2.3587	0.4730	**-298501**	**13786**	**0.0000**	-11829	8357	0.1570
health	**2.1764**	**0.7349**	**0.0030**	-15334	15227	0.3140	3076	2203	0.1630
civil party	0.2061	0.5329	0.6990	-12243	8848	0.1660	**-7921**	**1311**	**0.0000**
permit	-0.1256	0.3693	0.7340	-21048	14286	0.1410	-1398	2119	0.5100
permit-cond	-0.1300	0.3375	0.7000	-2244	5944	0.7060	-1194	860	0.1650
waste				**43327**	**14703**	**0.0030**	**-4793**	**2273**	**0.0350**
soil-ground				**32790**	**15200**	**0.0310**	-2567	2239	0.2520
noise				**42608**	**12847**	**0.0010**	**4498**	**2097**	**0.0320**
air-dust				24999	17956	0.1640	**8578**	**2672**	**0.0010**
water				**-38309**	**14473**	**0.0080**	**9050**	**2298**	**0.0000**
positive	-0.3806	0.4373	0.3840	1591	13056	0.9030	276	1840	0.8810
record	0.5398	1.0201	0.5970	30201	19722	0.1260	**-5453**	**2929**	**0.0630**
intent	-0.1475	0.4139	0.7220	-13352	10487	0.2030	-398	1501	0.7910
gain-seek	0.3238	0.4255	0.4470	-2146	10305	0.8350	**3505**	**1454**	**0.0160**
Gent	0.1556	0.4706	0.7410	-4418	9572	0.6440	**-14152**	**1373**	**0.0000**
Oudenaarde	1.0629	0.7982	0.1830						
Westhoek	0.3260	0.4467	0.4660						
year04	-0.3143	0.3802	0.4080						
year05	**-2.4216**	**0.6956**	**0.0000**						
year06	**-2.5596**	**0.7415**	**0.0010**						
lambda				1511	10302	0.8830	1071	1447	0.4590
# obs	252			28			28		
Wald chi2	81.13			727.48			242.81		
Prob > chi2	0			0			0		

Table 5: Estimation of change in criminal sanction in appeal for individuals

INDIVIDUALS	APPEAL			*DIF-EFFSAN*			*DIF-SUSSAN*		
	Coeff	*st.dev.*	*p-value*	*Coeff*	*st.dev.*	*p-value*	*Coeff*	*st.dev.*	*p-value*
constant	**-2.3353**	**0.2749**	**0.0000**	-101750	68894	0.1400	19501	69549	0.7790
ln(effsan)	0.0580	0.0557	0.2980						
ln(effsan)²	0.0030	0.0055	0.5810						
dif-effsan							**-0.2015**	**0.1137**	**0.0760**
professional	**0.2996**	**0.1620**	**0.0640**	-12559	20836	0.5470	16241	20587	0.4300
EPA				-11471	24060	0.6340	**-88885**	**24235**	**0.0000**
priority	**-0.4537**	**0.2382**	**0.0570**	-34820	35572	0.3280	**-58693**	**35682**	**0.1000**
nature	-0.3795	0.4384	0.3870	-63650	54773	0.2450	**100690**	**53843**	**0.0610**
health	**0.6992**	**0.3319**	**0.0350**	-55134	45557	0.2260	-26957	45486	0.5530
civil party	**0.3313**	**0.1957**	**0.0900**	**-44192**	**23238**	**0.0570**	**-90052**	**23236**	**0.0000**
permit	**0.3563**	**0.1790**	**0.0470**	-3191	23990	0.8940	11775	23582	0.6180
permit-cond	0.0743	0.1972	0.7060	**70261**	**25987**	**0.0070**	**-61991**	**26883**	**0.0210**
waste	0.1776	0.2098	0.3970	4482	26393	0.8650	-24808	26124	0.3420
soil-ground	**0.4287**	**0.2473**	**0.0830**	25491	31136	0.4130	12631	30814	0.6820
noise	0.4361	0.2627	0.0970	**82003**	**34209**	**0.0170**	35019	35152	0.3190
odor	0.3632	0.3594	0.3120	4361	45847	0.9240	27958	45250	0.5370
air-dust	0.1213	0.3560	0.7330	41162	46545	0.3770	-19084	46189	0.6790
water	0.1178	0.2578	0.6480	3880	32827	0.9060	-35378	32453	0.2760
positive	**-0.6267**	**0.2727**	**0.0220**	-43385	48565	0.3720	70876	49713	0.1540
record	0.1523	0.1904	0.4240	**39613**	**22689**	**0.0810**	**-40214**	**22503**	**0.0740**
intent	0.2974	0.1966	0.1300	**53409**	**25795**	**0.0380**	37737	26090	0.1480
gain-seek	-0.0434	0.2226	0.8450	-47597	29643	0.1080	**59607**	**29818**	**0.0460**
Gent	**0.5154**	**0.1746**	**0.0030**	-3141	23326	0.8930	14416	23214	0.5350
Oudenaarde	0.2950	0.3130	0.3460						
Westhoek	0.2195	0.2532	0.3860						
year04	-0.0862	0.1685	0.6090						
year05	**-0.8544**	**0.2038**	**0.0000**						
year06	**-1.9806**	**0.3819**	**0.0000**						
lambda				**47372**	**27460**	**0.0850**	-3954	27943	0.8870
# obs	1273			81			81		
Wald chi2				45			67.71		
Prob > chi2				0.0007			0		