Is Deterrence Effective? Results of a Meta-Analysis of Punishment

Dieter Dölling · Horst Entorf · Dieter Hermann · Thomas Rupp

Abstract It is supposed that threats of punishment deter potential criminals from committing crimes. The correctness of this theory is, however, questionable. Numerous empirical investigations have come to different results. In this article a meta-analysis is described which tries to find out the reasons for the different findings. First evaluations indicate that the methods of research have an influence on the results and that a possible deterring effect of the penal law can only be covered reasonably with a very differentiating model. Not all criminal acts can be influenced by deterrence. It appears that the most significant deterrent effects can be achieved in cases of minor crime, administrative offences and infringements of informal social norms. In cases of homicide, on the other hand, the meta-analysis does not indicate that the death penalty has a deterrent effect. According to the results, the validity of the deterrence hypothesis must be looked at in a differenciated manner.

Keywords Deterrence · General prevention · Meta-analysis

Introduction

A lot of legal systems assume that threats of punishment deter potential criminals from committing crimes (see Buikhuisen 1974). Thoughts on this theory of the general prevention effect of deterrence may be found inter alia in the writings of Cesare Beccaria

D. Dölling (✉)
University of Heidelberg, Heidelberg, Germany
e-mail: doelling@krimi.uni-heidelberg.de

H. Entorf
University of Frankfurt on the Main, Frankfurt, Germany

D. Hermann
University of Heidelberg, Heidelberg, Germany

T. Rupp
Technical University of Darmstadt, Darmstadt, Germany

(1766), Jeremy Bentham (1823) and Johann Anselm Feuerbach (1799). More recently, Gary S. Becker (1968) and Isaac Ehrlich (1973) have transferred the theory to the measurable level of mathematical-economic models (Becker) and econometric models (Ehrlich).

There exist numerous empirical studies on the general preventive effect of deterrence in the criminal law that operate with differing methods. However, not only the methods used in the investigation vary considerably, but the studies produce widely different results (see Eisele 1999).

Meta-analyses of deterrence studies have so far only been partially carried out and restrict themselves as a rule to summaries of the literature on the subject, to qualitative analysis methods and to sub-areas such as research into the effectiveness of the death penalty (see for example Nagin 1978; Cameron 1988). Overall, certain knowledge on the effectiveness of general preventive deterrence is slight (Kreuzer 2004: 207). The present meta-analysis relates both to the establishment of the degree of congruence and to the analysis of variances in the empirical investigations of the theory of the general preventive effect of deterrence in the criminal law.

Concept of the Study

The Selection of the Empirical Studies and the Instrument used to Collect the Data

The meta-analysis is a statistical analysis of studies. It constitutes a systematic quantitative examination of individual empirical studies with the aim of obtaining a reliable assessment of previous research results on a particular hypothesis (see, for example, Fricke/Treinies 1985; Hedges/Olkin 1985; Wolf 1986; Rosenthal 1991; Farin 1994). The conduct of a meta-analysis requires that the available empirical studies should be collected as thoroughly as possible (see Stanley 2001 for guidelines on a meta-analysis). The available studies of deterrence were therefore identified and entered into a data bank. Research was carried out in the following literature data bases on criminology, sociology and economics:

KrimDok[1]: Bibliographical Reference System on Criminological Literature, PsycINFO[2]: Psychological Abstracts, Sociological Abstracts[3], Social Services Abstracts[4], EconLit[5]: Electronic Bibliography of Literature on Economics, ISI[6]: Summary of the Science Citation Index Expanded (SCI-EXPANDED), the Social Sciences Citation Index (SSCI) and the Arts & Humanities Citation Index (A&HCI), NBER[7]: National Bureau of Economic Research: economics research papers, RePEc[8]: Economics research papers, SSRN[9]: Social Science Research Network, WISO-net[10]: Information pool for economic and social sciences

---

[1] http://www.ifk.jura.uni-tuebingen.de/krimdok/

[2] http://www.apa.org/psycinfo/

[3] http://www.csa.com/factsheets/socioabs-set-c.php

[4] http://www.library.ucsf.edu/db/socserv.html

[5] http://www.sciencedirect.com

[6] http://isi1.isiknowledge.com/portal.cgi?DestApp=WOS&Func=Frame

[7] http://papers.nber.org.papers.html

[8] http://ideas.repec.org/

[9] http://www.ssrn.com/

[10] http://www.wiso-net.de/indiv startseiten/pool01.ein

(contains the following data banks: ECONIS, HWWA, IFOLIT, IFOKAT, BLISS, FITT, SOLIS, FORIS), Ingenta:[11] Commercial provider of scientific publications, CiteSeer[12]: Scientific Literature Digital Library, WoPEC[13]: Economics research papers, IZA[14]: Research Institute on the Future of Labour: economics research papers, PsychARTICLES[15]: American Psychological Association: Psychological articles, IBSS[16]: International Bibliography of Social Sciences.

In addition, lists of literature in central monographs were considered. The search keys "deterrence", "general prevention", "negative general prevention" and "general deterrence" (both English and German) were used in the research. The first search yielded 9422 literature references in the fields of criminology, sociology and economics that were entered into a literature management data bank. Following the establishment of several criteria— e.g. elimination of duplications and studies irrelevant to the subject (such as theoretical contributions, articles on nuclear deterrence and studies on barriers to market entry) — 700 studies (situation in August 2006) remained. The meta-analysis was based on these studies.

An instrument was developed to record the data consisting of two sub-questionnaires. The first questionnaire relates to the design of the investigation used in the study. The second questionnaire records the results of the studies. More than 100 variables were included for each study.

The Analysis of the Data

The investigation is based on 700 studies with 7822 effect estimates. The aim of the investigation is a total review, i.e. a consideration of all published deterrence effects in each study. Economic studies frequently check the robustness of the effect calculated by varying the basic model. This means that the estimations reported are frequently very numerous in the economic studies but often differ only slightly in their basic parameters. For this reason, only one of these variations was randomly selected per offence in each study. With the criminological and sociological studies on the other hand, all relevant estimates were included. In order to avoid possible distortions through different numbers of estimations per study, the empirical analyses are weighted in such a way that each study – irrespective of the relevant number of its estimations – is included in the analysis with the same weighting.

Numerous statistics are given in the studies at the level of individual assessments, for example correlation co-efficients, partial regression coefficients, percentage differences, levels of significance, F-values and t-values. These statistical factors generally have different scales and are therefore only comparable to a limited degree. All estimations are thus converted into t-values in order to obtain comparable indices. The use of t-values is a frequently used procedure in meta-analyses (Stanley 2001; Antony/Entorf 2003). The t-value is a statistic most frequently used in inferential statistical analyses in order to calculate the probability of error. Many measures of association and inference-statistical measures can be converted into t-values, when the number of degrees of freedom is known. The t-values in this meta-analysis consist of "genuine" values already used in the studies and of

"converted" values. The t-values are coded in such a way that negative values signify a confirmation of the deterrent hypothesis and positive values a falsification. Of a total of 7822 measurements taken, 7057 t-values are available through direct recording or conversion.

The t-distribution depends on the number of degrees of freedom and accordingly on the sample size used as a basis and only acquires robustness with approximately 30 cases. The t-values are normalised in order to compensate the dependence of the t-statistic on the sample size. This guarantees a direct comparability of the t-values.[17] The arithmetical operations in order to determine the normalised t-values are documented in Rupp (2008: 78-80). The results presented below are all based on weighted analyses and normalised t-values.

Comparisons of mean values in particular are made in order to answer the central question posed by the meta-analysis of the conditions for the strength of the deterrent effect. Generally, the percentage share of estimations that are theory-consistent and statistically significant were determined.

Overall Assessment and a Comparison of Studies with Different Methods

Overall Assessment

One can obtain an indicator of the validity of the deterrent hypothesis from the sign (plus/minus) of the estimations. A negative sign consistent with the theory may be observed in 73.8 % of the estimates. For samples with larger sample sizes the critical value for the boundary between significant and insignificant t-values is -1.96. 41.7% of the estimations are smaller than the critical value of -1.96. In these cases the association on the 5% level is theory-consistent and statistically significant. A further 7.8% of the estimations are also significant; these contradict however the deterrent hypothesis. Approximately half of the estimations, namely 50.5%, are not significant. One can also conclude as regards the strength of the association that both the arithmetic average value and the median of the t-value are -1.4. These values are larger than the critical value. Thus one can at the most speak of a moderate confirmation of the deterrent hypothesis. The overall subjective assessment of the researchers confirms this result: the deterrent hypothesis is approved in 53% of the studies whilst a rejection may be recognised in 34%.

Differentiation According to Type of Study

The estimations are derived from studies carried out by means of different methods. Table 1 describes the distribution of the studies. According to this table, studies based on criminal statistics and questionnaires are dominant. The other studies relate chiefly to experiments.

The degree of acceptance or rejection of the authors of the studies on the deterrent hypothesis was measured. Diagrams 1, 2, 3 and 4 show the distribution of overall

---

[17] In high sample sizes t-values under -1.96 are significant on the 5% level. This marginal value is lower in the case of small sample sizes. "Normalisation" consists of an adjustment of the t-values with small sample size; for these cases t-values are calculated that would be obtained were the sample size higher, but the probability of error for the estimate remains unchanged. As a result of this normalisation, the value t=-1.96 is always the boundary between significant and non-significant estimates, irrespective of the sample size.

Table 1 Frequency distribution of types of study and estimations

	Number of studies	Number of estimations
Studies based on criminal statistics	391	4066
Survey-based studies	171	2569
Studies on the death penalty	52	842
Other studies	86	345
Total	700	7822

assessments for the different types of study. The lines on the individual bars are 95% confidence intervals.

The overall results of studies on the subject of the deterrent hypothesis differ considerably between the different types of study. Whilst studies based on criminal statistics show a clear approval, those into the death penalty show the opposite picture. In survey-based studies and other types of studies – these are particularly experiments – a modest confirmation of the deterrent hypothesis is prevailing.

If one investigates the influence of the type of study on the size of the estimates rather than on the overall result of the study, 60% of the estimations are theory-consistent and significant in the studies showing full agreement of the author with the deterrent hypothesis. In the studies showing partial agreement, the share of estimations that are theory-consistent and significant is 52%. The value is 20% in the case of studies showing partial rejection and 7% in the case of those showing complete rejection. Thus the authors' subjective assessment corresponds largely with the results of the objective statistics. However, differences are also evident between the subjective and the objective evaluation. This will become clear when one compares Diagrams 1, 2, 3 and 4 with Diagram 5. In Diagram 5 the percentage share of estimations that are theory-consistent and significant is documented, whereby a distinction is made according to the type of study.

In this analysis too, the share of theory-consistent and significant estimations drawn from studies on the death penalty is comparatively low, whereas the highest share of estimations supporting the theory is not to be found in studies based on criminal statistics but in other studies. Discrepancies are therefore evident between the subjective and the objective view.

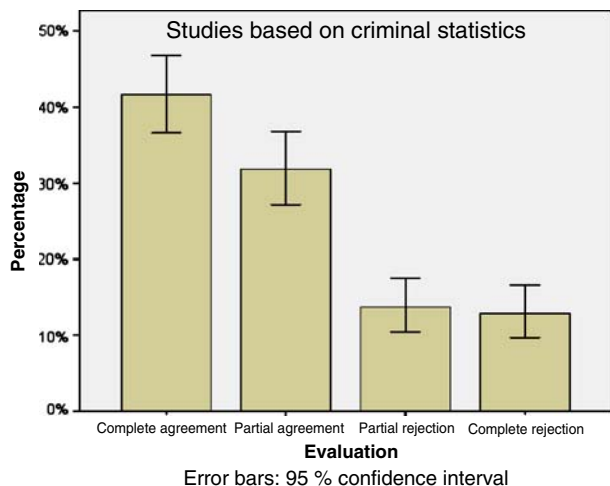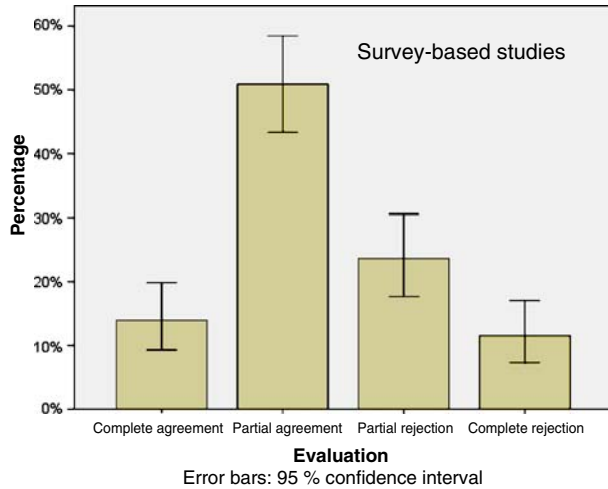**Diagram 1** Overall result of studies based on criminal statistics from the authors' point of view

Error bars: 95 % confidence interval

Diagram 2 Overall result of
survey-based studies from the
authors' point of view

Error bars: 95 % confidence interval

As already mentioned, the category "other studies" consists especially of experiments. When a distinction is made between the types of experiment, the share of theory-consistent and significant estimations is comparatively high especially in field experiments initiated by the researcher. The result of the analysis is shown in Diagram 6.

The above average frequency of the confirmation of the deterrent hypothesis in experiments, in particular in field experiments initiated by the researcher, must however be treated with caution due to the small number of studies. Seen overall, the method applied in a deterrent study therefore influences the result of the study.

Influence of the Year of Publication on the Results of the Investigation

The studies considered in the meta-analysis were published between 1952 and 2006. The analysis instruments used, the number of accessible data sets and the societies in which deterrent studies were carried out have changed during this period. It is therefore

Diagram 3 Overall result of
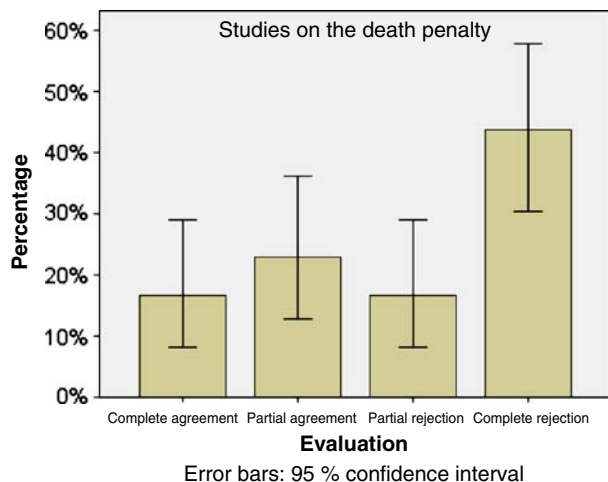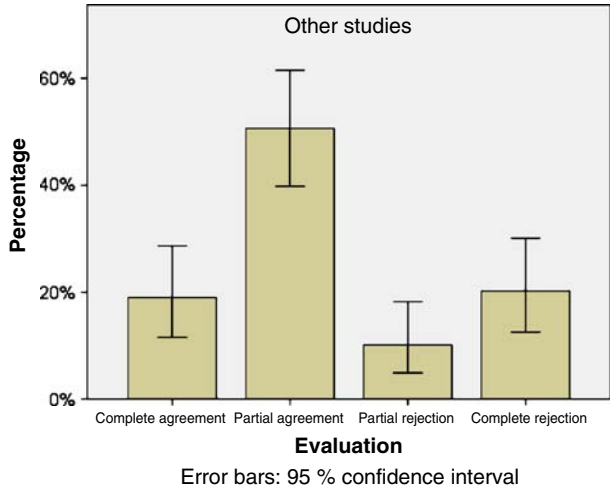studies on the death penalty from
the authors' point of view

Error bars: 95 % confidence interval

Diagram 4 Overall result of other studies from the authors' point of view

Error bars: 95 % confidence interval

conceivable that the results of studies on deterrence have also changed. However, a graph showing the association between the year the study was published and the size of the estimations (normalised t-value) shows no correlation. On the other hand, if one looks at the development of the relative shares of theory-consistent and statistically significant estimations compared with all estimations, a trend can be discerned but this does not present a linear development. The share of theory-consistent and significant estimations was 39.8% for studies published up to 1983. By comparison, studies published during the periods 1984 to 1995 and 1996 to 2005 show higher shares with 44.4% and 41%, respectively. When differentiated between types of study, this curvi-linear trend is only present in the case of studies based on criminal statistics; no change is discernible in studies conducted with other methods. An additional analysis shows that changes in the results of studies based on criminal statistics are only present in longitudinal investigations. Overall, no uniform trend on the influence of the date of publication can be recognised in the results analysed.

Diagram 5 Influence of the type of study on the percentage share of effect estimates that are theory-consistent and significant
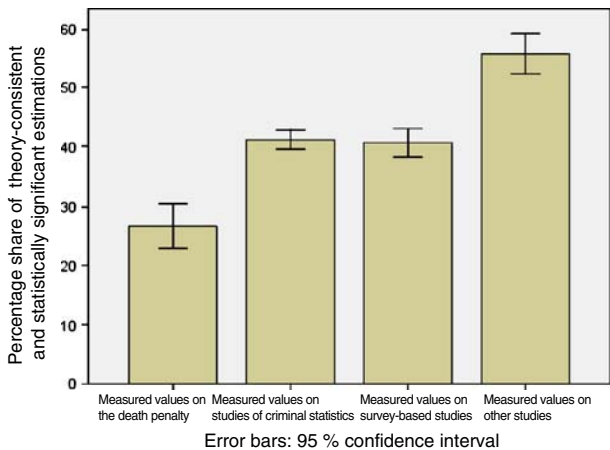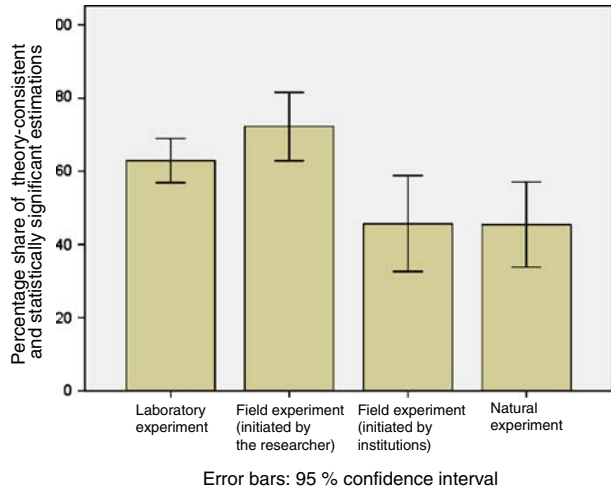

Error bars: 95 % confidence interval

Diagram 6 Influence of the type of experiment on the percentage share of theory-consistent and significant estimations

Error bars: 95 % confidence interval

Comparison of Studies Based on Quality Criteria of the Methods used
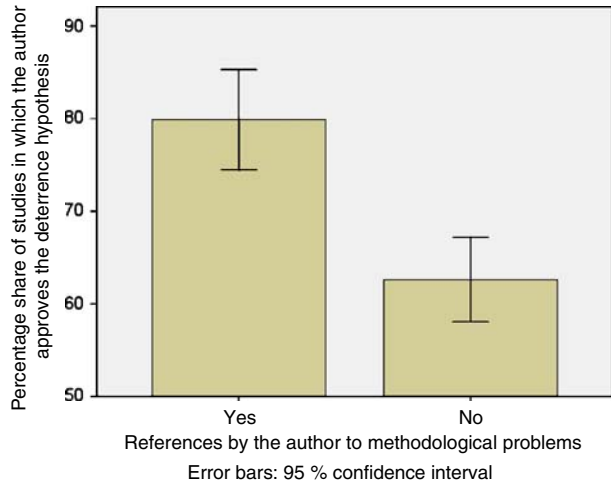
Empirical social research has several criteria for the assessment of the quality of investigations. These include especially the degree to which the data is representative, the quality of the measurements taken, that is reliability and validity, as well as the use of the appropriate statistical analytical procedures – these are as a rule multivariate methods and where applicable multi-level analysis (see Atteslander 2003; Diekmann 2008; Kromrey 2006). In this regard the studies to check the deterrent hypothesis vary enormously. Table 2 shows a comparison between the types of study. The numerical values used are percentage shares of such studies fulfilling a characteristic feature.

A check on the representative nature of the data only took place in the case of survey-based studies and was rare even here. Criminal-statistical studies are generally based on macro-sociological data, i.e. information on regions or states, for example. The question of representativeness is secondary in such cases. This is also true of studies on the death penalty. In the case of experiments, on the other hand, the question as to whether the results are only valid with respect to those taking part in the experiment or whether they may be

Table 2 Methodological-statistical characterisation of studies

Type of study Characterisation of the studies	Study based on criminal statistics	Survey-based study	Study of the death penalty	Other
Claim to be representative	11.3	44.4	13.5	11.6
Check on representativeness	0.0	12.3	0.0	0.0
Conduct of reliability tests	0.8	17.0	0.0	1.2
Conduct of validity tests	0.8	8.2	0.0	0.0
Consideration of control variables in the statistical analysis	83.4	80.1	78.8	57.0
Conduct of a multi-level analysis	0.0	0.0	0.0	0.0
References by the author to methodological problems	44.5	23.4	25.0	22.1
Indications of considerable methodological problems in the research group (Rater)	10.0	10.5	15.4	9.3

Diagram 7 Relation between the methodological self-criticism of the author in his study and his assessment of the validity of the deterrence hypothesis

Percentage share of studies in which the author approves the deterrence hypothesis

References by the author to methodological problems

Error bars: 95 % confidence interval

generalised is important. Investigations of the quality of the measurements were almost exclusively carried out in survey-based studies. But even in survey-based studies, these analyses are seldom used. Multivariate analysis techniques and thereby the consideration of control variables were used in almost all studies on deterrence, except that this method is used less frequently in experiments. This is due however to the special nature of the experiments that allows a consideration of control variables by means of the rules of the experiment. Multi-level analyses on the other hand were not used at all.
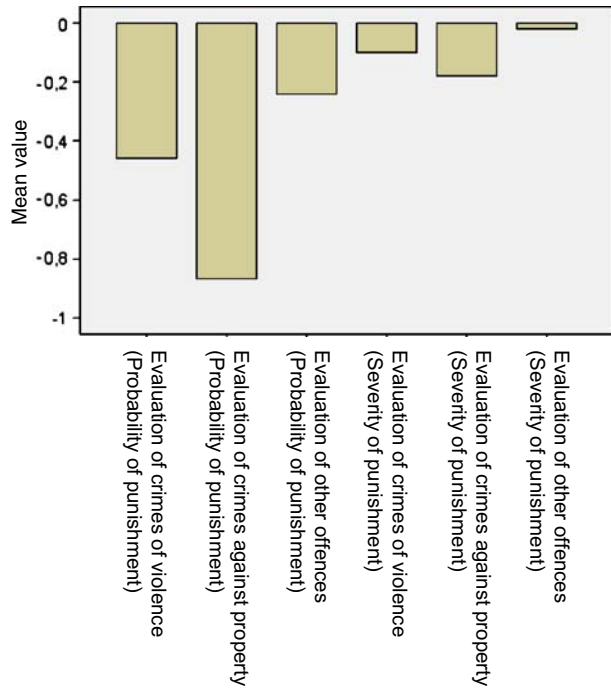
Methodological problems on the part of the authors were named most frequently in studies based on criminal statistics (45%). This is however not to be interpreted in such a way that these studies are particularly prone to problem, because the raters, i.e. the persons working on the project, whose job it was to document the results of the studies, found problems in only roughly 10% of the studies based on criminal statistics. In this regard, this type of study is not different from questionnaires and experiments. Most methodological problems were found in studies on the death penalty (15 %). Methodological problems seem to have only a limited effect on the results of the studies. The studies in which the representative nature and the reliability and validity of the measurements were checked are not significantly different from others in terms of their results. Only studies in which the authors themselves draw attention to methodological problems in their analyses confirm significantly more frequently the deterrence hypothesis – at least from a subjective point of view (Diagram 7). This distinction may be found in all types of study. Such a result makes one assume that confirmations of the deterrence hypothesis are more critically considered than falsifications.

Studies of Criminal Statistics

Description

Three hundred ninety-one studies based on criminal statistics were considered in the meta-analysis. Most of them, namely 73%, were published in the USA; 33% of the studies were from the time before 1984, 28% were published between 1984 and 1995 and 39% after this

Diagram 8 Overall result of studies based on criminal statistics in the author's opinion, distinguished between types of crime and the measurement of the deterrent variables

date. Almost all the publications are journal articles (87%) and only 2% monographs. Most of the authors are economists (56%). Only 29% of the investigations are based on cross-section data, all the others use longitudinal or panel data. The objects investigated, that is the cases in the data matrix, are generally local districts (36%), followed by regions in the sense of German federal states or Swiss cantons (31%) and nations (21%). With the analysed data the Uniform Crime Report (UCR, criminal statistics kept by the police in the USA) plays a key role; this data source was referred to in 33% of the studies.
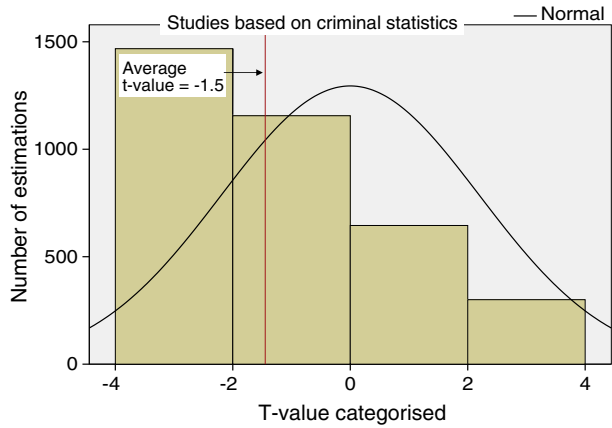
As already mentioned, the authors' assessment of the validity of the deterrence hypothesis was recorded for each study. A distinction was made in this regard as to whether the assessment referred to crimes of violence, crimes against property or other types of crime. A distinction was also made as to whether the degree of deterrence was based on the likelihood of punishment or the severity of the punishment. The average assessments for studies based on criminal statistics are shown in Diagram 8.

A negative value means that, in the author's opinion, the results of the examination agree with the deterrence hypothesis, and a positive stands for a falsification. Accordingly, the deterrence hypothesis is more frequently confirmed in investigations of crimes against property than in investigations of crimes of violence. Furthermore, the likelihood of punishment seems to exercise a greater deterrent effect than the severity of the punishment.

Distribution of Estimations

The authors' evaluation of the results of the examination is confirmed by a meta-analysis on the basis of the estimations. Diagram 9 shows the distribution of the normalised t-values. This distribution varies markedly from the normal distribution that would be obtained if the deterrence hypothesis were false. The number of theory-consistent and significant

Diagram 9 Distribution of the normalised t-values for estimations in studies based on criminal statistics

estimations far exceeds the number of theory-falsifying and significant estimations. On the other hand, the average t-value is not significant.

Influence of the Methodical-Statistical Characteristics of the Studies on their Results

It is to be assumed that the way of variable measurement has an effect on the result. This can relate both to the independent variable with which the degree of deterrence is measured and the dependent variable that records criminal activity. The findings of analyses of the influence of measurements on the results of deterrence studies are summarised in Tables 3 and 4. These relate to variance analyses in which the estimations (normalised t-values) represent the dependent variables. In these variance analyses groups are compared which differ from each other in the presence of one characteristic, namely in the nature of the measurement of the independent or dependent variables. In Table 3, for example, the line

Table 3 Influence of the measurements of the independent variables on the result of the analysis – studies based on criminal statistics

	Share	T-mean value	T-Median	Effects	Studies
Ratio of convictions to reported crimes	82.0 %	-3.3	-3.5	32	8
Probability of punishment	63.9 %	-2.0	-2.1	97	23
Arrested persons per crime	62.7 %	-2.9	-3.1	87	5
Financial penalty	49.6 %	-2.1	-1.7	39	5
Arrest quota	49.0 %	-2.2	-1.9	682	79
Ratio of convicted persons to suspects	44.7 %	-2.3	-1.8	266	24
Clearance rate	46.6 %	-1.8	-1.9	372	40
Severity of punishment	41.7 %	-1.5	-1.4	164	22
Average length of prison sentence imposed	34.0 %	-1.2	-1.4	208	4
Inspections	31.8 %	-1.3	-0.8	76	10
Spending on the police	30.6 %	-0.4	-1.0	196	25
Persons with a prison sentence (per x of those convicted)	30.1 %	-1.3	-0.8	78	2
Average length of prison sentence actually served	24.9 %	-0.7	-0.6	149	8
Arrested persons (per x of population, or absolute)	25.0 %	-0.8	-0.5	81	5
Police resources	20.7 %	-0.2	0.0	414	43
Number of suspected persons registered by the police	20.5 %	-0.3	0.3	17	4

Table 4 Influence of measurements of the dependent variables on the result of the investigation – studies based on criminal statistics

	Share	T-mean value	T-Median	Effects	Studies
Number of crimes registered by the police	52.9 %	-1.6	-2.1	243	42
Accidents	48.0 %	-1.5	-1.7	166	26
Extent of the infringement	45.2 %	-1.6	-1.7	73	11
Crimes in relation to population	39.7 %	-1.5	-1.3	2773	241

dealing with the probability of punishment means, firstly, that 63.9% of the estimations that use this variable are theory-consistent and statistically significant (t ≤ -1,96) and, secondly, that the average t-value for these estimations is -2.0. This group of estimations differs significantly from estimations that are based on other measurements of the independent variables in the studies based on criminal statistics. In Table 3 and in the following tables only significant results were shown. The last two columns show the numbers of estimations and studies on which the calculations are based. Both the last-mentioned values are obviously based on unweighted data whereas the other statistics are based on weighted data. In all of these analyses only such characteristics were shown as were considered in at least two studies and on which at least 25 estimations were available.

In certain studies several variables are combined to form indices. These cases must be analysed separately in order not to distort the results. The creation of an index of the independent variables (as a rule the product of conviction rate and sentence length) has no considerable influence on the size of the estimations. Should the estimations be based on individual items, the share of theory-consistent and statistically significant estimations is 41.3%; the share is 36.8% should items be amalgamated into indices. Such cases are few (3.7%) and the differences are not significant. The dependent variable was construed as an index in only 0.8% of all cases. In later analyses of the influence of measurements on the estimations therefore cases of indexing will be excluded.

Amongst the deterrent variables in studies based on criminal statistics, the variables recording the risk of punishment – for example the ratio of convictions to reported crimes – are particularly striking with an above-average share of theory-consistent and significant results. In comparison with this, the deterrent effect of the severity of punishment - for example, the average length of the sentence awarded or actually served – is comparatively low. No major differences appear with respect to the nature and the manner of measuring the incidence of crime.

An additional factor influencing the result of an investigation is the specification of the statistical model on which the estimations are based. Almost all statistical analyses were conducted multivariate. The number and the nature of control variables considered can vary in this context. The results of the analyses of the influence of control variables on the results of deterrence studies are summarised in Table 5.

As the table shows, the share of theory-consistent and statistically significant estimations changes considerably when certain control variables are considered: should, for example, the degree of religiousness be used as a control variable in a multivariate analysis of the deterrence hypothesis, the share of theory-consistent and statistically significant estimations is below 30%. This indicates that this is a variable that influences both the deterrence variables and delinquency, such that its not being considered would lead to a spurious correlation. These relationships are shown graphically in Diagram 10. It may be supposed that deterrence indicators are more clearly perceived in regions and societies that are

Table 5 Influence of the consideration of control variables on the result of the investigation – studies based on criminal statistics

	Share	T-mean value	T-median	Number of effects	Number of studies
Consumer spending by the population	52.3%	-2.0	-2.0	96	13
Share of earners	49.8%	-2.3	-1.9	97	13
Family situation	47.7%	-2.2	-1.8	128	17
Fixed Effects (cross-section)	44.9%	-2.3	-1.4	875	50
Personality characteristics	42.7%	-1.7	-0.9	106	10
Age	42.6%	-1.5	-1.3	711	59
Property value	42.2%	-1.7	-1.5	69	12
Youth	42.0%	-1.8	-1.4	884	78
Fixed Effects (Time)	41.3%	-2.0	-1.5	945	57
Sex	40.7%	-1.6	-1.5	358	30
Unemployment	40.7%	-1.5	-1.5	1780	141
Colour of skin	39.9%	-1.4	-1.2	1183	108
Income	38.5%	-1.5	-1.2	1565	133
Education	35.5%	-1.3	-1.4	336	33
Income differences	35.4%	-1.3	-1.0	486	43
Population (growth)	35.3%	-1.2	-1.2	791	63
Time trend	34.1%	-1.4	-1.6	201	26
Poverty, welfare	33.7%	-0.5	-0.9	441	39
Urbanisation	29.3%	-0.5	-0.6	452	37
Religion	28.8%	-1.0	-1.4	47	4
Alcohol (consumption)	27.3%	-0.7	-0.6	55	8
Nationality	24.9%	-1.1	-0.6	377	13

oriented towards religion and in which the rate of delinquency is also lower. One can assume that the deterrence effect would be over-estimated were account not to be taken of this variable.

On the other hand, there are also control variables the consideration of which leads to an above-average share of theory-consistent and statistically significant estimations. These relate in particular to economic characteristics, such as the proportion of persons in employment. This can be interpreted in such a way that these variables should belong to a model to explain the effects of deterrence and are probably linked to characteristics of deterrence; their absence will probably lead to a spurious non-correlation between deterrence indicator and crime, that is the deterrence effect is under-estimated when these control variables are not considered. Diagram 11 shows these formal causal relationships in a spurious non-correlation graphically. It may be supposed that deterrence measures are more relevant in regions and societies with a high degree of employment and that the rate of
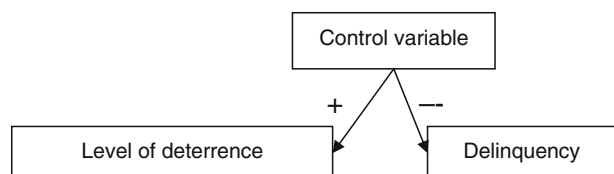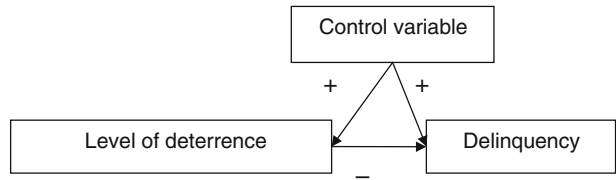
Diagram 10 Formalised description of a spurious correlation

Diagram 11 Formalised description of a spurious non-correlation

delinquency is comparatively high – this would correspond with the graphical representation shown in Diagram 11.

In both cases, the failure to consider the control variables mentioned would entail a false specification of the model and therefore distorted estimations. Accordingly, a survey to examine the deterrence hypothesis must reproduce completely and correctly the causal relationships in order to obtain realistic estimations.

Influence of the Objects of the Studies on their Results

In addition to methodological characteristics of a study and the analysis procedures used, the type of objects examined can also influence the results of the studies, that is the composition of the group of people investigated and the type of criminal actions included. Sub-populations of the total population have very rarely been investigated in studies based on criminal statistics and there are just a few investigations that only take account of older or younger people. There are more than 70 estimated values available here, the t-values of which, however, do not differ significantly from the other investigations. A concentration of the studies on the whole population is the general rule. A variation may however be found

Diagram 12 Overall result of survey-based studies in the opinion of the authors, separated between types of offence and the measurements of the deterrence variables
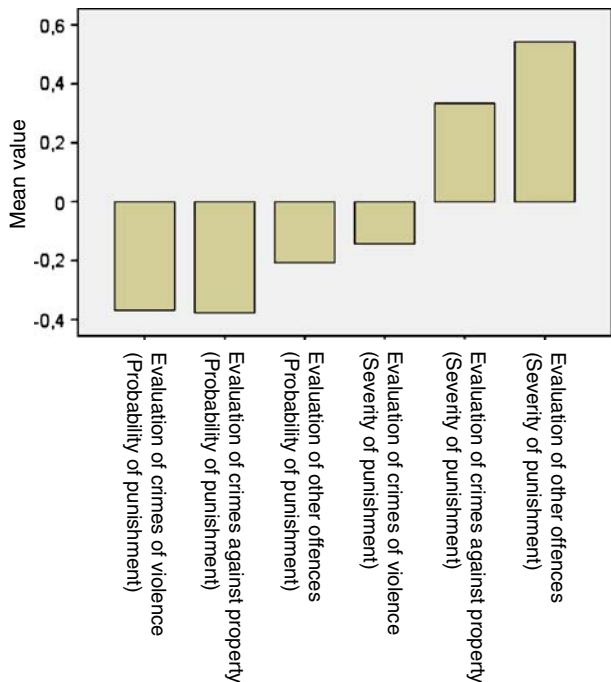
Table 6 The influence of the type of offence on the result of the investigation – studies based on criminal statistics

	Share	T-mean value	T-median	Number of effects	Number of studies
Driving under the influence of alcohol	51.5 %	-1,6	-2.0	271	48
Theft (higher value goods)	50.6 %	-2.1	-2.0	95	11
Tax evasion	49.9 %	-2.2	-1.8	46	8
Environmental offences	47.5 %	-1.7	-1.7	63	8
Burglary	41.9 %	-1.4	-1.4	600	69
Theft (minor)	41.8 %	-1.4	-1.9	59	4
Car theft	38.0 %	-1.1	-1.1	460	47
Robbery	37.5 %	-1.3	-1.0	711	78
Deliberate killing	37.4 %	-1.5	-1.1	789	118
Theft (all types)	36.8 %	-1.6	-1.0	622	53
Rape	34.4 %	-1.4	-1.0	393	41
Criminal assault and battery	34.3 %	-1.3	-0.6	529	47
Negligent bodily injury	32.4 %	-0.9	-0.4	74	7
Other sexual offences	32.3 %	-0.8	-0.5	28	3
Indecent assault	29.5 %	-0.9	-0.5	59	3
Negligent homicide	11.6 %	-0.3	0.0	25	5

with respect to the offences considered. Table 6 shows the percentage share of theory-consistent and statistically significant estimations as well as the mean value and median of the normalised t-values in relation to the type of offence. The table shows only such results as are based on at least two studies and 25 estimations.

The results show that the confirmation of deterrence effects is dependent on the type of offence. A very high proportion of theory-consistent and statistically significant estimations is to be found – for example – in cases of traffic offences, whereas the deterrence hypothesis is rarely confirmed in the case of more serious offences.

According to the rational choice approach that may be seen as the basis of the theory of negative general prevention, deterrence must be more efficient in the case of instrumental offences than in cases of expressive offences, because rational planning and strategic consideration are the characteristics of instrumental offences, whereas expressive offences are characterised by emotion and spontaneity. When one classifies offences against property as instrumental offences and violence as expressive offences, the expected distinctions are generally found.

If one compares the results of estimations from deterrence studies based on criminal statistics that are limited to crimes with those that place the emphasis on administrative offences, the latter case shows higher proportions with theory-consistent and statistically significant estimations (46.9% compared with 41.8%). This comparison also shows that deterrent effects are more clearly recognisable in cases of minor infringements of norms than in cases of serious delinquency.

Survey-based Studies

Description

The meta-analysis is based on 171 survey-based studies: 86% of these studies were published in the USA; 32% of the studies date from the period before 1984, 35 % were

published between 1984 and 1995, and 33% thereafter. A large part of the publications are journal articles (81%) and contributions to a compendium (9%) and only 2% monographs. Most of the authors are sociologists (36%) and criminologists (24%), 18% of the authors are from the field of economics, 81% of the investigations are based on cross-section data and all the others used longitudinal or panel data. The objects examined, i.e. the cases in the data matrix, are largely private individuals (49%) or groups (36%). Regions in the sense of the German federal states (2%) or countries (3%) were almost never used in survey-based studies. Of those questioned in the studies 58% were selected randomly, 10% of the cases were based on a complete population survey and 24% on an unsystematic random sample.
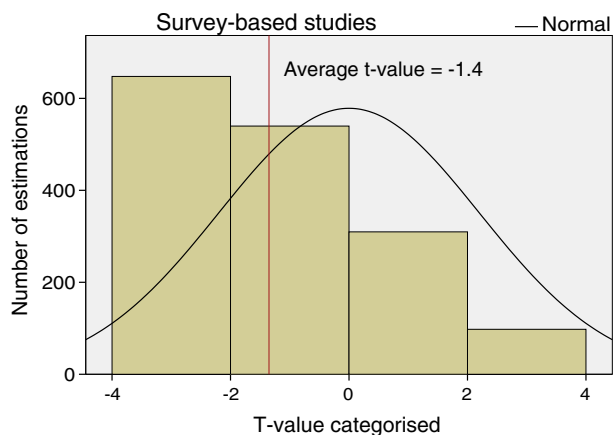
The authors' assessment of the validity of the deterrence hypothesis seen against the background of the results of their investigations is documented in Diagram 12. The average assessments are listed here, whereby a distinction is made between crimes of violence, crimes against property and other offences, as well as according to the perceived deterrence characteristic (probability of punishment or severity of punishment).

As already mentioned, a negative value signifies that, in the author's opinion, the results of the investigations agree with the deterrence hypothesis and a positive value stands for a falsification. Accordingly, the results of studies into crimes against property are not different from investigations into crimes of violence, if deterrence was operationalised as the probability of punishment. Survey-based studies, like studies based on crime statistics, appear to show that the probability of punishment has a greater deterrent effect than the severity of punishment.

Distribution of the Estimations

Diagram 13 shows the distribution of normalised t-values of the estimations derived from survey-based studies. This distribution largely corresponds with the distribution obtained with studies based on criminal statistics. It differs markedly from the normal distribution that one would obtain if no correlation existed overall between deterrence and delinquency. The number of theory-consistent and statistically significant estimations exceeds by far the number of estimations that falsify the theory and are significant. The average t-value is however not significant. One can also say, as regards the strength of the correlation, that the arithmetic mean of the t-value is -1.4. This value is lower than the critical value. One can therefore speak of a weak confirmation of the deterrence hypothesis in survey-based studies.

Diagram 13 Distribution of normalised t-values for estimations in survey-based studies

The influence of the Methodical-statistical Characteristics of the Studies on their Results

The creation of indices from the independent variables has no considerable influence on the size of the estimations. Should the estimations be based on individual items, the share of theory-consistent and statistically significant estimations is 40.3%; should items be amalgamated into indices, the share is 45.0%. Such cases are few (5.8%) and the differences are not significant. In only 3.4% of all cases was the dependent variable construed as an index. Cases of indexing will therefore be ignored in later analyses of the influence of measurements on the estimations.

The results of analyses of the influence of measurements of the independent variables on the results of deterrence studies are summarised in Table 7. This and the following tables are constructed in the same manner as the tables on studies based on criminal statistics. Here too, only such characteristics were considered as were included in at least two studies and for which at least 25 estimations existed.

The measurements of perceived deterrence have considerably high effects on the result of deterrence studies. Particularly high estimations are obtained through the recording of informal sanctions. The probability of informal sanctions via the immediate environment appears to have a greater deterrent potential than the probability of formal sanctions, whereby the severity of the informal sanctions and informal disapproval by third parties appear to be secondary. In many studies the question of the risk of discovery is not related to the person questioned but to a fictitious person. The question is not "how do you assess the risks…" but rather "how would a person who is similar to you assess the risk". It is hoped that this construction will increase the willingness to give an honest answer. The results in Table 7, however, show that this method of measurement of perceived deterrence only leads to comparatively modest estimations.

The dependent variable in general preventive deterrence studies is generally the delinquency the person himself reports (97%), only 3% of estimations are based on data taken from reported crime statistics. The distinctions are however minor: the share of theory-consistent and statistically significant estimations in dark field studies is 38.6% and 38.1% when based on recorded crime statistics.

Table 7 Influence of measurements of the independent variables on the result of the investigation – Survey-based studies

	Share	T-mean value	T-median	Number of effects	Number of studies
Expected probability of an informal sanction by friends/family	63.1 %	-2.1	-2.6	230	9
Expected probability of a sanction by the criminal justice system	46.1 %	-1.5	-1.7	397	34
Assessment of the risk of discovery by the police	45.4 %	-1.5	-1.7	613	61
Anticipated severity of a criminal law sanction	30.3 %	-0.8	-0.5	348	7
Anticipated severity of an informal sanction by friends/family	26.5 %	-0.8	-0.8	121	4
Anticipated severity of an informal sanction by a third party	24.2 %	-0.7	-0.7	68	5
Assessment of the risk of discovery of fictitious persons	21.6 %	2.3	1.8	31	3
Anticipated probability of other formal sanctions	20.0 %	-0.7	-0.0	37	4

Table 8 Influence of the consideration of control variables on the result of the survey-based studies

	Share	T-mean value	T-median	Number of effects	Number of studies
Family situation	49.9%	-3.0	-1.9	110	17
Degree of urbanisation	49.5%	-5.0	-1.7	48	4
Unemployment	44.6%	-1.4	-1.6	61	8
Personality characteristics	43.8%	-3.8	-1.2	48	2
Education	42.5%	-2.6	-1.5	216	21
Age	39.9%	-1.6	-1.4	333	44
Income	39.3%	-2.1	-1.7	172	27
Colour of skin	39.3%	-2.0	-1.5	210	21
Sex	39.0%	-1.5	-1.0	475	43
Nationality	34.1%	-0.9	-0.9	39	5
Acceptance of norms	33.0%	-1.0	-0.9	383	12
Religion	29.4%	-0.9	-0.4	132	7
Moral development	27.0%	-1.1	-1.0	218	9
Social integration	25.7%	-0.6	-0.7	165	10
Previous criminal record	22.9%	-0.7	-0.4	158	6

The result of the investigation in survey-based studies of general prevention is also dependent on the specification of the model and therefore also on the control variables considered in multivariate analyses. Table 8 shows the results of the relevant analyses.

The results correspond partially with the evidence in studies based on criminal statistics. In both cases estimations with a control of the family situation led to a high proportion of results consistent with the theory, whilst consideration of religion shows an opposite effect. Analyses using the degree of urbanisation produced contradictory results, the number of survey-based studies with this model specification is however small.

Table 9 Influence of the type of crime on the result of the investigation – survey-based studies

	Share	T-mean value	T-median	Number of effects	Number of studies
Negligent bodily injury	70.7 %	-2.0	-2.6	33	2
Exceeding the speed limit	70.3 %	-2.2	-3.4	39	5
Car theft	67.4 %	-2.0	-2.4	43	5
Robbery	64.1 %	-2.0	-2.6	77	5
Damage to property	63.8 %	-2.0	-2.4	138	6
Theft (minor)	58.1 %	-1.1	-2.1	201	15
Burglary	56.3 %	-1.1	-2.3	94	9
Theft (of high value goods)	54.8 %	-1.1	-2.2	159	10
Obtaining goods by deception	54.5 %	-1.8	-2.0	80	2
Drug trafficking (soft drugs)	53.4 %	-1.6	-2.3	63	3
Criminal assault and battery	51.6 %	-1.5	-2.0	177	13
Fraud	51.2 %	-1.8	-2.0	203	13
Theft (all types)	50.3 %	-1.7	-2.0	369	22
Driving under the influence of alcohol	50.2 %	-1.7	-2.0	177	27
Tax evasion	45.4 %	-1.3	-2.0	129	20
Drug trafficking – general	39.7 %	-1.1	-0.8	461	2
Drug trafficking (hard drugs)	35.9 %	-0.7	-0.5	39	2
Other crimes	34.5 %	-1.3	-1.0	215	15

Influence of the Objects of the Investigation on its Results

Table 9 shows the percentage shares of theory-consistent and statistically significant estimations as well as the medium value and median of the normalised t-values.

As shown in Table 9, the size of the deterrent effects is at least partly dependent on the seriousness of the offence. This is proved – for example – by the comparison between estimations for the frequency of exceeding the speed limit and of driving under the influence of alcohol. The share of theory-consistent and statistically significant effect estimations is greater in the first named offence. If one compares the results of estimations from survey-based studies that are limited to crimes with those that place the emphasis on administrative offences, the latter case shows higher proportions with theory-consistent and statistically significant estimations (45.3% compared with 41.0%).

Studies of the Death Penalty

Description

Fifty-two studies of the death penalty were included in the meta-analysis. Almost all, namely 90%, were published in the USA; 44% of the studies date from the period prior to 1984, 21% were published between 1984 and 1995 and 34% thereafter. Investigations of the death penalty tend to be older than studies of deterrence based on criminal statistics and survey-based studies. Almost all the publications are journal articles (94%) and monographs are not available. Most of the authors are economists (42%) or sociologists (32%); publication took place most frequently in journals on criminology. Only 12% of the studies are based on cross-section data, and all the others use longitudinal or panel data. The objects investigated, i.e. the cases in the data matrix, are always aggregated data (countries: 40% and federal states: 44%). With the data used the Uniform Crime Report (UCR) plays a central role; this data source was referred to in 54% of the studies. The classic study of the death penalty therefore uses recorded data from the USA on the number of crimes reported, whereby either regions or periods of time are compared in which the threat, the imposition or the execution of the death penalty vary. In 70% of the studies the

Diagram 14 Distribution of normalised t-values for estimations in studies on the death penalty
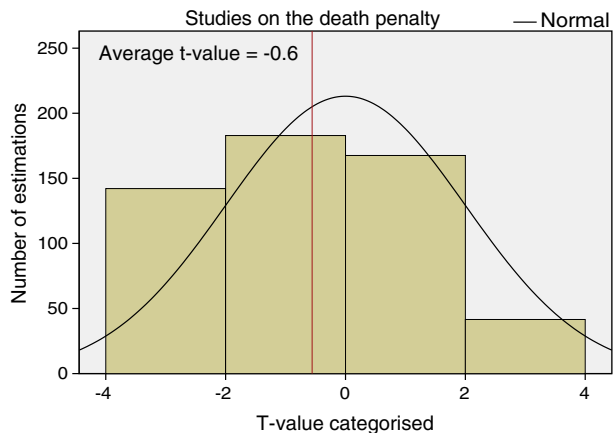
Table 10 Influence of measurements of the independent variables on the result of the investigation – studies of the death penalty

	Share	T- mean value	T-median	Estimations	Studies
Executions (absolute or relative values)	27.1 %	-0.7	-0.5	505	27
Ratio of convictions to death penalties in all convictions	20.3 %	-0.7	-0.5	93	3
Threat of the death penalty provided for in the law	12.2 %	0.2	0,1	69	6

authors interpret their results as a rejection of the deterrence hypothesis, whereby complete rejection is the dominant judgement (50%).

Distribution of the Effects

Diagram 14 shows the distribution of normalised t-values. This distribution corresponds approximately with the normal distribution, even if the distribution is skewed to the left and the number of theory-consistent and statistically significant estimations is slightly larger than the number of theory-falsifying and statistically significant estimations.

The Influence of Methodological and Statistical Characteristics of the Studies on their Results

Index creation was present in only 1.1% of all estimations in the case of the independent variables and 0.4% in the case of the dependent variables. Cases with index creation will therefore be ignored in later analyses of the influence of measurements on the estimations. The results of analyses of the influence of measurements of the independent variables on the results of deterrence studies are summarised in Table 10.

Amongst the deterrent variables in studies on the death penalty, the variables recording executions show an above-average share of theory-consistent and statistically significant results. The estimations in these cases are however also comparatively low. The legal threat of the death penalty appears to have no influence whatsoever on the level of crime; the average t-values are even slightly positive.

Table 11 Influence of the consideration of control variables on the result of the investigation – studies of the death penalty

	Share	T-mean value	T-median	Number of estimations	Number of studies
Time trend	44.4%	-1.5	-1.5	72	6
Unemployment	33.5%	-1.0	-1.1	435	17
Juveniles	32.9%	-0.7	-1.0	121	7
Income	31.5%	-0.5	-0.9	338	15
Income differences	28.9%	-0.7	-0.5	181	6
Colour of skin	27.2%	-0.4	-0.3	349	12
Age	26.3%	-0.3	0.1	247	11
Fixed Effects (Time)	25.8%	-0.1	-0.5	73	5
Education	24.7%	-0.6	-0.3	100	2
Sex	21.2%	0.2	1.3	57	6
Degree of urbanisation	21.0%	0.5	-0.2	261	9
Population (growth)	16.2%	0.0	0.3	138	5

An additional factor influencing the result of an investigation is the specification of the statistical model as regards the number and the nature of control variables considered. The results of the analyses of the influence of control variables are summarised in Table 11.

As the table shows, the share of theory-consistent and statistically significant estimates changes when certain control variables are considered: if, for instance, some economic characteristics are used as control variables, the share of theory-consistent and statistically significant estimates is over 30%. However, even when control variables are considered, the average estimation is at most t=-1.5 and is therefore lower than the critical value.

Experiments

Description

Eighty-six studies that could not be categorised as studies based on criminal statistics, survey-based studies or studies of the death penalty were considered in the meta-analysis. The largest part thereof, namely 50 studies, are experiments. The following comments refer to experiments: 74% of them were published in the USA; 26 % of the studies date from the period before 1984, 32% were published between 1984 and 1995 and 42% thereafter. Almost all the publications are journal articles (88%). Most authors are economists (37%), 20% are psychologists, 14% criminologists and 12% sociologists. Of the investigations 61% are based on cross-section data and all the others use longitudinal or panel data. Of the objects investigated 60% were individuals and otherwise groups; 129 estimations were recorded in the 50 experiments.

With the authors' evaluation of the results, distinction was made as to whether the degree of deterrence was affected by the probability of punishment or the severity of punishment. Here too it appears that the probability of punishment exercises a greater deterrent effect than the severity of the punishment. The authors agree with the deterrence hypothesis in 83% of the studies relating to the deterrent effect of the probability of punishment, whilst this is true in only 57% of investigations relating to the severity of the punishment.

Distribution of the Estimations

The authors' evaluation of the results is confirmed by the estimations in the meta-analysis. Diagram 15 shows the distribution of the normalised t-values. This distribution departs

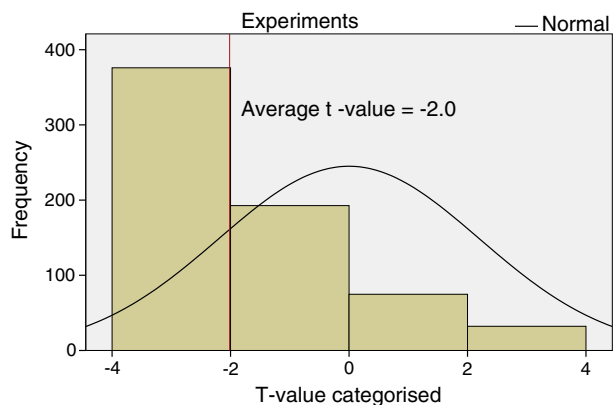**Diagram 15** Distribution of normalised t-values for estimations in experiments

Table 12 Influence of measurements of the independent variables on the result of the investigation – experiments

	Share	T-mean value	T-median	Estimations	Studies
Variation of the risk of discovery in laboratory experiments	77.4 %	-3.1	-2.9	31	16
Variation of the severity of punishment in laboratory experiments	47.8 %	-2.1	-1.7	29	9
Variation of the risk of discovery in field experiments	42.7 %	-1.4	-1.4	19	8
Variation of the severity of punishment in field experiments	21.9 %	-1.3	-1.0	17	4

considerably from the normal distribution that one would obtain if the deterrence hypothesis were false. The number of theory-consistent and statistically significant estimations exceeds by far the number of theory-falsifying and statistically significant estimations. The average t-value is significant.

Influence of the Methodological-statistical Characteristics of the Studies on their Results

Index creation was present in only 1.1% of all estimations in the case of the independent variables and 2.2% in the case of the dependent variables. Cases with index creation will therefore be ignored in later analyses. The results of analyses of the influence of measurements of the independent variables on the results of deterrence studies are summarised in Table 12. As described above, only such variables were included for which at least two studies had been considered and at least 25 estimations were available.

The results show that in laboratory experiments the proportion of theory-consistent and statistically significant results is considerably larger than in field experiments. It was most frequently possible to prove deterrent effects when the risk of discovery was varied in laboratory experiments. Control variables were rarely considered in the statistical analysis of experiments, because the consideration of control variables is generally part of the experiment.

Influence of the Objects Investigated on the Results of the Studies

Analyses of variations of the results of experimental studies on deterrence by type of offence reveal only slight differences. The proportion of confirmations for all categories of offence is over 60%. If one compares the results of estimations from experimental studies of deterrence restricted to crimes with those that concentrate on administrative offences, the latter case produces larger shares of theory-consistent and statistically significant estimations (68.3% compared with 57.8%).

Conclusion

There are many empirical studies on research into the general preventive effect of deterrence. Both the authors' assessments and a comparison of the estimations show that results negating the hypothesis are in the minority. Nevertheless, the average estimations are relatively low: the average t-value is approximately $t = -1.5$; that is, a non-significant value.

The greatest effects are found in experimental studies which concern norms not intended to protect essential interests. The smallest effects are to be found in studies on the death penalty. In this area the relevant norms protect fundamental interests. Moreover, the deterrence hypothesis is more frequently confirmed when administrative offences are investigated as opposed to crimes. The relevance and acceptance of a norm appears therefore to be an important condition for the effectiveness of deterrence (see also the analysis of Rupp 2008).

According to Coleman (1991), one macro-phenomenon gives rise to another macro-phenomenon when it first affects those involved and creates overall conditions to which they direct their actions. This gives rise to individual actions that in total then go to make up a new macro-phenomenon. Esser (1999) describes these steps as follows: the logic of the situation, the logic of selection and the logic of aggregation. Causality is a relation at the individual level in these macro-micro-macro models, whereby prevailing social conditions influence actions taken. Accordingly, a theory of general preventive deterrence ought to be conceived in a way that the law's threats of punishment and the practice of sanctioning influence individual perceptions of the costs and benefits of criminal actions. The result of this consideration influences the probability of criminal behaviour and the crime rate is then the aggregate of individual actions. An empirical investigation of such a model would require representative and therefore summable micro-sociological panel data on crime and individual utilitarian considerations, as well as data on the law's threats of punishment and the practice of sanctioning, as well as changes to them. Multi-level analyses would have to be carried out in order to check the model. An investigation with a design of this sort is not yet available. That means that in deterrence research to date the theoretical model has only been partially converted into hypotheses that can be empirically tested. The results may therefore be defective. Overall, in spite of numerous empirical studies on negative general prevention, a lot of research still has to be done.

References

Antony, J., & Entorf, H. (2003). Zur Gültigkeit der Abschreckung im Sinne der ökonomischen Theorie der Kriminalität: Grundzüge einer Meta-Studie. In H.-J. Albrecht, & H. Entorf (Eds.), *Kriminalität, Ökonomie und Europäischer Sozialstaat* (pp. 167–185). Heidelberg: Physica-Verlag.

Atteslander, P. (2003). *Methoden der empirischen Sozialforschung*. 12th edn. Berlin: Schmidt-Verlag.

Beccaria, C. (1766). *Über Verbrechen und Strafen. Übersetzt und herausgegeben von W. Alff, 1988.* Frankfurt/Main: Insel-Verlag.

Becker, G. S. (1968). Crime and Punishment: an Economic Approach. *Journal of Political Economy, 76*(2), 169–217.

Bentham, J. (1823). *An Introduction to the Principles of Morals and Legislation. Überarbeitete Auflage, 1907.* Oxford: Clarendon Press.

Buikhuisen, W. (1974). General Deterrence: Research and Theory. *Abstracts on Criminology and Penology, 14*(3), 285–298.

Cameron, S. (1988). The Economics of Crime Deterrence: A Survey of Theory and Evidence. *Kyklos, 41*(2), 301–323.

Coleman, J. (1991). *Grundlagen der Sozialtheorie, Vol. 1: Handlungen und Handlungssysteme.* München: Oldenbourg Verlag.

Diekmann, A. (2008). *Empirische Sozialforschung. Grundlagen, Methoden, Anwendungen*. 19th edition Reinbek: Rowohlt.

Ehrlich, I. (1973). Participation in Illegitimate Activities: A Theoretical and Empirical Investigation. *Journal of Political Economy, 81*(3), 521–565.

Eisele, H. (1999). *Die general- und spezialpräventive Wirkung strafrechtlicher Sanktionen. Methoden, Ergebnisse, Metaanalyse* (Ph.D. thesis). Heidelberg, University of Heidelberg.

Esser, H. (1999). *Soziologie. Spezielle Grundlagen, Vol. 1: Situationslogik und Handeln*. 3rd edn. Frankfurt/M.: Campus.

Farin, E. (1994). *Forschungsperspektive und Methodik der Metaanalyse. Forschungsberichte des Psychologischen Instituts der Albert-Ludwigs-Universität, No. 113*. Freiburg i. Br.: Albert-Ludwigs-Universität.

Feuerbach, P. J. A. (1799). *Revision der Grundsätze und Grundbegriffe des positiven peinlichen Rechts 1*. Erfurt: Henningsche Buchhandlung.

Fricke, R., & Treinis, G. (1985). *Einführung in die Metaanalyse. Methoden der Psychologie, Vol. 3*. Bern u. a.: Huber.

Hedges, L. V., & Olkin, I. (1985). *Statistical Methods for Meta-Analysis*. San Diego: Academic Press.

Kreuzer, A. (2004). Prävention durch Repression. In J.-M. Jehle (Ed.), *Angewandte Kriminologie zwischen Freiheit und Sicherheit* (pp. 205–218). Mönchengladbach: Forum Verlag.

Kromrey, H. (2006). *Empirische Sozialforschung*. 11th edn. Opladen: UTB Leske + Budrich.

Nagin, D. (1978). General Deterrence: A Review of the Empirical Evidence. In A. Blumstein, J. Cohen, & D. Nagin (Eds.), *Deterrence and Incapacitation: Estimating the Effects of Criminal Sanctions on Crime Rates* (pp. 95–139). Washington D.C.: National Academy Press.

Rosenthal, R. (1991). *Meta-Analytic Procedures for Social Research. Revised Edition*. Beverly Hills: Sage.

Rupp, T. (2008). Meta Analysis of Crime and Deterrence: A Comprehensive Review of the Literature (Ph.D. thesis). Darmstadt: Technical University. http://tuprints.ulb.tu-darmstadt.de/1054/2/rupp_diss.pdf(11/2008)

Stanley, T. D. (2001). From Wheat to Chaff: Meta-Analysis as Quantitative Literature Review. *Journal of Economic Perspectives*, *15*(3), 131–150.

Wolf, F. M. (1986). *Meta-Analysis. Quantitative Methods for Research Synthesis. University Paper Series on Quantitative Applications in the Social Sciences 59*. Thousand Oaks, CA: Sage.