



Legally binding precautionary and prevention principles: Aspects of epistemic uncertain causation



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ARTICLE INFO

Article history:

Received 16 April 2015

Received in revised form 16 June 2015

Accepted 17 June 2015

Available online 24 July 2015

Keywords:

Precaution
Causation
Catastrophes
Uncertainty
Dynamics
Law
Risk

ABSTRACT

Legally binding precautionary principles direct societal actions through regulatory laws to prevent future catastrophic or irreversible consequences that can result from human and natural hazards. Those principles connect uncertain cause and effect to public actions and hence must be transparent, scientifically sound and, on the average, demonstrably add to societal wellbeing. Focusing on legally binding forms of precaution and prevention concerning public choices, seen as prospects, we articulate how uncertainty affects causal analyses that must satisfy their legal requirements. The common measure of uncertainty is probability, explicitly used (and framed in various guises) by the three legal systems we study: the People's Republic of China, the European Union, and the United States. Probabilities can represent different forms of uncertainty, their technical differences, but use the same calculus. They occur at the intersection of legal and scientific causation and allow abstracting, from a prospective reality via models and simulations, future catastrophic or irreversible consequences. Probabilistic causal models—e.g., frailty models, power laws, self-organizing criticalities, and scale-free regularities – link environmental and other regulatory choices to reduce exposures likely to cause adverse responses. Thus, this type of causation is the scientific basis of the EU's Precautionary Principle, its Directives and Regulations; US federal regulatory and case law, and Chinese laws regarding the prevention of hazards. We use examples that clarify and guide public policy analysts to better formalize prospective public choices to avoid ambiguities or possibly incorrect results. We find that the scientific basis necessary to the analysis of precautionary and preventive choices is invariant to the jurisdictions that use it. We conclude that precautionary choices characterized by complex causation can be qualitatively assessed through adapting nine classic epidemiological criteria.

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1. Introduction

Environmental or health and safety instruments such as treaties, regulations, directives and case law both within and between the Member States in the EU; statutes and regulations in the PRC; and statutes, regulations, and case law in the US contain binding precautionary and preventive principles to justify public decisions designed to protect the public when causation is uncertain. Table 1 contains a simplified overview of the three jurisdictions we deal with in this paper. We focus on decision support through the coupling of legal reasoning with probabilistic

cause and effect to either predict or forecast future catastrophic or irreversible consequences.

The paradigm version of precautionary principle is the European Union's Consolidated Treaties – the Treaty on the Functioning of the European Union (TFEU, Lisbon Treaty, Article 191, paragraph 2) – regarding the protection of the *environment and public health*, as well as *the prudent and rational utilization of natural resources*. It states that:

Union policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Union. It shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay.

The US, which does not have a constitutional precautionary principle, mentions it in federal case law concerning EPA's regulations under the Clean Air Act, as Amended. The court stated

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Table 1
Simplified aspects of three jurisdictions: European Union, People's Republic of China, and the United States.

Jurisdiction	Key aspects	Constraints	Effect
European Union (28 Member States, MSs.) Chalmers (2006)	<ul style="list-style-type: none"> ● Socio-political union, treaty-based with laws of its Member States (e.g., civil (code) and common law (customary law)), as well as international law ● Key EU institutions include the: European Parliament, Council of the EU, European Council, European Commission, and the European Court of Justice of the European Union ● The ECJ rules on violations of a Treaty and determines culpability. A EU Treaty is similar to a supranational constitution. Directive and Regulations are key forms of secondary law made by the EU. Case law at the ECJ is essential to validate EU's or MSs actions 	<ul style="list-style-type: none"> ● European Treaties are the foundations of EU's laws such as Regulations and Directives ● The ECJ does not create laws (as opposed to the US Supreme Court) ● Proportionality, subsidiarity and other socio-economic and political principles guide the Union. Proportionality means that any freedom can only be limited by reaching the objectives of Treaties forming the union. Solidarity implies sharing burdens and advantages equally ● The Treaties give limited exclusive powers (functioning of the internal markets, monetary policy, commercial policy, e.g.,) to the EU, the residual powers either are shared or remain vested in the individual MSs 	<ul style="list-style-type: none"> ● Unity and equality via integrated citizenship, as European citizens, internal economic and monetary market for its Member States ● The objectives of a law must be legitimate and no more restrictive than needed. Directives apply to MSs less directly than Regulations and may be appealed by the MS to the ECJ
People's Republic of China (22 provinces; 34 province-level administrative units) Chen (1992) , Diamant (2005) , Information Office of the State Council of The People's Republic of China (2011)	<ul style="list-style-type: none"> ● The PRC's legal system, headed by the Constitution, with laws related to the Constitution, civil and commercial laws and several other branches as the mainstay, and consisting of laws, administrative regulations, local regulations and other tiers of legal ● The National People Congress is the ultimate decision-maker. The law on Legislation ensures exclusive legislative power to the NPC and its Standing Committee. The State Council formulates administrative regulations in accordance with the Constitution and laws ● The National Supreme People's Court has national jurisdiction; lower courts operate at the provincial and local levels ● European and Russian jurisprudence are the basis of post 1949 laws of the People's Republic 	<ul style="list-style-type: none"> ● Incomplete independence between legislation, courts and the government. All administrative, judicial, prosecutorial and military agencies and other state-level institutions are responsible to the NPC and are supervised by it ● The NPC and its Standing Committee promulgate laws. State Councils formulate administrative regulations. The operational pattern is legislation-centered, with administrative cooperation throughout the different levels of jurisdiction 	<ul style="list-style-type: none"> ● In the socialist system of laws with Chinese characteristics, some principles of law do not parallel Western legal thinking ● Focus on societal welfare, rather than the individual's ● Judicial review is not equivalent to the US or the EU. Some administrative law characteristics include the citizens' right to petition to the government ● Courts enforce judgments, unlike the US or the EU
United States (50 states) Feinman (2000)	<ul style="list-style-type: none"> ● A federation with laws initially based on English common law and Roman laws ● The Constitution is the supreme law of the United States ● Laws are created by the legislative branch (Congress). The executive branch (the Administration) is headed by the President of the US and consists of several agencies (e.g., the US EPA) and departments (e.g., Department of Energy). The US federal judicial system consists of district (trial) courts, courts of appeal, and the Supreme Court ● Courts' opinions can change the effect of the state or federal constitution and—in the case of the US Supreme Court, are of general applicability to the US. The US Supreme Court makes fundamental policy changes via its judgments 	<ul style="list-style-type: none"> ● Supremacy of federal law, relative to that of its states, in some legal areas (federal questions, delegation of powers to the federal government, money, defense, e.g.) ● Separation of powers between the legislative, executive, and judicial branches is not absolute (e.g., appointments made by the President of the US require the advice and consent of the Senate) ● Courts must exercise self-restraint (e.g., a definite controversy must exist and not simply a theoretical one; appeals can only deal with question of law, not fact; a court does not decide what it considers to be a political question) 	<p>The original Constitution has been amended, but these Amendments are difficult to make</p> <p>The courts' judgments make the Constitution a "living" instrument that keeps up with changes in societal and economic changes. Since 1925, the US Supreme Court may decide which case it hears (<i>certiorari</i> doctrine)</p>

that the CAAA has a *precautionary and preventive orientation* (*Lead Industries Ass'n, Inc. v. EPA, 647 F.2d 1130, (D.C.Cir. 1980)*).

The PRC laws also explicitly mention prevention and precaution. The prevention principle is one of the most fundamental guiding principles in China's environmental and public health-related laws. Concepts inherent to the precautionary principle, risk analysis, burden of proof, and scientific evidence are also mentioned in these laws, such as the Environmental Protection Law (adopted in 1989), the Environmental Impact Assessment Law (Adopted in 2002), the law on the Prevention and Control of Atmospheric Pollution (2000, as amended) and the law on Quality And Safety Of Agricultural Products (adopted in 2006).

The **EU's Commission** ([EU's COMM 2000 \(12-04-2011, EUR-Lex\)](#)) states that:

... the precautionary principle may be invoked when a phenomenon, product or process may have a dangerous effect, identified by a scientific and objective evaluation, if this evaluation does not allow the risk to be determined with sufficient certainty. Recourse to the principle belongs in the general framework of risk analysis ... and more particularly in the context of risk management ... The Commission stresses that the precautionary principle may only be invoked in the event of a potential risk and that it can never justify arbitrary

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