**Autonomous AI, private actors and hybrid modes of technology regulation: some firm level evidence**

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**Abstract**:

*Super-fast economic changes spurred by world-widely integrated markets and related explosive growth of generative AI represent one of the most triggering questions of the modern world. The world is on the threshold of the fourth industrial revolution that draws its energy from big data combined with algorithms and powerful computers. The current digital revolution is marked by its global scale, rapid convergence and the enormous impact that breakthroughs in emerging technologies are having on countries, economies, societies, international relations and the environment. Europe, which for centuries has been at the technological frontier, playing a major role in technological advances and been a pioneer in the production and use of cutting-edge products, is currently lagging the US and China. It may be even argued that there is a risk that the EU might fall behind in global standard setting and technology development. EU in its recent legislative proposals suggests that the AI and robotics should be human-centered and developed to complement human activities. The legal requirements should be adapted accordingly in line with the risk-based approach and due regard should be given to the precautionary principle where warranted. However, the industry level data shows that the new EU compliance requirements might needlessly increase the cost of developing and maintaining AI systems, which could make it more difficult for EU based small and medium-sized enterprises to compete in the AI markets. In addition, they could slow down the development of AI systems, as companies would have to devote more resources to ensuring compliance with the proposed EU AI Act.*

*This paper provides a multidisciplinary assessment of the proposed EU Artificial Intelligence Act and seeks to assess its impact on the research & development processes in companies that develop solutions with AI elements. While exploring the unique firm and industry level evidence paper explores the role of public and private actors in AI regulation. It also investigates hybrid modes of regulation with the focus on the inclusive growth of the AI industry in the EU. Moreover, paper provides a set of normative suggestions for an improved hybrid regulatory respond which should achieve optimal risk internalization, precaution, and firm level innovation. Furthermore, this paper provides the comparative, industry based economic, geopolitical and behavioral analysis of current regulatory approaches to AI in the EU, US and China.*

***JEL classification***: C23, C26, C51, K42, O43

***Keywords*:** autonomous artificial intelligence, risk, geopolitics, innovation, hybrid modes, private actors, technology regulation.

**1.Introduction**

Super-fast economic changes spurred by world-widely integrated markets and related explosive growth of autonomous AI represent one of the most triggering questions of the modern world. The world is on the threshold of the fourth industrial revolution that draws its energy from big data combined with algorithms and powerful computers. The current digital revolution is marked by its global scale, rapid convergence and the enormous impact that breakthroughs in emerging technologies are having on countries, economies, societies, international relations and the environment. Europe, which for centuries has been at the technological frontier, playing a major role in technological advances and been a pioneer in the production and use of cutting-edge products, is currently lagging the US and China. It may be even argued that there is a risk that the EU might fall behind in global standard setting and technology development. EU in its recent legislative proposals suggests that the AI and robotics should be human-centred and developed to complement human activities. The legal requirements should be adapted accordingly in line with the risk-based approach and due regard should be given to the precautionary principle where warranted. However, the industry level data shows that the new EU compliance requirements might needlessly increase the cost of developing and maintaining AI systems, which could make it more difficult for EU based small and medium-sized enterprises to compete in the AI markets. In addition, in the light of recent geopolitical changes they could slow down the development of generative AI systems, as companies would have to devote more resources to ensuring compliance with the proposed EU AI Act and consequently undermine the EU’s ambition on remaining on the frontier of technological progress.

 Autonomous artificial intelligence (‘AI’) and recent breakthroughs in machine–human interactions and machine learning technology are increasingly affecting almost every sphere of our lives. Such intelligence is on an exponential curve, with particular materialisations of it representing ever greater threats to privacy, possibly being ethically questionable, and even potentially dangerous, risky, and harmful.[[1]](#footnote-1) The creation of generative artificial intelligence that makes its own choices following an evaluative process raises one of the most debate-provoking questions facing the modern world. AI is unleashing a new industrial revolution where it is vital that lawmakers address the systemic challenges it brings and regulate its economic and social effects without stifling innovation. Current trends in favour of developing autonomous machines able to interact, learn, and make autonomous decisions (and hypothetically even develop personhood) also point to several different concerns regarding their direct and indirect potentially harmful effects, which call for a substantive legal and economic response.

 Russell, for example, argues that no one can predict exactly how the new AI technology will develop, but if autonomous machines far exceed human capacity and if we leave the mentioned concerns unaddressed, then autonomous AI could prove to be the last phenomenon in human history.[[2]](#footnote-2) Moreover, Turner argues that Europeans have not come to grips with what is ethical, let alone with what the law should be, thus creating a growing legal vacuum in almost every domain affected by this unprecedented technological development.[[3]](#footnote-3) Acemoglu, for example, argues that that if AI continues to be deployed along its current trajectory and remains unregulated, it may produce various social, economic and political harms.[[4]](#footnote-4) In addition, G7 leaders have at its recent summit called for the formulation of “guardrails” around the development of artificial intelligence which should reflect our democratic values and such systems should be accurate, reliable, safe and non-discriminatory, regardless of their origin.[[5]](#footnote-5) Finally, EU lawmakers have recently agreed on a tough set of rules over the use of AI, including restrictions on chatbots such as ChatGPT, as EU pushes forward in enacting the world’s most restrictive regime on the development of the technology.[[6]](#footnote-6)

 Having regard to such developments, the European Parliament and the European Commission together with many other lawmakers around the globe launched an intensive activity[[7]](#footnote-7) to consider the issue of liability and other broader challenges posed by emerging digital technologies. The EU legislator drafted the new EU Artificial Intelligence Act[[8]](#footnote-8) and (among several others) the ‘new technologies’ formation.[[9]](#footnote-9) Another task that EU lawmaker faced is the issue of whether a) it is appropriate and necessary to intervene regulatorily in AI technologies; b) such intervention should be developed in a horizontal or sectoral way; and whether c) new legislation should be introduced on the EU level.[[10]](#footnote-10) However, as commentators argue, Europe’s original plan to bring AI under control is no match for the technology’s new, shiny chatbot application and other generative AI.[[11]](#footnote-11) Joshua Bengio argues that advanced AI systems such as OpenAI’s GPT could destabilise democracy unless governments take quick action and “protect the public”[[12]](#footnote-12) and more than 1,000 AI experts and tech executives to sign an open letter last month calling for a six-month pause on the development of advanced AI systems.[[13]](#footnote-13) Moreover, Yuval Noah Harari argues that AI has hacked the operating system of human civilisation and that through its mastery of language, ai could even form intimate relationships with people, and use the power of intimacy to change our opinions and worldviews.[[14]](#footnote-14)

 Both the European Commission and the European Parliament consider the risk based approach (with civil liability for damage caused by any form of artificial intelligence) to be a crucial issue that must also be analysed and addressed on the EU level in order to ensure efficiency, transparency and consistency while ensuring optimal risk prevention by establishing legal certainty across the EU. From the law and economics perspective, the role of such a civil liability system is to deter people and firms from injuring others, discourage and prevent risks, internalise the costs of risky events, and compensate those who are injured. In addition, one may wonder whether society’s aims would be better served by reformulating our relationship with a generative AI in a more radical fashion and whether the current rules indeed cover all of the potential risks generated by generative AI.

 Incorporating the main insights from the law and economics literature,[[15]](#footnote-15) this paper seeks to address the role played by public policy in regulating generative AI, the associated risks, and innovation opportunities caused by such AI. In other words, this paper provides a multidisciplinary assessment of the proposed EU Artificial Intelligence Act and seeks to assess its impact on the research & development processes in companies that develop solutions with AI elements. While exploring the unique firm and industry level evidence paper explores the role of public and private actors in AI regulation. It also investigates hybrid modes of regulation with the focus on the inclusive growth of the AI industry in the EU. Moreover, paper provides a set of normative suggestions for an improved hybrid regulatory respond which should achieve optimal risk internalization, precaution, and firm level innovation. Furthermore, this paper provides the comparative, industry based economic, geopolitical and behavioural analysis of current regulatory approaches to AI in the EU, US and China.

 The analysis presented here is both positive and normative. The analytical approach engages in interdisciplinary analysis and enriches it with concepts used in the economic analysis of law.[[16]](#footnote-16) To make the economic analysis accessible to readers not acquainted with sophisticated mathematical reasoning, the law and economics toolkit relied upon follows the traditional comparative law and economics approach.[[17]](#footnote-17)

 This paper is structured as follows. The first part offers the general background and recapitulates literature on the main regulatory approaches. Second part provides a set of normative suggestions for an improved hybrid regulatory respond which should achieve optimal risk internalization, precaution, and firm level innovation. The third part briefly comments on recent EU Artificial Intelligence Act. Finally, some conclusions are presented.

**2.Literature review: conceptual and theoretical framework**

This section surveys a crucial debate in law and economics and also in other social sciences concerning the balance between the state and the market. Which activities should be left to markets and which others should be the purview of the state? Classic law and economics textbook suggest that such intervention is warranted only under clearly delineated circumstances. Among others, these include also the presence of “negative externalities,” which materialize when actions by individual actors have major negative consequences for others that are not mediated via markets, paving the way for excessive level of some activities.[[18]](#footnote-18) Economically speaking the potential hazards and damages caused by the uncontemplated activity of autonomous AI are a classic example of negative externalities and asymmetric information problem. Namely, the problem of positive transaction costs and asymmetric information results in the so-called market failures which cause suboptimal (inefficient) amount of economic activity and inefficient allocation of resources.[[19]](#footnote-19) Collective-action problem, agency problem, tragedy of commons and game theoretical prisoner’s dilemma phenomena are the notorious embodiment of positive transaction costs and asymmetric information problems that generate negative externalities. The materialization of these negative externalities accompanied by the “private law failure” prima facie warrants the employment of the regulatory intervention in the public interest.[[20]](#footnote-20) In other words, allocative efficiency and optimal human behaviour will result only if decision-making process achieves 100% internalization of all external costs and benefits.

 However, it has to be emphasized that the mere existence of market failures *per se* is not an adequate ground for the regulatory intervention. Such a regulatory intervention should take place if and only if the costs of such an intervention do not exceed the benefits of such an intervention. Namely, efficiency gains of such an intervention may be outweighed by market distortions, increased transaction cost and other misallocations in other sectors of the economy fueled by such a regulatory intervention.[[21]](#footnote-21) Moreover, as Tinbergen suggests that in principle that N problems require N legal rules – One Instrument Per Problem Rule.[[22]](#footnote-22) Moreover, the notorious “tragedy of commons” concept suggests that individuals and/or firms might not see themselves as responsible for common resources such as public safety and might eventually destroy such common resource.[[23]](#footnote-23)

 Where market failures are accompanied by private law failures there is the prima facie case for regulatory intervention. However, does the mere existence of any market failures justify corrective government intervention? Many instances of market failures are remediable “by private law and thus by instruments which are compatible with the market system in the sense that collective action is not required.[[24]](#footnote-24) Yet, as Professor Ogus convincingly shows private law cannot always provide an effective solution.[[25]](#footnote-25) Thus, where the “market failure” is accompanied with the “private law failure” there is, at least in theory, a *prima facie* (though not a conclusive) case for regulatory intervention. Namely, series of empirical studies have shown that the mere presence of suspected market imperfections does not by itself warrant government corrective action and regulatory intervention.[[26]](#footnote-26) Namely, once the government steps in, it might often exclude private initiative that might, in good entrepreneurial fashion, have invented ways of alleviating the suspected market imperfection.[[27]](#footnote-27) “Government intervention tends to foreclose such demonstration and thereby to become a self-perpetuating process.”[[28]](#footnote-28) Literature also suggest that even in instances of repeated market failures, the costs stemming from such imperfections should be weighed against those which government interventions itself generates.[[29]](#footnote-29) Namely, for such optimal governmental intervention one assumes perfect functioning of such public administration that merely maximizes social benefits.

 However, governmental intervention, while seeking to address certain market failure (and maybe even effectively curing particular, individual market failure), may unintentionally while distorting the rests of the markets imposed even higher cost upon society and its citizens.[[30]](#footnote-30) In other words, as a rule of thumb, regulatory intervention is warranted if, and only if the costs of such intervention do not exceed the its benefits. The argument for such a rule of thumb is that either regulatory solution may be no more successful in correcting the inefficiencies than the market or private law, or that any efficiency gains to which it does give rise may be outweighed by increased transaction costs or misallocations created in other sectors of economy.[[31]](#footnote-31)

 The costs of government failure should be carefully compared and weighed against those of market failure. For example, such distortions may, besides government’s tendency to perpetuate, materialize in rent seeking activities of particular interest groups under the guise of the general interest.

 Moreover, a traditional approach of political economy believed that that it was the main function of government to correct market failures.[[32]](#footnote-32) However, these justifications of governmental regulatory functions have one common weakness – they assume a perfectly functioning government. Yet, if there is a market failure, it cannot be excluded that there is also “government failure.”[[33]](#footnote-33) According to public choice theory one may assume that the main motivation of politicians is to maximize their individual utility and in principle seek to maximize the votes they get in general election.[[34]](#footnote-34) However, the regulatory intervention, enforcement of policies and correction of market failures is in reality executed by the public administration (bureaucrats). Public choice theory suggests that also the bureaucrats’ principal motivation is to maximize their utility.[[35]](#footnote-35) Their preferences often diverge, depending on function that they exercise within the organization.[[36]](#footnote-36) Literature argues that they may be interested in job security, a higher salary, more attractive employment terms, an increase in power, public appreciation and status or in decreasing their workload.[[37]](#footnote-37) Public choice theory hence suggest that bureaucrats are mainly motivated by maximizing their budget and might not be motivated, as assumed idealistically until the 1950s, by a romantic drive to correct market failures and other sources of inefficiencies.

 In addition, poor policy may result from inadequate information, failure to anticipate significant side-effects of certain behavior, phenomena (like generative AI) or regulatory instruments.[[38]](#footnote-38) Such poor regulatory intervention may occur where the government had to be seen to respond rapidly to widespread calls for action, following a disaster which had captured the public attention,[[39]](#footnote-39) or when it lacks resources or adapting a passive, compromising approach to contraventions.[[40]](#footnote-40) Therefore, public choice theory offers an additional support to our rule of thumb stating that “state interventions are only justified if they produce less harm than market inefficiencies.”

 In recent years study of regulation has become a multi-disciplinary field, with substantial contributions to regulatory debates being made by lawyers, political scientists, psychologists, behavioral economists, and others.[[41]](#footnote-41) Regulation actually become central to the interaction between economic, legal, political, entrepreneurial and innovation spheres. The rise of a better regulation agenda was then designed to encompass consistency between “red-tape” and “regulatory quality” developments.[[42]](#footnote-42) The so-called command-and-control (top-down approach) was the initial starting of regulators which subsequently evolved into the less-restrictive and incentive-based regulatory policies.[[43]](#footnote-43) This approach then evolved into the regulating by auditing the control regimes being operated within firms and hence relying on schemes of “meta-regulation.”[[44]](#footnote-44) Next step was then to see the regulatory issues in terms of risk-based, principle-based, control-based and risk management.[[45]](#footnote-45) In other words, regulation has become a central organizing principle for worlds of practice and research.[[46]](#footnote-46) Scholarly effort also produced insightful literature on compliance and deterrence approaches,[[47]](#footnote-47) smart regulation,[[48]](#footnote-48) problem-centered regulation,[[49]](#footnote-49) and behaviorally informed regulation (nudging).[[50]](#footnote-50) Hence regulatory literature operates on the fruitful trajectory between “trans-disciplinary” and “inter-disciplinary” explorations.[[51]](#footnote-51)

 In relation to direct regulation of generative AI[[52]](#footnote-52) Hacker et al. offer a novel terminology to capture the AI value chain in LGAIM settings by differentiating between LGAIM developers, deployers, professional and non-professional users, as well as recipients of LGAIM output.[[53]](#footnote-53) They also suggest a tailor-made regulatory duties to these different actors along the value chain and suggest strategies to ensure that LGAIMs are trustworthy and deployed for the benefit of society at large where rules in the AI Act and other direct regulation must match the specificities of pre-trained models.[[54]](#footnote-54) Dwivedi et al. argue that generative AI offers significant gains in the banking, hospitality and tourism, and information technology industries, business activities (e.g. management and marketing), yet it may also bring disruptions to practices, threats to privacy and security, and uncontemplated consequences of biases, misuse, and misinformation.[[55]](#footnote-55)

 Moreover, Helberger and Diakopolous argue that the European AI Act by its current risk-based approach is too limited for facing ChatGPT & co.[[56]](#footnote-56) They suggest that generative AI systems such as ChatGPT differ on at least two important points from the ‘traditional’ AI systems the Act has originally been written for: dynamic context and scale of use. Generative AI systems are not built for a specific context or conditions of use, and their openness and ease of control allow for unprecedented scale of use.[[57]](#footnote-57)

**3.Towards and improved regulatory respond**

The question of what represents a ‘good’ regulation has been extensively discussed in the literature[[58]](#footnote-58) and, although what constitutes such a ‘good’ regulation is difficult to establish, generally five criteria should be fulfilled.[[59]](#footnote-59) Moreover, regulation can be seen as being inherently about the control of risks, where risk is generally defined as the probability of a particular event (or hazard) occurring and the consequent severity of the impact of that event.[[60]](#footnote-60) The risk regulation is centrally concerned with the highly contested management of Knightian risk and uncertainty, the challenges of dealing with uncertain popular responses to anticipated or materialized risks and the issues presented by communication about risks.[[61]](#footnote-61) Literature offers a plethora of different legal instruments including rules of civil liability, command and control public regulations, market-based instruments, “suasive” and voluntary instruments, smart regulatory mixes and hybrid regulatory approaches.

 Acemoglu for example argue that if AI continues to be deployed along its current trajectory and remains unregulated, it may produce various social, economic and political harms. These include: damaging competition, consumer privacy and consumer choice; excessively automating work, fuelling inequality, inefficiently pushing down wages, and failing to improve worker productivity; and damaging political discourse, democracy's most fundamental lifeblood.[[62]](#footnote-62) Although there is no conclusive evidence suggesting that these costs are imminent or substantial, it may be useful to understand them before they are fully realized and become harder or even impossible to reverse, precisely because of AI's promising and wide-reaching potential. Acemoglu also suggest that these costs are not inherent to the nature of AI technologies, but are related to how they are being used and developed at the moment - to empower corporations and governments against workers and citizens.[[63]](#footnote-63) As a result, efforts to limit and reverse these costs may need to rely on regulation and policies to redirect AI research.[[64]](#footnote-64) This section offers a set of law and economics recommendations for an improved, EU wide, regulatory intervention which should deter hazards, induce optimal precaution and simultaneously preserve dynamic efficiency – incentives to innovate undistorted.

3.1 Generative AI and regulatory problems

Generative AI, which produces text or images automatically, has become a potential menace because of its awesome power and its uncontrollability — a noxious combination that presents a unique set of problems for anyone hoping to limit its capacity for harm. Moreover, Helberger and Diakopolous argue that current super-fast generative AI development challenge the current regulatory approach in the EU AI Act in at least three important ways: a) the feasibility of sorting generative AI systems into high/no high risk category; b), the unpredictability of future risks; and c) concerns around private risk ordering.[[65]](#footnote-65)

 Namely, before recent unprecedented and super-fast evolvement of the ChatGPT, a consensus had largely formed around the objectives of AI regulation.[[66]](#footnote-66) All the attention was on trying to control the applications of the technology, with a particular focus on its use in high-risk situations such as healthcare. Now, an altogether different question has presented itself. When a smart, all-purpose chatbot has the ability to cause upheaval across a wide range of human activity, is it time to regulate the AI models themselves?

 Moreover, the so-called general-purpose technologies such as generative AI, which can be used for many different things, present a particular problem for regulators. With AI, it is difficult to separate benign uses from the more sinister. And AI makers admit they cannot explain exactly how the technology works or predict when a particular input in the form of a prompt will lead to a particular output.[[67]](#footnote-67)

 Furthermore, generative AI is not a simple, ex-ante programmed algorithm but a neural network where researchers can only control its inputs and can observe the outcomes – yet the process and mechanisms inside of the neural network itself on how certain outcomes have been reached remains out of our comprehension. Hence, regulatory push for transparency, potentially making it easier to subject the models to a greater degree of outside scrutiny, might be due to our inability to understand what is happening inside of a learning system such as generative AI not as straightforward or effective as exposing the code in traditional software.

 Setting standards for safety processes, increasing transparency about the models’ workings and giving outside experts a chance to kick the tyres are all ways to increase assurances about generative AI. The question is what formal regulation, if any, is needed — and what restrictions should be placed on models deemed as super-risky?[[68]](#footnote-68)

 In addition, the current breakneck pace of development in AI would also cause problems, since today’s most advanced models quickly become tomorrow’s routine pieces of software. At the same time, some of the capabilities currently available only in large, all-purpose models such as ChatGPT may soon also come from much smaller systems trained to handle narrower tasks.

 As the proceeding sections demonstrate, generative AI might be able to perform more action than merely process information and will exert direct control over objects in the human environment. Somewhere out there are stock-trading AI, teachers-training AI and economic-balancing AI that might be even self-aware. Such generative AI might than cause serious indirect or direct harm.[[69]](#footnote-69) In order to mitigate this potentially serious hazards and damages the combination of the *ex ante* regulatory intervention (regulatory standards) and *ex post* imposition of liability via tortious liability is at law-maker’s disposal. In other words, this system of *ex ante* regulation and *ex post* sanctioning is designed to deter a future harmful behaviour. However, the triggering question is how would a law-maker modify the generative AI’s behaviour? Moreover, the prospect that AI might behave in ways designers or manufacturers did not expect challenges the prevailing assumption within tort law that courts only compensate for foreseeable injuries.

3.2. Law and economics of torts

Tort law (the law of compensatory damages) defines the conditions under which a person is entitled to damage compensation if her claim is not based on a contractual obligation and encompasses all legal norms that concern the claim made be injured party against the tortfeasor. Economically speaking every reduction of an individual’s utility level caused by a tortious act can be regarded as a damage.[[70]](#footnote-70) Tort law rules aim at drawing a just and fair line between those noxious events that should lead to damage compensation and others for which the damage should lie where it falls. A thorough overview of tort law and economics literature exceeds the limitations of this paper and can be found elsewhere.[[71]](#footnote-71) However, is should be emphasized that tort law and economics literature traditionally addresses three broad aspects of tortious liability. The first is the assessment of its effects on incentives (both whether to engage in activities and how much care to exercise to reduce the risk when so doing) – analytically speaking tort law is thus an instrument that improves incentives;[[72]](#footnote-72) second concerns risk-bearing capacity and insurance and the third is its administrative expense comprising the costs of legal services, the value of litigants’ time and the operating costs of the courts.[[73]](#footnote-73) These three categories are than subjected to rigorous cost-benefit analysis that should yield the marginal conditions for an efficient outcome. Wittman for example argues that the key is to find liability rule where the equilibrium levels of prevention undertaken by the injurer and the victim coincide with the optimal levels.[[74]](#footnote-74)

 However, it should be emphasized that even after a long debate on the economic effects of tort law there is still much disagreement as to the legitimate place of tort law in modern society. Should tort law be a comprehensive and expanding deterrence system, regulating securities’ and other markets, old and new hazards and then be open to all kinds of legal innovations necessary for optimal deterrence? Or should its domain be more restricted to the classical cases and leave complicated risks and hazards to other social institutions – safety regulations.[[75]](#footnote-75) This depends to a great extent on two factors, the availability of private insurance against hazards and the capacity of civil courts to obtain and process information.[[76]](#footnote-76) Yet, Schaefer also emphasizes that independent from potential informational constraints the tort system cannot be an efficient institution as long as reducing the scope of liability results in distortive incentive effects which are less costly than the resulting savings of costs of the judicial system and easier insurance coverage.[[77]](#footnote-77) As the costs per case filed are very high in the tort system, alternative institutions like no-fault insurance schemes or *ex ante* safety regulation might be better suited to reduce the overall costs of accidents than tort liability.[[78]](#footnote-78)

3.3 Liability for harm versus safety regulation

In his seminal paper on liability for harm versus regulation of safety professor Shavell paved the way towards analytical understanding of the optimal employment of tort liability and/or regulatory standards. Shavell instrumentally addressed the effects of liability rules and direct regulation upon the rational self-interested party’s decision-making process.[[79]](#footnote-79) Namely, liability in tort and the safety regulation represent two different approaches for controlling activities that create risks of harm and that induce the optimal amount of precaution.[[80]](#footnote-80) However, as Shavell emphasizes there have been major mistakes made in the use of liability and safety regulation.[[81]](#footnote-81) Regulation, when applied exclusively, had often, due to manifold problems, proved to be inadequate, whereas also tort liability might provide, due to causation problems, sub-optimal deterrence incentives.[[82]](#footnote-82) Shavell also argues that regulatory fines are identical to tortious liability in that they create incentives to reduce risks by making parties pay for the harm they cause.[[83]](#footnote-83) Yet fines also suffer from the inability to pay for harm and from possibility that violators would escape public agency.[[84]](#footnote-84) Nevertheless, as Shavell emphasizes, regulatory fines have advantage in instances where private suits (and related tortious liability) would not be brought due to difficulty in establishing causation or where harms are widely dispersed.[[85]](#footnote-85)

 Rose-Ackerman suggests that regulation (statues) should generally dominate so long as agencies can employ rule-making to shape policy.[[86]](#footnote-86) The tort rules should consequently be limited to areas of activity not covered by regulation and to situations in which courts can complement the regulatory (statutory) scheme with a supplementary enforcement and compensation mechanism.[[87]](#footnote-87)

 In addition, a tortfeasor who cannot fully pay for the harms that is causes and for which she has been found legally liable is said to be “judgement proof.” Shavell coined the term “judgement proof” in his path-breaking article on the judgement-proof problem where he showed that the existence of the judgement-proof problem seriously undermines the deterrence and insurance goals of tort law.[[88]](#footnote-88) He notes that judgement-proof parties do not have the appropriate incentive either to prevent accidents or to purchase liability insurance.[[89]](#footnote-89) In other words, the judgement-proof problem is of substantial importance, since if the injurers are unable to pay fully for the harm they may cause, their incentives to engage in risky activities will be greater than otherwise. Summers also shows that the judgement proof injurers tend to take too little precaution under strict liability, since the accident costs are only partially internalized.[[90]](#footnote-90)

 Moreover, one should that strict liability provides incentives for an optimal engagement in an activity if parties assets are enough to cover the harm they might cause, but their incentives will be inadequate if they are unable to pay for the harm.[[91]](#footnote-91) Furthermore, Shavell argues that also under the negligence rule in situations that injurers are not induced to take optimal care, or there are errors in the negligence determinations that sometimes result in findings of negligence, then the existence of judgement-proof problem induce injurers to engage more frequently (sub-optimally) in the activity than they normally would.[[92]](#footnote-92)

 Furthermore, when injurers are unable to pay all the harm, they might cause than also their incentives to take care tend to be suboptimal and the motive to purchase liability insurance is diminished too.[[93]](#footnote-93) Namely, Shavell shows that risk-averse injurers who may not be able to pay for the entire harm they cause will tend not to purchase full liability insurance or any at all.[[94]](#footnote-94) Particularly, the nature and consequences of this judgement-proof’s effect depend on whether liability insurers have information about the risk and hence link premiums to that risk.[[95]](#footnote-95) Consequently, reduction in the purchase of liability insurance tends to undesirably increase incentives to engage in the harmful activity.[[96]](#footnote-96) In addition, to the extent that liability insurance is purchased, the problem of excessive engagement in risky activities is mitigated; but the problem of inadequate levels of care could be exacerbated if insurers’ ability to monitor care is imperfect.[[97]](#footnote-97)

 Boyd and Ingberman extend this analysis to alternative precaution and accident technologies (pure probability, pure magnitude and joint probability-magnitude technology) and suggest supracompensatory-punitive-damages as a potential remedy for the inefficiently low incentives to adopt precaution.[[98]](#footnote-98) They also conclude that extending liability to lenders of capital to an risky undertaking is increasing the probability of environmental accidents.[[99]](#footnote-99) De Geest and Dari-Mattiachi revisit the use of negligence rules, punitive damages and under-compensation and show the superiority of average damages over punitive damages in the pure probability technology.[[100]](#footnote-100) They also show that strict liability induces optimal precaution above a high and intermediate threshold of assets and zero-magnitude-reducing (or sub-optimal) precaution otherwise.[[101]](#footnote-101)

 Others have extended initial analysis on legal policy regarding liability insurance[[102]](#footnote-102) and provided the optimal conditions for the combined use of liability insurance[[103]](#footnote-103) and a minimum amount of assets to undertake a given activity.[[104]](#footnote-104) Picker on the other hand explored the extension of liability to lenders who contributes capital to activity resulting in external harm and concluded that such extension is actually increasing the probability of accidents.[[105]](#footnote-105) Whereas Hiriart and Martimort analysed the extension of liability in a principal-agent setting and suggest that the extension of liability towards deep-pocket related third parties might have a beneficial effect.[[106]](#footnote-106)

3.3. Liability for harm and innovation

The essence of product liability is the appointment of the risks inherent in the modern mass production of goods. In last decades law and economics scholarship shifted its attention towards the potential detrimental effects of different tort law regimes and product liability on the innovative activity (Manning, 1997). Over the last 40 years, the core of liability law world widely has traversed from simple negligence to the far more complex concept of strict product liability. This change has been triumphed by many as a victory for consumers and safer products. In theory, enhanced quality, safety, and innovation should have resulted from this liability revolution. However, scholars found that the reverse occurred (Herbig and Golden, 1994; Malott 1988; McGuire, 1988). They show that product liability costs in US have prompted some manufacturers to abandon valuable new technologies, life-saving drugs, and innovative product designs (Herbig and Golden 1994; Malott 1988; McGuire 1988).

 Viscusi and Moore in their seminal article examined these competing effects of liability costs on product R & D intensity and new product introductions by manufacturing firms.[[107]](#footnote-107) They convincingly show that at low to moderate levels of expected liability costs, there is a positive effect of liability costs on product innovation.[[108]](#footnote-108) However, Kovac et al. in their recent study on the interrelationships between propensity to patent, innovative activity and litigation and liability costs generated by different legal systems show that product liability and related litigation costs across firms and countries do not account for the failure of pharmaceutical firms to acquire a valid patent.[[109]](#footnote-109) Thus, product liability and related litigation might be perceived as a filter that screens hazardous innovation in the pharmaceutical field and provides incentive for an efficient, productive and safe innovations and simultaneously also deter opportunistic litigants.

3.4 Regulatory strategies: self-regulation, meta-regulation and regulatory networks

Sparrow suggests that for some risks responsibilities (regulatory advantages) might be held close by the regulator (classic top-down approach) whereas for others where regulated entities have appropriate motivations and competences the regulator may delegate certain aspects of the control task to industry (information advantage and accountability).[[110]](#footnote-110) For example, the changes in regulatory strategy around the world have produced new forms of regulation: responsive-regulation, self-regulation, performance-based regulation, command-and-control regulation, right-touch regulation, outcome-based regulation, light-touch regulation, really-responsive-regulation, co-regulation, incentive based regulation, market-harnessing control regulation, regulation by contract, disclosure regulation (e.g. naming and shaming), direct action regulation, nudge based regulation, rights and liabilities regulation, public compensation & social insurance model regulation ect.[[111]](#footnote-111)

 Self-regulation is taking place when a group of firms exerts control over its own membership and their behaviour.[[112]](#footnote-112) A host of different arrangements of self-regulatory regimes can be identified and the case for such an approach rest principally on considerations of expertise and efficiency.[[113]](#footnote-113) Ayres and Braithwaite also distinguish enforced self-regulation from co-regulation.[[114]](#footnote-114) They characterize co-regulation as the one with industry-association self-regulation with some oversight and/or ratification by government.[[115]](#footnote-115) Enforced self-regulation on the other hand involves a subcontracting of regulatory functions to regulated firms.[[116]](#footnote-116) Meta-regulation refers to processes in which the regulatory authority oversees a control of risk-management system rather than carries out regulation directly - it steers rather than rows.[[117]](#footnote-117) Literature offers a list of potential advantages of delegating regulation down to firms.[[118]](#footnote-118) For example, ‘the expenses and strictures of command and control regimes can be replaced by systems that are cheaper and more effective because corporations are given freedom and incentives to work out what, for their mode of operating, is the best way to avoid the given mischief.’[[119]](#footnote-119) Moreover, such firm specific meta-regulation may be more precise than industry/technology-wide rules, which are by definition highly complex, abstract and vague because they have to deal with a certain negative externality in all its possible contexts and materializations.[[120]](#footnote-120) Furthermore, transaction costs argument (introduction easier with firm-specific rules, managers more likely to innovate and improve controls and to align their modes of conduct with the expectations of the society, limited enforcement capacity and resources; asymmetric information problem) and the potential to change the general culture of firms and industrial sectors are also invoked in favour of meta-regulation.[[121]](#footnote-121) However, meta-regulation system has its own deficiencies, since ill-intentioned, ill-informed or inefficient firms may also fail to devise appropriate rules.[[122]](#footnote-122)

 Finally, literature emphasizes that the best regulatory outcomes will generally involve mixtures of institutions and instruments (hybrid types of regulation).[[123]](#footnote-123) However, the problem of how to design the optimal mixes or to state in advance which institutions and instruments will work together effectively can hardly be overstated.[[124]](#footnote-124) Sparrow for example suggests that risk-based regulation (problem solving) should be placed at the centre of regulatory policymaking and stresses the need to define problems precisely, to monitor and measure performance and to adjust strategy on the basis of performance assessment.[[125]](#footnote-125) The ‘really-responsive’ regulatory approach requires that in designing and developing regulatory systems attention has to be paid to five main matters: the behaviour, attitudes, and cultures of regulatory actors; the institutional settings of the different regulators; the different logics of regulatory tools and strategies (and their interaction); the regime’s own performance over time; and changes in each of these elements.[[126]](#footnote-126)

3.5 Current regulatory approaches: a comparative assessment

In the US, the National Institute of Standards and Technology has been recently working with experts to try to come up with standards for how these systems should be designed, tested and deployed. Moreover, the EU-US governments are implementing policies that will be basis for the democratic governance of AI. On the other side EU-China are implementing two completely different approaches. EU has taken more horizontal approach and China has more vertical approach, meaning that the rest of the world will see what approach is better, and choose the better one, or the one that means it suits the most, or probably the best approach will be mixture of both.

 On side of horizontal approach, the biggest negative consequence is stifling innovations, pure horizontal will not be able to set out meaningfully specific requirements for all applications of AI, as it tries. The AI Act in the EU employs comprehensive horizontal legislation to define the overall scope of AI applications that require regulation. However, it also allows domain-specific entities like courts, standards bodies, and developers to establish specific parameters and strategies for compliance. To enhance its contextual effectiveness, the EU complements the requirements outlined in the AI Act with co-regulatory approaches such as regulatory sandboxes, updated liability policies to address AI challenges, and related legislations pertaining to data, market structures, and online platforms.[[127]](#footnote-127) Furthermore, implementing new vertical regulation for each new AI application will most probably create a compliance mess among regulators and companies as well. So most probably in China vertical approach will be used to tighten information controls.[[128]](#footnote-128) (O'Shauhnessy & Sheehan, 2023)

 In the last year, China has introduced groundbreaking regulations that are globally unique, focusing on algorithms and AI. Their approach has been primarily vertical, where they select specific algorithm applications and establish regulations that govern their implementation in specific contexts. The initial regulations in this category have concentrated on recommendation algorithms and deep synthesis technology (generative AI).

 The differences in regulatory approaches can also create competitive advantages or disadvantages for AI innovation on a global scale. Companies operating in different regions may face varying levels of regulatory hurdles, influencing where they choose to invest in AI research and development.

 The initial achievements of the EU-U.S. Trade and Technology Council in the field of AI have been notable, particularly in their efforts to establish shared metrics and methodologies for trustworthy AI. In addition, both the EU and U.S. have reached an agreement to cooperate on international AI standards and conduct joint studies on emerging AI risks and the utilization of new AI technologies.[[129]](#footnote-129)

 The management of AI risk in the United States is widely spread across various federal agencies, with many of them adapting to AI without seeking new legal authorities. In the meantime, the U.S. has made investments in non-regulatory infrastructure, including the development of a new framework for AI risk management, evaluations of facial recognition software, and substantial funding for AI research. On the other hand, the European Union (EU) takes a different approach to AI risk management, which involves a more comprehensive set of laws specifically tailored to different digital environments. The EU intends to impose fresh requirements on AI systems deemed high-risk in socioeconomic processes, government utilization of AI, and regulated consumer products with AI systems. Additionally, other EU legislation promotes greater transparency and public influence in the design of AI systems used in social media and e-commerce.[[130]](#footnote-130)

 One can also make an anecdotal analysis and compare the rising number of bills containing “artificial intelligence” with decreased number of in year-over-year private investment in AI. So, when policymaker interest has raised - number of bills containing “AI” from just 1 in 2016 to 37 in 2022 – for the first time in the last decade, year-over-year private investment in AI decreased, for 26,7% less than in 2021.[[131]](#footnote-131)

 However, UK has embarked on a very different regulatory path then the EU counterpart and on 29th March 2023 published a white paper entitled “A pro-innovation approach to AI regulation.” The paper sets out a new “flexible” approach to regulating AI which is intended to build public trust and make it easier for businesses to grow and create jobs. Unlike the EU there will be no new legislation to regulate AI.[[132]](#footnote-132) The white paper outlines the following five principles that regulators are to consider facilitating the safe and innovative use of AI in their industries: a) Safety, Security and Robustness (applications of AI should function in a secure, safe and robust way where risks are carefully managed); b) Transparency and Explainability (organizations developing and deploying AI should be able to communicate when and how it is used and explain a system’s decision-making process in an appropriate level of detail that matches the risks posed by the use of the AI); c) Fairness (AI should be used in a way which complies with the UK’s existing laws (e.g., the UK General Data Protection Regulation), and must not discriminate against individuals or create unfair commercial outcomes); d) Accountability and Governance (measures are needed to ensure there is appropriate oversight of the way AI is being used and clear accountability for the outcomes); and e) Contestability and Redress (people need to have clear routes to dispute harmful outcomes or decisions generated by AI).

 Moreover, over the next 12 months, UK regulators will be tasked with issuing practical guidance to organisations, as well as other tools and resources such as risk assessment templates, that set out how the above five principles should be implemented in their sectors.[[133]](#footnote-133)

However, on should note that this approach does make the UK an outlier in comparison to global regulatory trends. As already stated US and EU are developing or passing special laws to address alleged AI dangers, such as algorithmic rules imposed in EU, China or the United States.

**4.Comment on the EU Artificial Intelligence Act**

Generative AI needs to be regulated in a way that balances innovation (enabling EU to be on the frontier of technological progress), geopolitical equlibrium and potential harms. With the technology now at an inflection point it is important to regulate it well. Developing policy frameworks that anticipate potential harms and unlock benefits requires, as we argue, deep discussions between governments, industry experts, publishers, academia and civil society. Moreover, we should achieve a continuous investment in research and development for responsible and safe application of generative AI. This section employs a novel industry level insights from transport, automation, process control and digitalization (in industry and buildings) industries and provides a set of normative suggestions for an improved hybrid regulatory respond which should achieve (balance) optimal risk internalization, precaution, and firm level innovation.[[134]](#footnote-134)

 Previously discussed regulatory models are not mutually exclusive and should co-exist in the so-called hybrid regulatory models. For example, an independent regulatory agency may be supplemented and strengthened by contracting-out or outsourcing of certain regulatory functions, if the external capacity is there and if it is cost effective. A regulatory contract may also be supported by outsourced functions and expertise provided by third parties (consultants or an expert panel). Thus, hybrids are possible, including the co-existence of regulatory contracts and independent regulatory oversight. The choice from the menu of options, including hybrid combinations, depends ultimately on the best fit with the technological development and progress.[[135]](#footnote-135)

4.1 Co-regulation and hybrid approach

Performed analysis and firm level interviews (and their reflection upon the proposed EU AI Act) calls for the following regulatory issues: a)Providing real/workable/ definition of AI; b) Providing definitions of risk, high-risk, low-risk, remote biometric identification and harm; c) Determining standards to be applied to AI systems; e) Regulatory sandboxes with proof best practice guidelines and other supporting materials, documented obligations and how to implement them on firm- and industry-level; f) Transferring the formulation of precise technical requirements to expert standard-setting bodies will allow more technical knowledge and precision to be focused on precise specifications; g) Industry must play an important role in the standardisation process (co-regulation); h) A vertical soft law. A purely horizontal regulatory approach will not be able to set out meaningfully specific requirements for all applications of AI; i) Legislators to be able to amend or supplement the main horizontal rules to keep up with technology. Static horizontal regulation for a rapidly evolving technology is unlikely to be sustainable; j) Allowing compliance strategies to be flexible across sectors and as technology evolves; 10) The possibility of adopting common technical specifications if harmonised standards are not available or not sufficient; 11) Use of soft law (an instrument that has some normative or enforcement effects: opinions, recommendations, communications, non-legislative resolutions, memos, guidelines). Soft law increases the effectiveness of EU policy and thus the substantive legitimacy of EU policy; 12) Self-regulation of the industrial sector. Many sectors have schemes that reflect technical or process standards. There are also a series of codes of conduct, practice or ethics, and in some industries there are agreements or Memoranda of Understanding (MoUs) that have some regulatory effect. Accreditation schemes are a specific mechanism used in some areas;[[136]](#footnote-136) 13) Rules for cooperation between national standardisation bodies, Member States and the EU Commission in drawing up ´technical specifications that a product must comply with (above all in terms of quality, environmental protection and health); 14) Mediating between the horizontal approach to regulating AI and the sectoral dimensions of markets, given the sectoral regulations that may already govern some AI tools in sectors, the structural characteristics of AI-driven services, and the traditional objectives of legislation; 15) Companies can rent access to ChatGPT, however in such instances this access should be closely monitored so that regulators know who is using those systems so we can track potentially illegal or dangerous uses; 16) Make AI systems more transparent, including auditing the data being used to train them and their outputs (including international coalition to fund AI research in areas that matter to the public, such as climate and healthcare – like investments into CERN in Europe or space programmes).

 Industry also suggest that the most important is to raise trust level in AI among the population, all stakeholders where a) Tech companies should orient AI research and development around humanistic values, prioritizing the pursuit of humanity's best interest over corporate profit; companies should engage in public dialogues about both - benefits and risks of AI; b) Everything should be transparent in order to reduce lack of trust into AI tech - no company should be against audits and reviews by third parties - AI system should be developed transparent and explainable (obstacle for companies); c) Foster a culture of responsible AI development and use within the company; and d) Leverage existing regulations, such as GDPR, to ensure that AI systems are developed in compliance with data protection laws.

 Interviewed industry experts also suggest that regulators, policymakers and other stakeholders should include companies and together try to shape effective and balanced regulatory frameworks, try to establish ethical and legal guidelines for AI development and use, in a way so that companies can contribute their expertise and perspectives. Moreover, companies should be coordinated and advocate for the countries/Community (EU) to work on developing alliances with other countries so that development is really around human values and coordinated worldwide, like GAIA mentioned by Amy Webb in her book Big 9, which does not include China, but for the good of humanity, it would be best with China as well.[[137]](#footnote-137) Hybrid regulatory approach should also include other companies and academic institutions to share knowledge and resources and establish best practices for AI development and use. Finally, industry suggests that EU should review US and China's approach to AI regulations - China passes all laws for the benefit of AI development, nothing to inhibit innovation (population is more open for that innovations, have more trust in technology;) like the case is in the EU, where for every research and development companies should get a million consents from the citizens.

4.2 Industry’s constraints: the impact of AI regulation on innovation activity

Performed interviews on the relationship between regulatory intervention, EU’s geopolitical role (in its current “de-risking” relationship with China) and maintenance of EU’s technological frontier offer the following insides: 1) Heavily investments in AI research and development; 2) Restrictive regulations can lead to restrictions for industry – too strict regulations can hinder the flexibility and agility needed for rapid innovation: 3) Compliance costs and administrative burdens associated with regulation, especially for smaller companies with limited resources are prohibitively high; 4) Regulations that are not well aligned with technological progress can hinder the development and deployment of state-of-the-art solutions; 5) The impact of the rules will depend on the nature, scope and effectiveness of the rules implemented; 6) Differences in the levels of development of European countries and the strictness of restrictions on digital trade and technologies. This combination has an impact over time on their ability to use new digital technology to increase productivity in these industries; 7) There are fears that the focus will be on improving efficiency and benefits for large companies. This also limits innovation by new and small firms, which often makes an important contribution to the sector's productivity growth; 8) Policy environments vary considerably across the EU, and the effects of new rules will depend in part on the extent to which other rules encourage or discourage digital economic activity, the extent to which they promote competition, market competitiveness, entrepreneurship and business growth. Countries have different levels of business and market restrictions in areas affecting the digital economy, and the impact of new laws is likely to be felt differently across the EU due to the composition of these existing business restrictions; 9) The EU is falling further and further behind the world's digital and technical frontiers. New horizontal regulation of artificial intelligence may even increase the EU's lag behind; 10) Over-regulation can lead from slowing down the competitiveness of AI, to delaying technological growth, to losing out on potential innovators, investors, top talent, and private companies and start-ups that may choose to relocate; 11) The EU’s human-centric approach on AI does not favour the maximum utilization of AI innovation monetization; 12) The level of R&D with other key global players in the field of artificial intelligence may decrease; 13) The aim should be to maximise benefits and minimise the cost of regulations. It should ensure the most effective way to achieve regulatory objective; 14) A sectoral approach will be needed. If all sectors have to apply the same rules to AI, this is likely to impose excessive or duplicative requirements on some, while for others it will be insufficient; 15) Uncertainties about how different, sometimes duplicated or conflicting, legislative instruments will be complementary. This lack of guidance results in regulatory uncertainty; 16) Questions are raised about possible conflicting requirements in sectoral and horizontal legislation. As an example of the uncertainty related to software update requirements and the lack of authorisation of new technology in export markets; and 17) The regulator needs to understand how the software is used in general and in specific use cases. Risks and impacts vary between sectors and between specific use cases.

4.3 Effect of generative AI on transportation industry

Data protection and privacy – personal data collected, stored and processed by AI system used in vehicles would need to comply with strict data protection regulations. Addressing ethical dilemmas related to autonomous vehicles, such as decision-making in critical situations or potential job displacement caused by automatization. It may be introduced measures to protect consumers in the transportation sector – ensuring transparency in pricing algorithms, enforcing fair competition, and preventing discriminatory practices in AI driven transportation services. Autonomous vehicles – safety – specific guidelines and requirements (high risk) for development and deployment – safety standards, establishing liability framework, and ensuring transparency in the decision-making processes of autonomous vehicles.

4.4 Generative AI-Generated Hazards Should Be Clustered within the Realm of Fault-Based Liability Rather Than Product Liability

Law and economics scholarship has argued for the need to rethink legal remedies when applying them to AI torts.[[138]](#footnote-138) For example, Shavell even argues that AI renders classic product liability law unable to create the optimal incentives for the use, production and adoption of safer AI technologies as it is currently designed.[[139]](#footnote-139) AI-related hazards are essentially unknown risks and the law and economics literature has addressed the problem of imposing liability for such unknown and unexpected risks and argues that whether ‘liability for unknown risks is desirable depends on what is more important: avoiding the marketing of products which are not safe enough, or not hindering the introduction of better new products’.[[140]](#footnote-140) Landes and Posner suggest that such liability might actually induce producers to invest in safer technologies.[[141]](#footnote-141)

 More recently, in their novel approach Guerra, Parisi, and Pi state that AI-generated accidents should be clustered within the realm of ‘fault-based liability rather than product liability’, where negligence-based rules should be blended with strict liability rules to create precaution incentives for AI operators and their potential victims, and R&D incentives for manufacturers’ development of safer AI.[[142]](#footnote-142) They offer a novel liability regime, which they refer to as the ‘manufacturer residual liability’ rule.[[143]](#footnote-143) Under such a ‘manufacturer residual liability’ regime, the primary liability is held by either the AI human operator or the victim, and the residual liability – the assignment of the accident cost when neither party is negligent – then falls on the manufacturer.[[144]](#footnote-144) Namely, human operators and victims should bear accident losses attributable to their own negligent behaviour and manufacturers should only be held liable for non-negligent accidents. The negligence of the AI human operator also marks the boundary between a human operator’s fault-based liability and the manufacturer’s strict residual liability. Further, manufacturer’s liability would arise for two separate sources of accidents caused by AI: a) malfunctions;[[145]](#footnote-145) and b) design limitations.[[146]](#footnote-146) Finally, they show that such a liability regime might offer several advantages over simple negligence and strict liability, and might achieve four objectives of an AI tort law regime, one that induces: a) efficient human precautionary care; b) efficient activity levels; c) investments in the R&D of safer AI; and d) the adoption of safer technology.[[147]](#footnote-147) Such a ‘manufacturer residual liability’ regime, however, assumes the existence of a human operator who is capable of directing the activity of the AI and eventually overriding its decisions (i.e. supervised AI). Hence, this proposed regime will not be sufficient for addressing the potential hazards in instances where AI is completely capable of self-determination (i.e. unsupervised AI). This scenario and potential legal remedies are addressed in the next section.

**5.Conclusions**

Super-fast economic changes spurred by world-widely integrated markets and related explosive growth of generative AI represent one of the most triggering questions of the modern world. The world is on the threshold of the fourth industrial revolution that draws its energy from big data combined with algorithms and powerful computers. The current digital revolution is marked by its global scale, rapid convergence and the enormous impact that breakthroughs in emerging technologies are having on countries, economies, societies, international relations and the environment.

 As discussed, the unprecedent breakthroughs in the Generative AI, which produces text or images automatically and has thus become a potential menace because of its awesome power and its uncontrollability, represents, via its noxious combination, a formidable and unique challenge for regulator and lawmaker hoping to limit its capacity for harm. With most recent generative AI, it is difficult to separate benign uses from the more sinister. Moreover, even the most sophisticated AI makers admit that they cannot explain (due to neural-networks) exactly how the technology works, or predict when a particular input in the form of a prompt will lead to a particular output.

 Thus, current version of the EU AI act might not adequately del with generative AI and the current risk-based approach (designed for ‘classic’ AI where predesigned purpose and control of algorithmic process was still possible). Current attempts to merely list generative AI on the list of high-risk AI might be, due to its dual nature (no intended purpose and /dynamic context and scale of adoption) inadequate and even counterproductive (deterrence of innovation). Namely, characteristics of the most novel generative AI that, as of time of writing, appeared just few weeks ago challenge the current EU AI Act approach in several different ways (e.g. the feasibility of sorting generative AI systems into high/no risk categories, the unpredictability of future risks and concerns around private ordering where ultimate use is actually defined by the end user).

 In order to mitigate identified shortcoming of the current EU AI Act this paper provides a list of systemic regulatory proposals and instruments. These include proposal for co-regulative and hybrid regulatory approach, introduction of manufacturer residual liability rule, general monitoring obligation of systemic risks and registration, regulation of contractual relationships between providers and users. To conclude, we argue for employment of hybrid forms of regulations, including the co-existence of regulatory contracts and independent regulatory oversight. The choice from the menu of options, including hybrid combinations, depends ultimately on the best fit with the super-fast technological development and progress.

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1. Michal Kosinski and Wang Yilun, ‘Deep Neural Networks are More Accurate than Humans at Detecting Sexual Orientation from Facial Images’ (2018) 114 Journal of Personality and Social Psychology 246. [↑](#footnote-ref-1)
2. Stuart Russell, *Human Compatible: Artificial Intelligence and the Problem of Control* (Allen Lane 2019) 4. See also Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach* (3rd edn, Pearson 2016). [↑](#footnote-ref-2)
3. Jacob Turner, *Robot Rules: Regulating Artificial Intelligence* (Palgrave Macmillan 2019) 81-86. [↑](#footnote-ref-3)
4. Acemoglu Daron, “Harms of AI,” National Bureau of Economic Research Working Paper 29247, 2021,

DOI 10.3386/w29247. See also Haidt, J. (2022). Yes, Social Media Really is Undermining Democracy, Despite What Meta Has to Say. The Atlantic; Haidt, J. (2020). A guilty verdict. Nature, 578, 226-227; and Twenge, J. M., Haidt, J., Lozano, J. & Cummins, K. M. (2022). Specification curve analysis shows that social media use is linked to poor mental health, especially among girls. Acta Psychologica, 224. [↑](#footnote-ref-4)
5. Foy Henry and Jim Pickard, “G7 leaders call for ‘guardrails’ on development of artificial intelligence,” Financial Times, May 19 2023. [↑](#footnote-ref-5)
6. Last week, the European Parliament reportedly suggested, as a last-minute addition, to expand the potential reach of the AI Act by placing AI-generated texts that could be mistaken for human-generated and deep fakes that say or do things that never happened to the list of high-risk categories. This new EU set of regulations will form part of Europe’s Artificial Intelligence Act and will include a total ban of almost all facial recognition for surveillance of citizens. Under the European parliament’s proposals, developers of generative AI models like ChatGPT would have to disclose content that was generated by AI and publish summaries of copyrighted data used for training purposes, so that creators can be remunerated for the use of their work; Espinoza Javier and Ian Johnston, “EU lawmakers agree tough measures over use of AI,” Financial Times, May 11, 2023. [↑](#footnote-ref-6)
7. See e.g. European Commission, ‘Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonized Rules on Artificial Intelligence (Artificial Intelligence Act) and Amending Certain Union Legislative Acts’ (Communication) COM (2021) 206 final; European Parliament, ‘Resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics’ (Resolution) P8\_TA(2017)0051; and European Commission, ‘Report on the safety and liability implications of Artificial Intelligence, the Internet of Things and robotics’ (Communication) COM (2020) 64 final. [↑](#footnote-ref-7)
8. Proposal for a Regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) and amending certain Union Legislative Acts, COM/2021/206 final. [↑](#footnote-ref-8)
9. European Commission, ‘Artificial Intelligence for Europe’ (Communication) COM (2018) 237 final. [↑](#footnote-ref-9)
10. ibid. [↑](#footnote-ref-10)
11. Volpicelli Gian, “ChatGPT broke the EU plan to regulate AI,” Politico, 13.5.2023. [↑](#footnote-ref-11)
12. He also argues that if we want humanity and society to survive these challenges, we can’t have the competition between people, companies, countries — and a very weak international co-ordination; Madhumita Murgia, “AI pioneer Yoshua Bengio: Governments must move fast to ‘protect the public,’ Financial Times, 18 May 2023. [↑](#footnote-ref-12)
13. As stated in the widely-endorsed Asilomar AI Principles, Advanced AI could represent a profound change in the history of life on Earth, and should be planned for and managed with commensurate care and resources; Future of Life Institute, “Pause Giant AI Experiments: An Open Letter,” March 22, 2023. [↑](#footnote-ref-13)
14. Yuval Noah Harari, “Yuval Noah Harari argues that AI has hacked the operating system of human civilisation,” The Economist, April 28th 2023. [↑](#footnote-ref-14)
15. See e.g. Steven Shavell, ‘On the Redesign of Accident Liability for the World of Autonomous Vehicles’ (2020) 49 The Journal of Legal Studies 243; Bryan Casey and Mark A Lemley, ‘You Might be a Robot’ (2019) 105 Cornell Law Review 287; Eric Talley, ‘Automators: How Should Accident Law Adapt to Autonomous Vehicles? Lessons from Law and Economics’ (2019) Columbia Law School Working Papers Series No. 19002; Alberto Galasso and Hong Luo, ‘Punishing Robots: Issues in the Economics of Tort Liability and Innovation in Artificial Intelligence’ in Ajay Agrawal, Joshua Gans and Avi Goldfarb (eds), The Economics of Artificial Intelligence: An Agenda (National Bureau of Economic Research 2018) 493-504; Andrea Bertolini, ‘Robots as Products: The Case for Realistic Analysis of Robotic Applications and Liability Rules’ (2013) 5 Law, Innovation and Technology 214; Hans-Bernd Schäfer and Claus Ott, *The Economic Analysis of Civil Law* (Edward Elgar Publishing 2004) 107-273; Michael Faure, ‘Toward a Harmonized Tort Law in Europe? An Economic Perspective’ (2001) 8 Maastricht Journal of European and Comparative Law 339-350; Hans-Bernd Schäfer, ‘Tort Law: General’ in Budewijn Bouckaert and Gerrit De Geest (eds), *Encyclopaedia of Law and Economics* (Edward Elgar Publishing 2000) 569-596; Emons Winand and Joel Sobel, ‘On the Effectiveness of Liability Rules When Agents Are Not Identical’ (1991) 58 Review of Economic Studies 375; Steven Shavell, *Economic Analysis of Accident Law* (Harvard University Press 1987); Mitchell A Polinsky and William P Rogerson, ‘Product Liability, Consumer Misperceptions and Market Power’ (1983) 14 Bell Journal of Economics 581; Steven Shavell, ‘Strict Liability Versus Negligence’ (1980) 9 Journal of Legal Studies 1; Kenneth J Arrow, ‘Optimal Insurance and Generalized Deductibles’ [1974] Scandinavian Actuarial Journal 1; Richard A Posner, ‘A Theory of Negligence’ (1972) 1 Journal of Legal Studies 29; Richard A Posner, ‘Strict Liability: A Comment’ (1973) 2 Journal of Legal Studies 205; Guido Calabresi, ‘Some Thoughts on Risk Distribution and the Law of Torts’ (1961) 70 Yale Law Journal 499, 499-553; Guido Calabresi, ‘The Decision for Accidents: An Approach to Non-fault Allocation of Costs’ (1965) 78 Harvard Law Review 713, 713-745; and Guido Calabresi, *The Costs of Accidents: A Legal and Economic Analysis* (Yale University Press 1970). [↑](#footnote-ref-15)
16. See Gerrit De Geest, *Contract Law and Economics – Encyclopaedia of Law and Economics*, vol 6 (2nd edn, Edward Elgar Publishing 2011); and Richard A Posner, *Economic Analysis of Law* (8th edn, Wolters Kluwer 2011). [↑](#footnote-ref-16)
17. Roger Van den Bergh, *The Roundabouts of European Law and Economics* (Eleven International Publishing 2018) 21-28. [↑](#footnote-ref-17)
18. Acemoglu, Daron, and James A. Robinson. 2019. The Narrow Corridor: States, Societies, and the Fate of Liberty. New York: Penguin Press. [↑](#footnote-ref-18)
19. Akerloff, A. George. 1970. “The Market for Lemons: Quality, Uncertainty and the Market Mechanism.” Quarterly Journal of Economics 84: 488. [↑](#footnote-ref-19)
20. Ogus, Anthony. 2004. Regulation: Legal Form and Economic Theory. London: Hart Publishing. [↑](#footnote-ref-20)
21. Ibid. [↑](#footnote-ref-21)
22. Policy makers generally tend to use a single instrument to solve many problems at the same time. However, doing so is problematic for two reasons. First, such a single rule will be a compromise rule, which is not very effective at solving all the problems. Second, choosing the right compromise requires information on the relative social importance of all the problems; such information is nearly impossible to get, and therefore makes the discussion indeterminate; Tinbergen, Jan, “On the Theory of Economic Policy;” Amsterdam: North-Holland, 1952. See also Kovac Mitja, Judgement-Proof Robots and Artificial Intelligence, A Comparative Law and Economics Approach, Palgrave MacMillan, 2020, pp. 109-144; and De Geest, Gerrit. 2018. “Old Law is Cheap Law. In Don’t take it Seriously: Essays in Law and Economics in Honour of Roger Van den Bergh, edited by Michael Faure, Wicher Schreuders and Louis Visscher, 505-525. Cambridge: Intersentia. [↑](#footnote-ref-22)
23. Hardin, Garrett. 1968. “The Tragedy of the Commons.” Science 162: 1243-1248. See also Gordon, H. Scott. 1954. “The Economic theory of a Common-Property Resource: The Fishery,” Journal of Political Economy 62(2). [↑](#footnote-ref-23)
24. Ogus, supra note 19. [↑](#footnote-ref-24)
25. Ibid. [↑](#footnote-ref-25)
26. Cheung, N. Steven. 1973. “The Fable of the Bees: An Economic Investigation.” Journal of Law and Economics 16 (2): 11-33; and Coase, H. Ronald. 1974. “The Lighthouse in Economics.” Journal of Law and Economics 17(1): 357-376. [↑](#footnote-ref-26)
27. MacKaay, Ejan. 2015. Law and Economics for Civil Law Systems. Cheltenham: Edward Elgar. [↑](#footnote-ref-27)
28. Ibid. [↑](#footnote-ref-28)
29. MacKay, supra note 26. See also Ogus, supra note 19; and Posner, A. Richard. 2014. Economic Analysis of Law. 9th ed., New York: Wolters Kluwer. [↑](#footnote-ref-29)
30. Posner, supra note 28. [↑](#footnote-ref-30)
31. See Ogus, supra note 19; Viscusi, W. Kip, John M. Vernon, and Joseph E. Harrington. 1992. Economics of Regulation and Antitrust. Cambridge: MIT Press; and Kahn, E. Alfred. 1971. The Economics of Regulation: Principles and Institutions. Cambridge: MIT Press. [↑](#footnote-ref-31)
32. Towfigh, V. Emanuel, and Niels Petersen. 2015. “Public and Social Choice Theory.” In Economic Methods for Lawyers, edited by Emanuel V. Towfigh and Niels Petersen, 121-146. Cheltenham: Edward Elgar. [↑](#footnote-ref-32)
33. Ibid. [↑](#footnote-ref-33)
34. See Mueller, C. Dennis. 2003. Public Choice III. Cambridge: Cambridge University Press; and Sunstein, R. Cass. 1985. Interest Groups in American Public Law. Stanford Law Review 38(29): 3829–3887. [↑](#footnote-ref-34)
35. See e.g. Tullock, Gordon. 1965. The Politics of Bureaucracy. Washington D.C.: Public Affairs Press; Downs, Anthony. 1967. Inside Bureaucracy. Boston: Little, Brown and Company; and Niskanen, A. William. 1971. Bureaucracy and Representative Government. Chicago: Aldine. [↑](#footnote-ref-35)
36. Towfigh and Petersen, supra note 31. [↑](#footnote-ref-36)
37. See e.g. Tullock, supra note 34; Niskanen, supra note 34; and Towfigh and Petersen, supra note 31. [↑](#footnote-ref-37)
38. Levine, E. Michael, and Jennifer L. Forrence. 1990. “Regulatory Capture, Public Interest, and the Public Agenda: Towards a Synthesis.” Journal of Law, Economics and Organization 6(4): 167-191. [↑](#footnote-ref-38)
39. Ibid. [↑](#footnote-ref-39)
40. See Cranston, Ross. 1979. Regulating Business-Law and Consumer Agencies. London: Palgrave MacMillan; and Gunningham, Neil. 1974. Pollution, Social Interest and the Law. New Jersey: Wiley-Blackwell. [↑](#footnote-ref-40)
41. For a synthesis see Baldwin Robert, Martin Cave and Martin Lodge, “The Oxford Handbook of Regulation,” Oxford University Press, 2010. See also Sparrow K. Malcom, “Fundamentals of Regulatory Design,” Harvard University Press, 2020. [↑](#footnote-ref-41)
42. Ibid at p. 7. See also Lodge, Michael and K. Wegrich, “High Quality Regulation: Its Polularity, Its Tools and Its Future,” 29 Public Money and Management 3, 2009, pp. 145-152. [↑](#footnote-ref-42)
43. Baldwin et al., supra note 41. [↑](#footnote-ref-43)
44. See e.g. Braithwaite John, “Meta Risk Management and Responsive Regulation for Tax System Integrity,” 25 Law and Policy 1, 2003, pp. 1-16; Coglianese, C. and D. Lazar, “Management Based Regulation: Prescribing Private Management to Achieve Public Goals,” 37 Law and Society Review 1, 2003, pp. 691-730; May, P., “Performance-based Regulation and Regulatory Regimes: The Saga of Leaky Buildings,” 25 Law and Policy 2, 2003, pp. 381-401; and Parker, C., “Regulator-required Corporate Compliance Program Audity,” 25 Law and Policy 3, 2003, pp. 221-244. [↑](#footnote-ref-44)
45. See e.g. Black John, “The Emergence oof Risk-based Regulation and the New Public Risk Management in the UK,” Public Law, 2005, pp. 512-549; Hutter, B., “Regulation and Risk: Occupational Health and Safety on the Railways,” Oxford: Oxford University Press, 2001; Hood, C., James O., Peters, G.B., and C. Scott, “Controlling Modern Government,” Cheltenham: Edward Elgar, 2004. [↑](#footnote-ref-45)
46. For example there is a vast literature on interest groups, regulatory space, principal-agent and transaction based regulatory approaches, culture and discourse regulatory school. See e.g. Barke, R. P., and W. Riker, “A Political Theory of Regulation with some Observations on Railway Abandonments,” 39 Public Choice 1, 1982, pp. 37-106; Wilson, J. Q., “The Politics of Regulation,” in J. Q. Wilson (ed.), “The Politics of Regulation,” New York: Basic Books, 1980; Scott, C., “Analysing Regulatory Space: Fragmented resources and Institutional Design,” Public Law, 2001, pp. 329-353; Levy, B. and P. Spiller, “The Institutional Foundations of Regulatory Commitment: A Comparative Analysis of Telecommunications Regulation,” 10 Journal of Law, Economics and Organization 1, 1996, pp. 201-246; Hood et al. supra note 45; and Black, J., “Decentring Regulation: Understanding the Role of Regulation and Self-regulation in a Post-regulatory World,” 54 Current Legal Problems 1, 2002, pp. 103-147. [↑](#footnote-ref-46)
47. Baldwin, Richard, “Rules and Government,” Oxford: Oxford University Press, 1995. [↑](#footnote-ref-47)
48. Gunningham, N. and P. Grabovsky, “Smart Regulation: Designing Environmental Policy,” Oxford: Oxford University Press, 1999. [↑](#footnote-ref-48)
49. Sparrow, M. K., “The Regulatory Craft,” Washington DC: Brookings, 2000. [↑](#footnote-ref-49)
50. Sunstein Cass and Richard Thaler, “Nudge,” New Haven: Yale University Press, 2008; Jolls, C., Cass Sunstein and Richard Thaler, “A Behavioural Approach to Law and Economics,” in Cass Sunstein (ed.), “Behavioural Law and Economics,” Cambridge: Cambridge University Press, 2000; and Baldwin, R. and J. Black, “Really Responsive Regulation,” 71 Modern Law Review 1, 2008, pp. 59-94. [↑](#footnote-ref-50)
51. For a synthesis of economic approaches to regulation see Veljanovski Cento, “Economic Approaches to regulation,” in Baldwin Robert, Martin Cave and Martin Lodge (eds.), “The Oxford Handbook of Regulation,” Oxford University Press, 2010, pp. 17-39. [↑](#footnote-ref-51)
52. On the definition and concepts of generative AI see Garon, Jon M., A Practical Introduction to Generative AI, Synthetic Media, and the Messages Found in the Latest Medium (March 14, 2023). Available at SSRN: https://ssrn.com/abstract=4388437 or http://dx.doi.org/10.2139/ssrn.4388437 [↑](#footnote-ref-52)
53. Philipp Hacker, Andreas Engel, Marco Mauer; “Regulating ChatGPT and other Large Generative AI Models,” arXiv:2302.02337, 2023. [↑](#footnote-ref-53)
54. They argue for three layers of obligations concerning LGAIMs (minimum standards for all LGAIMs; high-risk obligations for high-risk use cases; collaborations along the AI value chain). In general, regulation should focus on concrete high-risk applications, and not the pre-trained model itself, and should include (i) obligations regarding transparency and (ii) risk management. Non-discrimination provisions (iii) may, however, apply to LGAIM developers. Lastly, (iv) the core of the DSA content moderation rules should be expanded to cover LGAIMs. This includes notice and action mechanisms, and trusted flaggers. In all areas, regulators and lawmakers need to act fast to keep track with the dynamics of ChatGPT et al.; ibid. [↑](#footnote-ref-54)
55. Yogesh K. Dwivedi, Nir Kshetri, Laurie Hughes, Emma Louise Slade, Anand Jeyaraj, Arpan Kumar Kar, Abdullah M. Baabdullah, Alex Koohang, Vishnupriya Raghavan, Manju Ahuja, Hanaa Albanna, Mousa Ahmad Albashrawi, Adil S. Al-Busaidi, Janarthanan Balakrishnan, Yves Barlette, Sriparna Basu, Indranil Bose, Laurence Brooks, Dimitrios Buhalis, Lemuria Carter, Soumyadeb Chowdhury, Tom Crick, Scott W. Cunningham, Gareth H. Davies, Robert M. Davison, Rahul Dé, Denis Dennehy, Yanqing Duan, Rameshwar Dubey, Rohita Dwivedi, John S. Edwards, Carlos Flavián, Robin Gauld, Varun Grover, Mei-Chih Hu, Marijn Janssen, Paul Jones, Iris Junglas, Sangeeta Khorana, Sascha Kraus, Kai R. Larsen, Paul Latreille, Sven Laumer, F. Tegwen Malik, Abbas Mardani, Marcello Mariani, Sunil Mithas, Emmanuel Mogaji, Jeretta Horn Nord, Siobhan O’Connor, Fevzi Okumus, Margherita Pagani, Neeraj Pandey, Savvas Papagiannidis, Ilias O. Pappas, Nishith Pathak, Jan Pries-Heje, Ramakrishnan Raman, Nripendra P. Rana, Sven-Volker Rehm, Samuel Ribeiro-Navarrete, Alexander Richter, Frantz Rowe, Suprateek Sarker, Bernd Carsten Stahl, Manoj Kumar Tiwari, Wil van der Aalst, Viswanath Venkatesh, Giampaolo Viglia, Michael Wade, Paul Walton, Jochen Wirtz, Ryan Wright, “So what if ChatGPT wrote it?” Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy,” 71 International Journal of Information Management 1, 2023. [↑](#footnote-ref-55)
56. Helberger, N. and Diakopoulos, N. (2023). ChatGPT and the AI Act. Internet Policy Review,[online] 12(1). Available at: https://policyreview.info/essay/chatgpt-and-ai-act [Accessed: 22 May. 2023]. [↑](#footnote-ref-56)
57. Ibid. [↑](#footnote-ref-57)
58. See e.g. Baldwin Robert and Christopher McCrudden, “Regulation and Public Law,” London: Weidenfeld and Nicolson, 1987; and Radaelli Claudio and Fabrizio De Francesco, “Regulatory Quality in Europe: Concepts, Measures and Policy Processes,” Manchester: Manchester University Press, 2011. [↑](#footnote-ref-58)
59. Legislative mandate, accountability, due process, expertise, efficiency; Baldwin Robert, Martin Cave and Martin Lodge, “Understanding Regulation: Theory, Strategy, and Practice,” 2nd ed., Oxford: Oxford University Press, 2012. [↑](#footnote-ref-59)
60. Frank Knight provides a distinction between uncertainty and risks, where uncertainty is inherently impossible to measure and risk which is amenable to quantification; Knight Frank, “Risk, Uncertainty and Profit,” Boston: Harvard University Press, 1921. [↑](#footnote-ref-60)
61. Baldwin et al., supra note 59, at p. 83. See also Hutter B.M., “Anticipating Risk and Organising Regulation,” Cambridge: Cambridge University Press, 2010; and Hutter B.M. and M. Power, “Organizational Encounters with Risk,” Cambridge: Cambridge University Press, 2005. [↑](#footnote-ref-61)
62. Acemoglu supra note 4. [↑](#footnote-ref-62)
63. Ibid. [↑](#footnote-ref-63)
64. Where attempts to contain them just by promoting competition may be insufficient; Acemoglu, supra note 4. [↑](#footnote-ref-64)
65. Helberg and Diakopolus, supra note 44. [↑](#footnote-ref-65)
66. Waters Richard, “Can AI be regulated?,” Financial Times, May 19, 2023. [↑](#footnote-ref-66)
67. The so-called large language models that lie behind generative AI services such as ChatGPT fail on the most basic measure of effectiveness for any piece of technology: being able to clearly specify what they are intended to do, and then measure whether they achieve their objectives. There is little that is repeatable in their performance, and evaluations of their output are highly subjective. [↑](#footnote-ref-67)
68. One possibility, suggested by Alexandr Wang, chief executive of Scale AI, would be to treat AI the same as the GPS positioning system, limiting the most powerful versions of the technology for restricted uses. But it would be hard to impose limits like this in a competitive technology market. Another approach, recommended this week by OpenAI CEO Sam Altman, would be to subject LLMs to direct regulatory oversight. A licensing regime could be used to ensure they adhere to certain safety standards and have been appropriately vetted. [↑](#footnote-ref-68)
69. Calo for example argues that high speed trading algorithms can destabilize stock market or cognitive radio systems that can interfere in emergency communications, may hold potential, alone or in combination, to cause serious damages; Calo Ryan, “The case for a federal robotics commission 9-10,” Brookings Ctr. For Tech. Innovation, 2014. [↑](#footnote-ref-69)
70. Schaefer Hand-Bernd, “Tort Law,” in De Geest Gerrit and Boudewijn Bouckaert (eds.), “Encyclopaedia of law and economics,” Volume II. Civil Law and Economics, Edward Elgar, 2000. [↑](#footnote-ref-70)
71. For an excellent treatise see e.g. Cooter Robert and Thomas Ulen, “Law and Economics,” 6th ed., Addison-Wesley, 2016, pp. 287-373; Posner A. Richard, “Economic Analysis of Law,” 8th ed., Wolters Kluwer, 2011, pp. 213-273; and Schaefer Hans-Bernd and Claus Ott, “The Economic Analysis of Civil Law,” Edward Elgar, 2004, pp. 107-273. [↑](#footnote-ref-71)
72. On the exemptions from tort liability – some people and groups have immunity from tort law – and consequential externalization of the precaution costs see De Geest Gerrit, “Who should be immune from tort liability,”41 The Journal of Legal Studies 2, 2012, pp. 291-319. [↑](#footnote-ref-72)
73. For a synthesis see Shavell Steven, “Liability for Accidents,” in Polinsky A. Mitchell and Steven Shavell (eds.), “Handbook of law and economics, Volume 1,” North-Holland, 2007, pp. 139-183. [↑](#footnote-ref-73)
74. Wittman Donald, “Economic Foundations of Law and Organization,” Cambridge University Press, 2006, at p. 131. [↑](#footnote-ref-74)
75. Schaefer, supra note 42, at p.8. [↑](#footnote-ref-75)
76. Schaefer argues that tort law has to play a predominant role in reducing primary accident costs if one takes the view that civil courts can handle most of the informational problems properly, and that regulatory agencies, even though better endowed to collect and process information, are often influenced by well-organized interest groups; Schaefer, supra note at p. 6. [↑](#footnote-ref-76)
77. Ibid at p. 8. [↑](#footnote-ref-77)
78. Dewees, Duff and Trebilcock argue that in such circumstances only empirical research can then find out which system or which combination of systems is best suited to reduce accident costs; Dewees, Donald N., Duff, David and Trebilcock, Michael J., “Exploring the Domain of Accident Law: Taking the Facts Seriously,” Oxford University Press, 1996, p. 452. [↑](#footnote-ref-78)
79. Shavell Steven, “Liability for harm versus regulation of safety,” 13 Journal of Legal Studies 2, 1984, pp. 357-374. [↑](#footnote-ref-79)
80. Tort liability is private in nature and works not by social command but rather indirectly, through the deterrent effect of damage actions that may be brought once harm occurs, whereas standards and ex ante regulations are public in character and modify behaviour in an immediate way through requirements that are imposed before the actual occurrence of harm; ibid at p. 357. [↑](#footnote-ref-80)
81. Ibid, at p. 372. [↑](#footnote-ref-81)
82. When harm is so diffused that individuals have little incentives to sue and cannot cheaply organize as a

group, this rational apathy of victims leads to systematic under-compensation and consequently to underdeterrence. Shavell also notes that conversely certain regulations might be too restrictive, unduly constraining or imposing excessive costs on industry; Shavell, supra note 59 at p. 372. See also Epstein A. Richard, “The principles of environmental protection; the case of superfund,” 2 Cato J. 9, 1982. [↑](#footnote-ref-82)
83. Shavell, supra note 59 at p. 373. [↑](#footnote-ref-83)
84. Ibid. [↑](#footnote-ref-84)
85. Ibid. [↑](#footnote-ref-85)
86. Rose-Ackerman Susan, “Tort law as a regulatory system,” 81 AEA Papers and Proceedings 2, 1991. [↑](#footnote-ref-86)
87. Yet, as Rose-Ackerman points out, if the implementation of a statutory scheme requires that private tort actions be pre-empted, alternative methods of compensating victims, such as social insurance or statue-based private damage actions should be designed; ibid at p. 54. [↑](#footnote-ref-87)
88. Shavell Steven, “The Judgement proof problem,” 6 International Review of Law and Economics, 1986, pp. 45-58. However, Summers has actually identified the problem of a disappearing defendant several years before Shavell’s seminal paper. See Summers J., “The case of the disappearing defendant: an economic analysis,” University of Pennsylvania Law Review, 132, 1983, pp. 145-185. [↑](#footnote-ref-88)
89. Ibid. [↑](#footnote-ref-89)
90. Summers J., “The case of the disappearing defendant: an economic analysis,” University of Pennsylvania Law Review, 132, 1983, pp. 145-185. [↑](#footnote-ref-90)
91. Shavell, supra note 53, at p. 169. See also Ganuza and Gomez (2004). [↑](#footnote-ref-91)
92. Shavell, ibid at p. 169 et seq. [↑](#footnote-ref-92)
93. Shavell offers an example of the injurer’s problem of choosing care x under strict liability, when his assets are y < h and where the injurer’s problem is formulated as minimizing x + p (x) y; where injurer chooses x(y) determined by -p’ (x) y = 1 instead of -p’ (x)h=1, so that x(y) < x\* (and the lower is y, the lower is x(y)). In such instance the injurer’s wealth after spending on care would be y-x, and only this amount would be left to be paid in a judgement; Shavell, supra note 68, at p. 169. [↑](#footnote-ref-93)
94. Ibid, at p. 170. See also Huberman G., Mayers D., C. Smith, “Optimal insurance policy indemnity schedules,” Bell Journal of Economics 14, 1983; and Keeton W. R., and E. Kwerel, “Externalities in automobile insurance and the underinsured driver problem,” Journal of Law and Economics 27, 1984, pp. 149-179. [↑](#footnote-ref-94)
95. Shavell, supra note 68 at p. 170. [↑](#footnote-ref-95)
96. Ibid. [↑](#footnote-ref-96)
97. Shavell, supra note 66 at pp. 45-46. [↑](#footnote-ref-97)
98. Boyd, J., and D.E. Ingberman, “Noncompensatory damages and potential insolvency,” Journal of Legal Studies 23, 1994, pp. 895-910. [↑](#footnote-ref-98)
99. Boyd J. and D.E. Ingberman, “The search for deep pockets: is extended liability expensive liability,” Journal of Law, Economics and Organization 13, 1997, pp.1427-1459. [↑](#footnote-ref-99)
100. De Geest Gerrit and Giuseppe Dari-Mattiachi, “An analysis of the judgement-proof problem under different tort models,” 2002. [↑](#footnote-ref-100)
101. Ibid. [↑](#footnote-ref-101)
102. See e.g. Jost P.J., “Limited liability and the requirement to purchase insurance,” International Review of Law and Economics 16, 1996, pp. 259-276; and Polborn M., “Mandatory insurance and the judgement-proof problem,” International review of law and economics 18, pp. 141-146. [↑](#footnote-ref-102)
103. Shavell Steven, “On the social function and the regulation of liability insurance,” Geneva papers on risk and insurance, Issues and Practice 25, 2000, pp. 166-179. [↑](#footnote-ref-103)
104. See e.g. Shavell Steven, “Minimum assets requirements,” Working paper, John M. Olin Center for Law and Economics, and Business, Harvard Law School, 2002; and Shavell Steven, “Minimum assets requirement and compulsory liability insurance as solutions to the judgement-proof problem,” Working paper, John M. Olin Center for Law and Economics, and Business, Harvard Law School, 2004. [↑](#footnote-ref-104)
105. Pitchford R., “How liable should a lender be? The case of judgement-proof firms and environmental risk,” American Economic Review 85, 1995, pp. 1171-1186. [↑](#footnote-ref-105)
106. Hiriart Y., and D. Martimort, “The benefits of extended liability,” WP University of Touluse, 2003. See also Boyer M., and D. Porrini, “Modelling the choice between regulation and liability in terms of social welfare,” 2004. [↑](#footnote-ref-106)
107. Viscusi W. Kip and Michael J. Moore, “Product Liability, Research and Development, and Innovation,” 101 Journal of Political Economy 1, 1993. [↑](#footnote-ref-107)
108. Whereas, at very high levels of liability costs, the effect is negative. Moreover, they show that at the sample mean, liability costs increase R & D intensity by 15 percent. The greater linkage of these effects to product R & D rather than process R & D is consistent with the increased prominence of the design defect doctrine; ibid. [↑](#footnote-ref-108)
109. The results reveal that higher litigation and liability costs across firms, combined with damage caps, reversed causality, limited class actions and broad statutory excuses, between and within countries have a positive effect on the validation rate, application rate and on the stock of EPO patents; Kovac, Mitja, Datta, Salvini, Spruk, Rok. Pharmaceutical product liability, litigation regimes, and the propensity to patent : an empirical firm-level investigation. 11 SAGE open 2, 2021. [↑](#footnote-ref-109)
110. Of course, regulators have to know which parts of the task they may safely delegate, for which types of risk and under what conditions; Sparrow, supra note 41, at p. 100. [↑](#footnote-ref-110)
111. See Sparrow supra note 41, and Baldwin et al., supra note 59. [↑](#footnote-ref-111)
112. See e.g. Ogus Anthony, “rethinking Self-regulation,” 15 OJLS 97, 1995; Ayres Ian and John Braithwaite, “Responsive Regulation, Oxford: Oxford University Press, 1992; Black J., “Constitutionalising Self-Regulation,” 59 Modern Law Review 24, 1996; and Baggot R. and L. Harrison, “The Politics of Self-Regulation,” 14 Policy and Politics 143, 1986. [↑](#footnote-ref-112)
113. Whereas shortcomings of self-regulation tend to centre on concerns relating to mandates, accountability and the fairness of procedures; Ogus, supra note 111. See also Baldwin et al., supra note 59, at p. 139 et seq. [↑](#footnote-ref-113)
114. Ayres and Braithwaite, supra note 111. See also Baldwin et al., supra note 59, at p. 146; and Grabosky Peter and John Braithwaite, “Of Manners Gentle: Enforcement Strategies of Australian Business Regulatory Agencies,” Oxford: Oxford University Press, 1987. [↑](#footnote-ref-114)
115. Ibid. [↑](#footnote-ref-115)
116. Ibid. See also Black J., “An Economic Analysis of Regulation: One View of the Cathedral,” 16 OJLS 699, 1997, p. 706. [↑](#footnote-ref-116)
117. In other words, there is delegation of risk-control function to firms where the primary control responsibilities are carried out within risk management systems of firms and the regulator’s role is auditing, monitoring and incentivizing those firms’ systems; Baldwin et al., supra note 59, at p. 147. See also Osborne D., and T. Gaebler, “reinventing Government,” Boston: Harvard University Press, 1992; Parker C., “The Open Corporation,” Cambridge: Cambridge University Press, 2002; and Coglianese C. and E. Mendelson, “Meta-regulation and Self-regulation,” in Baldwin Robert, Martin Cave and Martin Lodge (eds.), “The Oxford Handbook of Regulation,” Oxford University Press, 2010. [↑](#footnote-ref-117)
118. Coglianese Cary and Jennifer Nash, “Regulating from the Inside: Can Environmental Management Systems Achieve Policy Goals,” Washington: Routledge, 2001. [↑](#footnote-ref-118)
119. Here each firm enjoys information advantage (in relation to the central regulator) and will produce a set of rules tailored to the specific context of the firm, and these rules will be scrutinized by a regulatory agency – non-uniform standards may produce better results than across the board rules, which might be to restrictive or too lax; Baldwin et al., supra note 59, at p. 147. See also Coglianese and Nash, supra note 117. [↑](#footnote-ref-119)
120. Ibid. [↑](#footnote-ref-120)
121. Ibid. See also Gunningham N. and J. Rees, “Industry Self-regulation: An Institutional Perspective,” 19 Law and Policy 2, 1997, pp. 363-414. [↑](#footnote-ref-121)
122. Ayres and Braithwaite, supra note 111, at p. 120 et seq. See also Fairman R. and C. Yapp, “Enforced Self-regulation, Prescription and Conception of Compliance within Small Businesses,” 27 Law and Policy 1, 2005, pp. 491-519; and Black J., “Talking about Regulation,” Public Law 77, 1998. [↑](#footnote-ref-122)
123. See e.g. Murray A. and C. Scott, “Controlling the New Media: Hybrid Responses to New Forms of Power,” 65 Modern Law Review 1, 2002, pp. 491-516. [↑](#footnote-ref-123)
124. See e.g. Gunningham N. and P. Grabosky, “Smart Regulation,” Oxford: Oxford University Press, 1998, pp. 422-53. [↑](#footnote-ref-124)
125. Sparrow also advocates the dynamic nature of the risk control game and targeting key problems and solve these by developing interventions; Sparrow K. Malcolm, “The Regulatory Craft: Controlling Risks, Solving Problems, and Managing Compliance,” Washington: Brookings Institution Press 2003. [↑](#footnote-ref-125)
126. Moreover, regulatory design should take into account the detection of undesirable or non-compliant behaviour, developing tools and strategies for responding to that behaviour, enforcing those tools and strategies on the ground, assessing their success or failure, and modifying them accordingly; Baldwin et al., supra note 59, at p. 159. See also Black J., “Decentring Regulation: The Role of Regulation and Self-Regulation in a Post-Regulatory World,” Current Legal Problems, 2001, pp. 103-146. [↑](#footnote-ref-126)
127. O'Shauhnessy Matt and Matt Sheehan, “Lessons From the World’s Two Experiments in AI Governance,” Carnegie Endowment for International Piece, 2023. [↑](#footnote-ref-127)
128. Ibid. [↑](#footnote-ref-128)
129. The EU and U.S. strategies for AI risk management have some commonalities in terms of a risk-based approach, trustworthiness principles, and recognition of international standards. However, there are more differences than similarities in the specific regulations and practices of these regimes. The EU and U.S. are particularly divergent in their approaches to AI applications in areas such as socioeconomic processes and online platforms, indicating a significant misalignment between the two; Engler Alex, “Early thoughts on regulating generative AI like ChatGPT,” Brookings, 2023. [↑](#footnote-ref-129)
130. The Office of Management and Budget (OMB) provided guidance (M-21-06) in November 2020, which followed the February 2019 executive order (EO 13859) titled "Maintaining American Leadership in Artificial Intelligence." This executive order marked the initial federal strategy for overseeing artificial intelligence (AI). The OMB guidance, though delayed by 15 months, outlined a risk-based approach for AI regulation and management; ibid. [↑](#footnote-ref-130)
131. Brynjolfsson Erik, Danielle Li & Lindsey R. Raymond, “Generative AI at Work,” NBER Working Paper 31161, April 2023. [↑](#footnote-ref-131)
132. In its press release, the UK government says: “The government will avoid heavy-handed legislation which could stifle innovation and take an adaptable approach to regulating AI. Instead of giving responsibility for AI governance to a new single regulator, the government will empower existing regulators – such as the Health and Safety Executive, Equality and Human Rights Commission and Competition and Markets Authority – to come up with tailored, context-specific approaches that suit the way AI is actually being used in their sectors.” [↑](#footnote-ref-132)
133. Michelle Donelan MP, Secretary of State for Science, Innovation and Technology, considers that this this light-touch, principles-based approach “will enable . . . [the UK] to adapt as needed while providing industry with the clarity needed to innovate.” [↑](#footnote-ref-133)
134. We have performed series of in-depth interviews with different stakeholders in Slovene-Austrian-German transport, automation, process control and digitalization (in industry and buildings) industries. [↑](#footnote-ref-134)
135. See e.g. Eberhard, Anton. 2007. Matching Regulatory Design to Country Circumstances: The Potential of Hybrid and Transitional Models. Gridlines; No. 23. © World Bank, Washington, DC. [↑](#footnote-ref-135)
136. For example, Google is already making sure that they develop and deploy the technology responsibly, reflecting our deep commitment to earning the trust of our users. That’s why we published AI principles in 2018, rooted in a belief that AI should be developed to benefit society while avoiding harmful applications; Sundar Pichai, Google CEO: Building AI responsibly is the only race that really matters, Financial Times, 23.5.2023. [↑](#footnote-ref-136)
137. GAIA - a Global Alliance of Intelligence Augmentation - Guided by humanistic values, this new international body would bring together a broad array of leaders and experts: not just politicians and AI researchers, but also economists, sociologists, political scientists and futurists.” [↑](#footnote-ref-137)
138. See e.g. Mark A Lemley and Bryan Casey, ‘Remedies for Robots’ (2019) 86 The University of Chicago Law Review 1311; and Eric Talley, ‘Automators: How Should Accident Law Adapt to Autonomous Vehicles? Lessons from Law and Economics’ (2019) Columbia Law School Working Papers Series No. 19002. [↑](#footnote-ref-138)
139. Steven Shavell, ‘On the Redesign of Accident Liability for the World of Autonomous Vehicles’ (2020) 49 The Journal of Legal Studies 243-285. [↑](#footnote-ref-139)
140. Michael Faure, Louis Visscher and Franziska Weber, ‘Liability for Unknown Risk – A Law and Economics Perspective’ (2016) 7 Journal of European Tort Law 198. [↑](#footnote-ref-140)
141. William M Landes and Richard A Posner, ‘A Positive Economic Analysis of Products Liability’ (1985) 14 The Journal of Legal Studies 535. [↑](#footnote-ref-141)
142. Alice Guerra, Francesco Parisi and Daniel Pi, ‘Liability for Robots II: An Economic Analysis’ (2021) 18(4) Journal of Institutional Economics 553, 554. [↑](#footnote-ref-142)
143. ibid 2. [↑](#footnote-ref-143)
144. Such a liability regime makes operators and victims liable for accidents due to their negligence – hence, incentivising them to act diligently; and makes manufacturers residually liable for non-negligent accidents – thus, incentivising them to make optimal investments in R&D for robots’ safety. In turn, as Guerra, Parisi, and Pi argue, such a rule would bring down the price of safer robots, driving unsafe technology out of the market and, due to the percolation effect of residual liability, would induce operators to adopt optimal activity levels in AI usage; ibid 2. See also Alice Guerra, Francesco Parisi and Daniel Pi, ‘Liability for Robots I: Legal Challenges’ (2021) 18(3) Journal of Institutional Economics 331 . [↑](#footnote-ref-144)
145. Malfunctions should be dealt with by ordinary product liability law already in place where victims may sue manufacturers directly or by allowing operators to sue manufacturers in subrogating when operators face direct liability under conventional tort law; ibid 6. [↑](#footnote-ref-145)
146. Design limitations refer to accidents that occur when AI encounters a new unforeseen circumstance that causes it to behave in an undesired manner; ibid 6. [↑](#footnote-ref-146)
147. ibid 3. In addition, Cooter and Porat offer a ‘total liability for excessive harm’ rule for instances of multiple tortfeasors where officials can verify the total harm caused by all injurers but not the harm caused by an individual injurer. Under the ‘total liability for excessive harm’ rule, each individual injurer should be liable for the total harm that everyone causes in excess of the optimal harm. They suggest that a remarkable consequence of such a rule is that injurers respond to it by causing the optimal harm and their liability is nil; Robert D Cooter and Ariel Porat, *Getting Incentives Right: Improving Torts, Contracts and Restitution* (Princeton University Press 2014) 74-89. For example, an AI agency could establish a safety target and announce that each producer of AI systems in a certain area is liable for the damage caused by all producers of AI systems in excess of the target. As Cooter and Porat suggest, the agency gains control over the damages (i.e. negative externalities) without having to monitor individual producers, while the producers do not have to pay damages or comply with bureaucratic regulations; ibid 74. [↑](#footnote-ref-147)