
This is an electronic reprint of the original article.
This reprint may differ from the original in pagination and typographic detail.

Pearce, Joshua M.

Towards quantifiable metrics warranting industry-wide corporate death penalties

Published in:
Social Sciences

DOI:
[10.3390/socsci8020062](https://doi.org/10.3390/socsci8020062)

Published: 01/01/2019

Document Version
Publisher's PDF, also known as Version of record

Published under the following license:
CC BY

Please cite the original version:
Pearce, J. M. (2019). Towards quantifiable metrics warranting industry-wide corporate death penalties. *Social Sciences*, 8(2), [62]. <https://doi.org/10.3390/socsci8020062>

This material is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of the repository collections is not permitted, except that material may be duplicated by you for your research use or educational purposes in electronic or print form. You must obtain permission for any other use. Electronic or print copies may not be offered, whether for sale or otherwise to anyone who is not an authorised user.



Article

Towards Quantifiable Metrics Warranting Industry-Wide Corporate Death Penalties

Joshua M. Pearce ^{1,2}

¹ Materials Science & Engineering and Department of Electrical & Computer Engineering, Michigan Technological University, 601 M&M Building, 1400 Townsend Drive, Houghton, MI 49931-1295, USA; pearce@mtu.edu

² School of Electrical Engineering, Aalto University, 02150 Espoo, Finland

Received: 18 December 2018; Accepted: 8 February 2019; Published: 18 February 2019



Abstract: In the singular search for profits, some corporations inadvertently kill humans. If this routinely occurs throughout an industry, it may no longer serve a net positive social purpose for society and should be eliminated. This article provides a path to an objective quantifiable metric for determining when an entire industry warrants the corporate death penalty. First, a theoretical foundation is developed with minimum assumptions necessary to provide evidence for corporate public purposes. This is formed into an objective quantifiable metric with publicly-available data and applied to two case studies in the U.S.: the tobacco and coal mining industries. The results show the American tobacco industry kills 4 times more people per year than it employs, and the American coal-mining industry kills more than one American every year for every coal miner employed. The results clearly warrant industry-wide corporate death penalties for both industries in America. Future work is discussed to ensure industries only exist to benefit humanity in all the societies in which they operate.

Keywords: pollution; environmental externalities; emissions; ethics in organizations; corporate corruption; corporate death penalty; corporate misconduct; public management

1. Introduction

Few corporations actively seek to kill humans directly, but rather because of their nearly singular focus on maximizing corporate profits (Friedman 2007), their operations and the concomitant pollution often damages air, water, soil, and food supplies (Kelly 2001), which can result in human mortality (Lloyd et al. 1985; Dasgupta et al. 1997; Brunekreef 1999; Mahmood 2011; López-Abente et al. 2012; Markowitz and Rosner 2013; García-Pérez et al. 2015; Martínez-Solanas et al. 2017). There are literally hundreds of thousands of articles dedicated to these environmental externalities and although some pollutants have been effectively regulated, significant corporate-caused externalities persist and are often exported to poor areas (Lucas et al. 1992; Birdsall and Wheeler 1993; Behera and Reddy 2002; He 2006; Zeng and Zhao 2009; Bell 2011; Büchs et al. 2011; Huang et al. 2016). However, with the legal recognition of corporations as persons (Schane 1986)—corporations gained the rights of personhood. As these corporate ‘persons’ are inanimate yet immortal and soulless (Coffee 1981) they present a challenge for authorities seeking to impose meaningful punishments for misconduct (Kennedy 1997; Ramirez and Ramirez 2017). It is widely acknowledged that the State does not need to permit corporate conduct it does not tolerate from actual human persons like murder and theft. However, corporate criminal behavior is still rampant, with the *Journal of Management Inquiry* recently hosting not one but two special issues in 2017 on corruption alone (Zyglidopoulos et al. 2017). Weak penalties for corporate misconduct appear to be ineffective (Noonan 2011) and strong ones such as imposing a sufficiently large fine to divest a corporation of all of its assets are only imposed on corporations with

no legitimate business operations (Hamdani and Klement 2008). Markoff, for example, points out that no publicly-traded company failed because of a conviction that occurred between 2001 and 2010 (Markoff 2012). When reviewing an exhaustive list of attempts and largely-failed legal means to control corporate misconduct, Hulpke asks “If all else fails, a corporate death penalty?” and answers his own question with a proposal of a three-strikes-and-you-are-out corporate death penalty act (Hulpke 2017). He is not alone. Many authors have been analyzing the potential benefits of a corporate death penalty (Amann 2000; Yaron 2000; Noonan 2011; Heller 2014; Grossman 2015; Ramirez and Ramirez 2017), including specific legal analysis of the idea to revoke corporate charters for environmental violations (Linzey 1995, 1997; Crusto 2002). However, all of these articles focus on the area of illegal corporate activity. This might be enough in a society with a low level of corruption. However, where corruption is real (Mauro 1995; Treisman 2000; Rose-Ackerman and Palifka 2016) and laws can be adjusted to enable corporate profit at the expense of human lives, it is not enough. It is clearly worse when an entire class of corporations that make up an industry, legally cause unacceptable human harm and death (e.g., it is not a ‘bad apple’ rogue corporation). An objective metric, one in which personal feelings, opinions and politics are removed from the consideration of benefits and harms of an industry, is thus needed to guide policy. The ideal metric would use publicly-available data as well as clear and concisely defined harms and benefits.

To rectify these omissions in legal corporate oversight, this article provides the base-line for a new means of setting up an objective quantifiable metric for determining when an entire industry warrants the corporate death penalty. First, a theoretical foundation is developed with the minimum of assumptions necessary to provide evidence (or lack-there-of) for corporate public purpose. Next, this theoretical foundation will be formed into an objective quantifiable metric making use of publicly-available data. Then, this metric will be applied to two case studies: (1) The tobacco industry and (2) the coal mining industry in the U.S. The results will be presented and discussed, and future work outlined for applying the metrics to less straight-forward cases.

2. Methods

2.1. Model Assumptions

In order to build a model of industry-wide corporate death penalty three assumptions are being employed here to test the limits of a particular interpretation of the rights of corporations to exist. These assumptions are based primarily on the Universal Declaration of Human Rights by the U.N. General Assembly (2018) to ensure their universality. They are necessary to provide a hierarchy of rights between humanity and an industry’s right to existence. These assumptions, which can be universally (or nearly universally) agreed upon are:

1. Everyone has the right to life. This is explicitly called for in Article 3 of the Universal Declaration of Human Rights by the U.N. General Assembly. In addition, it is intuitively obvious that the right to life is the primary right as it is necessary to be alive to enjoy any other right (i.e., the right to work).
2. Everyone has the right to work. This is explicitly called for in Article 23 of the Universal Declaration of Human Rights. Corporations are large companies or groups of companies authorized to act as a single legal entity (person) to efficiently generate profit for the benefit of humans, and one of their primary additional benefits is job creation. Thus, corporations help facilitate the right to work.
3. Human law should give corporations the right to exist if they are beneficial to humanity. Corporations are human constructs created by law to benefit humanity. Thus, in the simplest possible case, corporations can be viewed as good as they create profit and jobs, unless their operation interferes with the right to life of humans they are meant to benefit.

It should be noted here that there are benefits corporations can provide that go beyond employment (e.g., products that provide a benefit, gifts to charity, etc.) and also that there are corporate

harms that are less severe than death (e.g., adverse ecosystem impacts that harm nature and nonhuman species, which only indirectly effects humans). Calculations of these impacts are complicated, often the data is inadequate, and they are time-scale dependent (e.g., far future estimations of impact are imprecise). In this study, to determine the base-minimum for continued corporate existence, a framework for a transparent analysis is used with a primary benefit which is straight-forward to quantify (employment in the year) and the most severe impact (net premature human deaths per year).

2.2. Quantifiable Metrics

These three assumptions lead to the inescapable conclusion that a company does not have the right to exist if it kills¹ more people than it employs. It should be pointed out here that this requirement represents the minimum to establish benefit of a corporation. This is because one must be alive to work so life takes primacy in terms of rights. If an industry is killing more people than it is employing than primary rights are being sacrificed for secondary rights and the net benefit to humankind is negative. This conclusion, however, does not infer that if a company merely employs more people than it kills that it is a net benefit. This can be quantified using the death to job ratio, r , for company (c) as:

$$r_c = \frac{d}{j} \quad (1)$$

where d is the premature deaths caused by company c per year and j is the number of jobs company c provides the economy directly. The units of r_c is deaths per job (or full time employee (FTE)). Thus, the value of r_c must be <1 in order for a company c to have the right to exist.

Similarly, it is obvious that an entire industry does not have the right to exist if it kills more people than it employs. So, the death to job ratio, r_i , for an industry (i) can be written as:

$$r_i = \frac{\sum_{a=1}^N d_{i(a)}}{\sum_{a=1}^N j_{i(a)}} \quad (2)$$

where N is the total number of corporations in industry i . The most conservative and straight-forward case is where the cause of premature deaths are uniformly distributed throughout an industry. Then r_i for a given industry must be below 1 or the entire industry should undergo an industry-wide corporate death penalty by eliminating the existence of the companies that make it up.

To illustrate the use of r_i to determine the need for industry-wide corporate death penalties two industries are evaluated in the U.S., (1) the tobacco industry and (2) the coal mining industry. In both cases, the distribution of premature death is roughly equivalent throughout the respective industries.

3. Case Studies

3.1. The Tobacco Industry

The health-related dangers for tobacco have been well established by the scientific and medical community (Barendregt et al. 1997; Murray and Lopez 1997; Peto and Lopez 2000). The World Health Organization (2009, 2011, 2013, 2015, 2017) continually refers to a “global tobacco epidemic”. Tobacco use causes approximately 6 million deaths per year globally and represents the leading cause of preventable deaths (World Health Organization 2011, 2013). Despite substantial effort by public health officials to institute control policies (Jha 1999; Fichtenberg and Glantz 2000; World Health Organization 2003; Farrelly et al. 2008; Wakefield et al. 2008; World Health Organization 2017), the U.S. Department

¹ This refers to the net impact on human life (e.g., a company/industry might make products that saves lives like medicine, but does kill a small fraction of users). The net impact on premature death is the important factor used here, which refers to deaths that occur before a person reaches a standard life expectancy. These deaths are preventable by the elimination of the given industry.

of Health and Human Services (2018) considers the use of tobacco an epidemic even in the United States of America. Controls have even been instituted both locally and internationally such as the WHO's Global Treaty on Tobacco Control, which places broad restrictions on the sale, advertising, sponsorship, promotion, shipment, and taxation of tobacco products (World Health Organization 2003). These restrictions have continued to expand over the last decade and a half (World Health Organization 2017). However, despite these restrictions, the profits available to the tobacco companies individually and the tobacco industry as whole provides an incentive to continue tobacco production.

The following values are used to answer the question: In the U.S. does the tobacco industry employ enough people to justify the number of deaths that the use of tobacco products cause?

The number of the premature deaths can be determined from U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (2014) data. Overall, in the U.S., about 480,000 deaths per year are caused from cigarette smoking directly and nearly 42,000 deaths result from secondhand smoke, so the total number of deaths attributable to the tobacco industry is at least 522,000 per year ($d_{tobacco}$). It should be noted that this is a conservative estimate, as it does not include any other tobacco-related deaths from other products or secondary deaths resulting from the industrial activity (e.g., accidents, work related fatalities, pollution from farm and processing chemicals, etc.).

The jobs in the tobacco industry are dependent on the year. For example, the jobs related to tobacco manufacturing according to the (Bureau of Labor and Statistics 2016) was a total of 13,030. However, the North American Industry Classification System (NAICS) Code 3122 for tobacco manufacturing listed only approximately 9012 jobs involved with making cigarettes, cigars, chewing and smoking tobacco and stemming and redying (SIICODE 2018a). In addition, NAICS provides data for the wholesale trade of tobacco and tobacco products, which employs approximately 19,407 people (SIICODE 2018b) and tobacco stores, which employ approximately 81,823 people (SIICODE 2018c). Finally, tobacco growing employed in the U.S. dropped from 51,700 in 2000 to only 14,100 in 2013 (International Labour Organization (ILO) Sectoral Policies Department (2014)). Using the most recent data available, this provides a $j_{tobacco}$ of about 124,342 jobs.

3.2. The Coal Mining Industry

Mining coal can be directly dangerous for workers but results in a relatively low number of deaths per year (15 in 2017) (Raby 2018). The most common use for coal is combustion for electrical generation, which releases carbon dioxide, methane, particulate matter, nitrogen and sulfur oxides, and heavy metals such as mercury (Ross et al. 2002; Weisser 2007; Epstein et al. 2011; Gaffney and Marley 2009). Poor air quality directly resulting from coal combustion is well known to adversely affect human health including: Mortality and morbidity effects on respiratory, cardiovascular, nervous, urinary, and digestive systems (Finkelman et al. 2002; Markandya and Wilkinson 2007; Curtis et al. 2006; Smith et al. 2013). The primary health-related dangers for the coal industry that kill people is from air pollution (Cohen et al. 2005; Penney et al. 2009). The total number of American deaths due to coal fired electricity-based air pollution is about 52,000/year (Caiazzo et al. 2013). This was determined from detailed meteorology and air quality models used to equate emissions to pollutant concentrations applied to concentration-response functions due to the potentially avoidable deaths related to the instantaneous removal of combustion emissions from coal (Caiazzo et al. 2013). Mining coal can also be directly dangerous for workers and the local community (Hendryx 2008, 2009; Hendryx and Zullig 2009) and does result in additional premature deaths. In addition, climate change is already causing deaths around the world and in the U.S., which will increase in the future with additional average global heating from greenhouse gas emissions from coal (Haines et al. 2006; McMichael et al. 2006; McGeehin and Mirabelli 2001). However, comprehensive studies have not been done to quantify these additional deaths caused by coal, so they are excluded from the preliminary

analysis provided here. This makes, d_{coal} a conservative 52,015 deaths per year, which is an order of magnitude below that of $d_{tobacco}$.²

U.S. coal-related employment has recently dropped drastically as coal plants are retired due to lack of profitability (U.S. Energy Information Administration 2014a). Factors reducing coal-related profit and employment include: (1) Price pressure from natural gas (U.S. Energy Information Administration 2014b) and renewable energy technologies such as wind power and solar photovoltaic (PV) technology (Milligan et al. 2015), (2) increasingly stringent environmental regulations such as the Mercury and Air Toxic Standards (MATS), Cross-State Air Pollution Rule (CSAPR) and the Clean Power Plan Proposed Rule, (3) aging coal-fired power plants (Mufson 2014), (4) slow growth in electricity demand (U.S. Energy Information Administration 2014c), (5) rising mine-mouth prices due to decreasing productivity (U.S. Energy Information Administration 2014b), (6) poor public perception of the coal industry (Jacobe 2013) and (7) a growing threat of liability due to inherent greenhouse gas emissions that come from coal combustion (Allen 2003; Faure and Nollkaemper 2007; Stott et al. 2013; Heidari and Pearce 2016). The U.S. Energy Information Administration reports that in 2016 the total coal mining employment in the U.S. was 51,795 (j_{coal}) (U.S. Energy Information Administration 2016).

4. Results and Discussion

4.1. Case Study Results on the Tobacco Industry

Using Equation (2), $r_{tobacco}$ was calculated to be 4.198. This indicates that for every direct job that the tobacco industry provides the U.S. more than four Americans die prematurely every year. Thus, the tobacco industry is not currently earning the right to exist, as it is not offsetting the considerable harm it does to America with the employment it creates. The unescapable conclusion is that the tobacco industry should be eliminated by corporate death penalties. As reviewed above, many authors have gone into detail on the process for rescinding a corporate charter, in this case these methods need to be scaled to the entire tobacco industry.

Only modest efforts would need to be made to transition existing tobacco workers to companies providing a net benefit to society. Past work has shown that tobacco executives that earned the most money per tobacco-related death had already started to diversify their businesses (Pearce and Denkenberger 2015). If facing the threat of an industry-wide corporate death penalty, many tobacco companies could pivot to existing non-tobacco products, while eliminating tobacco.³ Most of the tobacco jobs that are semi-skilled can be transferred to other industries without significant retraining (e.g., farm laborers to food crops, retail clerks in tobacco shops to retail jobs in clothing stores, etc.). In addition, a recent study has shown tobacco farm owners might increase profits now by converting tobacco farms to large-scale solar photovoltaic farms (Krishnan and Pearce 2018). That study focused on opportunities in North Carolina, which has already started to replace tobacco fields with solar arrays as profits from tobacco have decreased as the number of American smokers declines (Swanson and Plumer 2018).

It should be pointed out here that eliminating the tobacco industry with an industry-wide corporate death penalty does not make tobacco or smoking illegal and does not infringe on an individual's rights to use tobacco products. Individuals would still have the right to use these products

² It should also be noted here that these deaths and the following analysis is only in reference to the coal mined for power production (steam coal). Other applications like the use of coking coal for production of coke for blast furnaces and coal used for activated carbon, carbon fibre and other chemicals is left for future work and not included here.

³ Critics will point out here that the context of industry-wide death penalties, it may not be appropriate to allow companies to pivot into a new line of business. This idea is presented here as a pre-emptive recommendation for companies to avoid corporate death penalties by reducing the harm they due to humanity. Future work is needed to address what a just and fair distribution would be of company profits from an industry slated for elimination. For example, should such companies be allowed to invest them in a new business or should these profits be earmarked for victims and their families, employees for retraining, or to pay the costs shouldered by larger society (e.g., environmental remediation)? Similarly, the liability for executives and majority shareholders that benefited from past profits of a deadly industry is also left for future work.

that have a high probability of harming them. However, they would need to source and manufacture the product themselves, which would be a high enough effort-barrier to be expected to greatly reduce tobacco related deaths in the short term, but more importantly in the long term as less people would be likely to start smoking and become addicted.

4.2. Case Study Results on the American Coal-Mining Industry

Using Equation (2), r_{coal} is calculated to be 1.004. This indicates that for every direct job that the coal mining industry provides the U.S., more than one American dies prematurely every year because of coal mining used for power production. Thus, the coal mining industry (used for power) is not currently earning the right to exist, as it does not offset the considerable harm it does to America with the employment it creates. If we concede that, as Lynch and Barrett point out from a criminological view in their analysis of the victimization by particle matter from coal fired power plants in the U.S. (Lynch and Barrett 2015), the unescapable conclusion is that the coal mining industry in the U.S. should be eliminated by industry-wide corporate death penalties.

A recent study has already determined that a relatively minor investment in retraining would allow the vast majority of coal workers to switch to solar photovoltaic-related positions in the event of the complete elimination of the coal industry while increasing their annual income a few percent (Louie and Pearce 2016). Coal has already begun to be phased out in many locations in the world such as Ontario in 2014 (Harris et al. 2015), the UK by 2025 (Twidale 2018) and Germany by 2038 (Vaughan 2019). Eliminating the coal mining industry in the U.S. will save over 51,999 American lives a year (Prehoda and Pearce 2017), even when potential premature deaths from alternative forms of electricity generation are taken into account. There thus appears to be no technical (i.e., other forms of power can offset it for lower costs) or social (i.e., all existing coal workers can be retrained for other areas in the energy industry and most would see a pay increase) reason to allow for the continued use of coal for power generation.

4.3. Enacting Industry-Wide Corporate Death Penalties

Noonan lays out the case for corporate charter revocation at the federal level (Noonan 2011), which could be applied here for corporations that are responsible for killing more Americans than they employ. Ideally, industry-wide corporate death penalties against industries that kill more people than they employ could be enacted at the federal level for complete elimination as rapidly as possible. However, Linzey points out that 49 states and the District of Columbia still possess statutes that grant an agent of the state (usually an attorney general) the power to revoke corporate charters (Linzey 1995). These powers could be used to begin the genocide process in a piecemeal fashion, as for example coal is only mined in significant quantities in 10 out of the 25 coal mining states and could be largely eliminated if these 10 states cut all coal mining. However, Linzey also notes that these codes go unused because of the refusal of state officers to exercise their power because of the reliance of the state on corporate structures for income. This is the same mechanism that has created the legal inertia that enables these industries to continue to kill Americans up until this point in history. However, it is well within reason to assume that sometime in the future enough honorable elected officials will exist to begin to eliminate corporations that no longer serve the best interests of the public. Industry representatives may argue that their industry provides other benefits, which cannot be substituted by other products on the market. For the tobacco industry, which sells a toxic, addictive luxury good an alternative is not necessary. For the coal industry, which does sell the modern necessity of electricity, it is well established that there are numerous alternative energy sources that could more than provide the electricity needed to remove coal-fired power plants entirely from the electric grid. There are even jurisdictions that have already demonstrated the viability of complete coal elimination. For other industries that warrant industry-wide corporate death penalties, alternatives to their products that are providing essential services should be identified.

4.4. Future Work

This was a preliminary study and there are considerable areas left for future work. First, only two case study industries were analyzed and found to kill more people each year than they employ in the U.S. Many more industries must be carefully analyzed for their own potential harm as well as their potential harm to be increased in the first wave of industry death penalties. This is because in some cases demand for a given industry's products may shift to another industry potentially doing more harm. For example, tobacco consumers could switch to alcohol or other legal drugs and thus premature deaths from alcohol-related health causes and accidents (e.g., drunk driving) should be carefully scrutinized. In this case, for example, in 2004 the WHO ([World Health Organization 2004](#)) estimates about 3.3 million deaths are due to alcohol consumption and this consumption has grown. Similarly, coal users could convert to natural gas or oil and such industries whose pollution is a known contributor to premature death ([Mukhopadhyay and Forssell 2005](#); [Litovitz et al. 2013](#)) should also be carefully analyzed. These cases are less clear-cut so considerably more analysis is needed. One method to prioritize which industries should be evaluated first are those that knowingly deceived the public about the negative effects of their products (e.g., coal and tobacco as shown here).

In addition, this study used somewhat limited definitions of deaths caused by an industry (e.g., coal-related deaths were only calculated based on air pollution, yet coal is also responsible for water pollution ([ETDEWEB 1995](#); [You and Xu 2010](#); [Kim and Chon 2001](#)) that may have a quantifiable impact on premature death). Future work is needed to ensure that all potential death modes are taken into account for industries under analysis. It is clear that the Framework Convention on Tobacco Control ([Burci 2003](#)) has not been effective enough to put a stop to the hundreds of thousands of deaths in America alone every year from tobacco, and to eliminate coal-related pollution deaths, the transition to renewable energy in the U.S. is far from complete. Clearly, there is a need to re-establish the social benefit of corporations ([Cray and Drutman 2005](#)) and this appears to require a corporate death penalty for bad industry representatives ([Ramirez 2005](#)) and industry-wide corporate death penalties for the worst offenders as seen here.

These same case studies can be applied to other countries throughout the world and can also be applied in more granular detail such as at the state level (e.g., it may make sense to eliminate coal preferentially from states that suffer high coal pollution related fatalities). Similarly, it may also be more beneficial for society to phase out an entire industry targeting first the companies that are responsible for the most harm. However, it may also be best for society to apply the approach globally because many of these industries are made up of large multi-national corporations. If the industry-wide death penalty is only implemented at the federal level, high-death rate industries like tobacco and coal could move their operations to countries with less environmental or human health safe guards in place, such as the Global South, thereby simply displacing harm to other countries. Electricity, for example, is already commonly 'traded' across national lines. Much more work is needed on the means of applying such rules globally.

The values used for the calculations here were also unnecessarily conservative because data was missing on the secondary causes of premature deaths from both industries. Future work could provide more careful human life accounting to obtain values of death closer to the total premature deaths caused by a given industry. Similarly, many more industries that are known to cause human mortality should be analyzed to determine their ratios of deaths to jobs. In the two case studies here, it was relatively straightforward to identify occupations in other industries for which workers from eliminated industries could find employment. This may not always be the case and future work is needed to develop a general method for transitioning workers into socially beneficial industries.

Most importantly, this study only considered the most straightforward case calling for industry-wide corporate death penalties if the number of jobs did not equal the number of people killed as a result of those jobs for an industry. This minimum threshold for continued industry survival is actually an exceptionally low bar. For example, the U.S. Environmental Protection Agency (U.S. EPA) recommends that the central estimate of the value of a statistical life is US\$7.4 million (in 2006 dollars)

(U.S. Environmental Protection Agency (EPA) (2018)), which when updated to 2018 is US\$9.28 million. According to the Bureau of Labor Statistics the median wage of an American is US\$887/week or US\$46,124/year (U.S. Bureau of Labor Statistics 2018). Thus, to reach the economic value of the U.S. EPA estimation the average worker would need to labor for over 200 years, indicating that a human life is already considered more valuable than the mere sum of his or her earnings. Thus, it is clear that companies that are killing people with their operations, the simplest test provided here is inadequate (and perhaps all the more surprising that the two industry case studies failed to meet the threshold for continued existence).

More work is needed to consider the less straightforward situations for societies to determine an appropriate value of r to warrant industry-wide corporate death penalties. Questions must be answered such as: Is an industry a net benefit if for every η jobs it maintains, a single human dies per year? Where η equals 2, 10, 100, 1000 or 10,000 and so on. In addition, the mortality impacts of an industry are often not observed over small time scales. Thus, the time over which r should be calculated should be determined for each industry rather than using the default one used here. Should the number of deaths used to calculate r be aggregated over several years or over the working lifetime of an employee? Finally, work is needed to determine the most socially constructive method to implement industry-wide corporate death penalties for each industry identified as warranting it. For example, there is some evidence that corporate harm should be viewed more as crimes (Stretesky et al. 2013) and that appropriately large enough fines would deter poor corporate behavior (Simpson 2002). For example, if the coal industry was economically responsible for paying for the 52,015 American lives they end every year from air pollution, the fine would amount to US\$482,699,200,000/year if the U.S. EPA value per life were used. This is roughly an order of magnitude more than the U.S. coal industry annual revenue (Statista 2014), which would immediately eliminate the industry. In summary, no one, especially a well-informed rational human being that does not hate America, should “dig coal” (Toumey 2017).

5. Conclusions

This article provided a simple theoretical foundation for establishing an objective quantifiable metric for determining when an entire industry warrants industry-wide corporate death penalties. This metric is necessary because past attempts to reign in industries with known and substantial grave human impacts were unable to eliminate the harm. The results of the case studies show the American tobacco industry kills 4 times more people per year than it employs and the American coal-mining industry kills more than one American every year for every coal miner employed. Thus, the tobacco and coal-mining industries do not have the right to exist in the U.S. as they both kill more people than they employ. The results clearly warrant industry-wide corporate death penalties for both the tobacco industry and the coal mining industry in America. The tobacco industry sells an unhealthy luxury product, for which a replacement is unnecessary and tobacco industry workers can be transitioned to companies providing a net benefit to society with only modest efforts. Coal mining provides what has become a necessity in modern society: electricity. However, there are numerous methods of producing electricity needed to power American society, without the severe health and environmental effects and mortality caused by burning coal. Previous work has already shown the entire coal industry workforce could be transitioned into the solar photovoltaic industry with minor retraining. Future work is needed to deploy industry-wide corporate death penalties when appropriate and to do research to provide the data needed to ensure industries only exist to benefit human societies.

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflict of interest.

References

- Allen, Myles. 2003. Liability for climate change. *Nature* 421: 891–92. [CrossRef] [PubMed]
- Amann, Diane Marie. 2000. Capital Punishment: Corporate Criminal Liability for Gross Violations of Human Rights Symposium: Holding Multinational Corporations Responsible under International Law. *Hastings International and Comparative Law Review* 24: 327–38.
- Barendregt, Jan J., Luc Bonneux, and Paul J. van der Maas. 1997. The health care costs of smoking. *New England Journal of Medicine* 337: 1052–57. [CrossRef] [PubMed]
- Behera, Bhagirath, and V. Ratna Reddy. 2002. Environment and accountability: Impact of industrial pollution on rural communities. *Economic and Political Weekly* 37: 257–65.
- Bell, Karen. 2011. Environmental Justice in Cuba. *Critical Social Policy* 31: 241–65. [CrossRef]
- Birdsall, Nancy, and David Wheeler. 1993. Trade Policy and Industrial Pollution in Latin America: Where Are the Pollution Havens? *The Journal of Environment & Development* 2: 137–49. [CrossRef]
- Brunekreef, Bert. 1999. Air Pollution Kills Babies. *Epidemiology* 10: 661–62. [CrossRef] [PubMed]
- Büchs, Milena, Nicholas Bardsley, and Sebastian Duwe. 2011. Who bears the brunt? Distributional effects of climate change mitigation policies. *Critical Social Policy* 31: 285–307. [CrossRef]
- Burci, Gian Luca. 2003. World Health Organization (WHO): Framework Convention on Tobacco Control. *International Legal Materials* 42: 515–39. [CrossRef]
- Bureau of Labor and Statistics. 2016. Tobacco Manufacturing—May 2016 OES Industry-Specific Occupational Employment and Wage Estimates. Available online: https://www.bls.gov/oes/current/naics4_312200.htm (accessed on 7 February 2018).
- Caiazzo, Fabio, Akshay Ashok, Ian A. Waitz, Steve HL Yim, and Steven RH Barrett. 2013. Air pollution and early deaths in the United States. Part I: Quantifying the impact of major sectors in 2005. *Atmospheric Environment* 79: 198–208. [CrossRef]
- Coffee, John C. 1981. “No Soul to Damn: No Body to Kick”: An Unscandalized Inquiry into the Problem of Corporate Punishment. *Michigan Law Review* 79: 386–459. [CrossRef]
- Cohen, Aaron J., H. Ross Anderson, Bart Ostro, Kiran Dev Pandey, Michal Krzyzanowski, Nino Künzli, Kersten Gutschmidt, Arden Pope, Isabelle Romieu, Jonathan M. Samet, and et al. 2005. The Global Burden of Disease Due to Outdoor Air Pollution. *Journal of Toxicology and Environmental Health, Part A* 68: 1301–7. [CrossRef] [PubMed]
- Cray, Charlie, and Lee Drutman. 2005. Corporations and the Public Purpose: Restoring the Balance Linking Corporate Law with Progressive Social Movements. *Seattle Journal for Social Justice* 4: 305–62.
- Crusto, Michael F. 2002. Green Business: Should We Revoke Corporate Charters for Environmental Violations. *Louisiana Law Review* 63: 175–242.
- Curtis, Luke, William Rea, Patricia Smith-Willis, Ervin Fenyves, and Yaqin Pan. 2006. Adverse health effects of outdoor air pollutants. *Environment International* 32: 815–30. [CrossRef] [PubMed]
- Dasgupta, Susmita, Hua Wang, David Wheeler, and Hua Wang. 1997. *Surviving Success: Policy Reform and the Future of Industrial Pollution in China*. Policy Research Working Papers. Washington, DC: The World Bank.
- Epstein, Paul R., Jonathan J. Buonocore, Kevin Eckerle, Michael Hendryx, Benjamin M. Stout III, Richard Heinberg, Richard W. Clapp, Beverly May, Nancy L. Reinhart, Melissa M. Ahern, and et al. 2011. Full cost accounting for the life cycle of coal. *Annals of the New York Academy of Sciences* 1219: 73–98. [CrossRef] [PubMed]
- ETDEWEB. 1995. Coal Mining and Water Quality (Technical Report). IEA Coal Research. Available online: <https://www.osti.gov/etdeweb/biblio/187133> (accessed on 25 January 2019).
- Farrelly, Matthew C., Terry F. Pechacek, Kristin Y. Thomas, and David Nelson. 2008. The Impact of Tobacco Control Programs on Adult Smoking. *American Journal of Public Health* 98: 304–9. [CrossRef] [PubMed]
- Faure, Michael G., and Andre Nollkaemper. 2007. International Liability as an Instrument to Prevent and Compensate for Climate Change Climate Change Liability and the Allocation of Risk. *Stanford Environmental Law Journal* 26A: 123–80.
- Fichtenberg, Caroline M., and Stanton A. Glantz. 2000. Association of the California Tobacco Control Program with Declines in Cigarette Consumption and Mortality from Heart Disease. *New England Journal of Medicine* 343: 1772–77. [CrossRef] [PubMed]

- Finkelman, Robert B., William Orem, Vincent Castranova, Calin A. Tatu, Harvey E. Belkin, Baoshan Zheng, Harry E. Lerch, Susan V. Maharaj, and Anne L. Bates. 2002. Health impacts of coal and coal use: Possible solutions. *International Journal of Coal Geology* 50: 425–43. [CrossRef]
- Friedman, Milton. 2007. The Social Responsibility of Business Is to Increase Its Profits. In *Corporate Ethics and Corporate Governance*. Edited by Walther Ch Zimmerli, Markus Holzinger and Klaus Richter. Berlin and Heidelberg: Springer, pp. 173–78. ISBN 978-3-540-70818-6.
- Gaffney, Jeffrey S., and Nancy A. Marley. 2009. The impacts of combustion emissions on air quality and—From coal to biofuels and beyond. *Atmospheric Environment* 43: 23–36. [CrossRef]
- García-Pérez, Javier, Virginia Lope, Gonzalo López-Abente, Mario González-Sánchez, and Pablo Fernández-Navarro. 2015. Ovarian cancer mortality and industrial pollution. *Environmental Pollution* 205: 103–10. [CrossRef] [PubMed]
- Grossman, Drew Isler. 2015. Would a Corporate Death Penalty Be Cruel and Unusual Punishment? *Cornell Journal of Law and Public Policy* 25: 697–722.
- Haines, Andy, R. Sari Kovats, Diarmid Campbell-Lendrum, and Carlos Corvalán. 2006. Climate change and human health: Impacts, vulnerability and public health. *Public Health* 120: 585–96. [CrossRef] [PubMed]
- Hamdani, Assaf, and Alon Klement. 2008. Corporate Crime and Deterrence. *Stanford Law Review* 61: 271–310.
- Harris, Melissa, Marisa Beck, and Ivetta Gerasimchuk. 2015. *The End of Coal: Ontario's Coal Phase-Out*. Winnipeg: International Institute for Sustainable Development.
- He, Jie. 2006. Pollution haven hypothesis and environmental impacts of foreign direct investment: The case of industrial emission of sulfur dioxide (SO₂) in Chinese provinces. *Ecological Economics* 60: 228–45. [CrossRef]
- Heidari, Negin, and Joshua M. Pearce. 2016. A review of greenhouse gas emission liabilities as the value of renewable energy for mitigating lawsuits for climate change related damages. *Renewable and Sustainable Energy Reviews* 55: 899–908. [CrossRef]
- Heller, Alex B. 2014. Corporate Death Penalty: Prosecutorial Discretion and the Indictment of SAC Capital Comments. *George Mason Law Review* 22: 763–800.
- Hendryx, Michael. 2008. Mortality Rates in Appalachian Coal Mining Counties: 24 Years behind the Nation. *Environmental Justice* 1: 5–11. [CrossRef]
- Hendryx, Michael. 2009. Mortality from heart, respiratory, and kidney disease in coal mining areas of Appalachia. *International Archives of Occupational and Environmental Health* 82: 243–49. [CrossRef] [PubMed]
- Hendryx, Michael, and Keith J. Zullig. 2009. Higher coronary heart disease and heart attack morbidity in Appalachian coal mining regions. *Preventive Medicine* 49: 355–59. [CrossRef] [PubMed]
- Huang, Xin, Ping He, and Wei Zhang. 2016. A cooperative differential game of transboundary industrial pollution between two regions. *Journal of Cleaner Production* 120: 43–52. [CrossRef]
- Hulpke, John F. 2017. If All Else Fails, A Corporate Death Penalty? *Journal of Management Inquiry* 26: 433–39. [CrossRef]
- International Labour Organization (ILO) Sectoral Policies Department. 2014. Tobacco Sector, Employment Statistical Update, International Labour Organization. Available online: http://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---sector/documents/publication/wcms_329284.pdf (accessed on 7 February 2018).
- Jacobe, Dennis. 2013. Americans Want More Emphasis on Solar, Wind, Natural Gas Oil, Nuclear, and Coal are More Popular with Republicans and in the South. Gallup. Available online: <http://www.gallup.com/poll/161519/americans-emphasis-solar-wind-natural-gas.aspx> (accessed on 15 November 2018).
- Jha, Prabhat. 1999. Curbing the epidemic: Governments and the economics of tobacco control. *Tobacco Control* 8: 196–201.
- Kelly, Marjorie. 2001. *The Divine Right of Capital: Dethroning the Corporate Aristocracy*. Oakland: Berrett-Koehler Publishers. ISBN 978-1-57675-125-1.
- Kennedy, Shayne. 1997. Probation and the Failure to Optimally Deter Corporate Misconduct Note. *Southern California Law Review* 71: 1075–104.
- Kim, Ju-Yong, and Hyo-Taek Chon. 2001. Pollution of a water course impacted by acid mine drainage in the Imgok creek of the Gangreung coal field, Korea. *Applied Geochemistry* 16: 1387–96. [CrossRef]
- Krishnan, Ram, and Joshua M. Pearce. 2018. Economic impact of substituting solar photovoltaic electric production for tobacco farming. *Land Use Policy* 72: 503–9. [CrossRef]

- Linzey, Thomas. 1995. Awakening a Sleeping Giant: Creating a Quasi-Private Cause of Action for Revoking Corporate Charters in Response to Environmental Violations. *Pace Environmental Law Review* 13: 219–80.
- Linzey, Thomas. 1997. Killing Goliath: Defending Our Sovereignty and Environmental Sustainability through Corporate Charter Revocation in Pennsylvania and Delaware. *Dickinson Journal of Environmental Law & Policy* 6: 31–64.
- Litovitz, Aviva, Aimee Curtright, Shmuel Abramzon, Nicholas Burger, and Constantine Samaras. 2013. Estimation of regional air-quality damages from Marcellus Shale natural gas extraction in Pennsylvania. *Environmental Research Letters* 8: 014017. [CrossRef]
- Lloyd, O. L., G. Smith, M. M. Lloyd, Y. Holland, and F. Gailey. 1985. Raised mortality from lung cancer and high sex ratios of births associated with industrial pollution. *Occupational and Environmental Medicine* 42: 475–80. [CrossRef]
- López-Abente, Gonzalo, Javier García-Pérez, Pablo Fernández-Navarro, Elena Boldo, and Rebeca Ramis. 2012. Colorectal cancer mortality and industrial pollution in Spain. *BMC Public Health* 12: 589. [CrossRef] [PubMed]
- Louie, Edward P., and Joshua M. Pearce. 2016. Retraining investment for U.S. transition from coal to solar photovoltaic employment. *Energy Economics* 57: 295–302. [CrossRef]
- Lucas, Robert EB, David Wheeler, and Hemamale Hettige. 1992. *Economic Development, Environmental Regulation, and the International Migration of Toxic Industrial Pollution, 1960–1988*. Washington, DC: World Bank Publications.
- Lynch, Michael J., and Kimberly L. Barrett. 2015. Death Matters: Victimization by Particle Matter from Coal Fired Power Plants in the US, a Green Criminological View. *Critical Criminology* 23: 219–34. [CrossRef]
- Mahmood, Shakeel Ahmed Ibne. 2011. Air pollution kills 15,000 Bangladeshis each year: The role of public administration and governments integrity. *Journal of Public Administration and Policy Research* 3: 129–40.
- Markandya, Anil, and Paul Wilkinson. 2007. Electricity generation and health. *The Lancet* 370: 979–90. [CrossRef]
- Markoff, Gabriel. 2012. Arthur Andersen and the Myth of the Corporate Death Penalty: Corporate Criminal Convictions in the Twenty-First Century. *University of Pennsylvania Journal of Business Law* 15: 797–842. [CrossRef]
- Markowitz, Gerald, and David Rosner. 2013. *Deceit and Denial*. Berkeley: Univ of California Press.
- Martínez-Solanas, Èrica, Montse Vergara-Duarte, Miquel Ortega Cerdà, Juan Carlos Martín-Sánchez, Maria Buxó, Eduard Rodríguez-Farré, Joan Benach, and Glòria Pérez. 2017. The Geography of the Alzheimer's Disease Mortality in Spain: Should We Focus on Industrial Pollutants Prevention? *Healthcare* 5: 89. [CrossRef] [PubMed]
- Mauro, Paolo. 1995. Corruption and Growth. *The Quarterly Journal of Economics* 110: 681–712. [CrossRef]
- McGeehin, Michael A., and Maria Mirabelli. 2001. The potential impacts of climate variability and change on temperature-related morbidity and mortality in the United States. *Environmental Health Perspectives* 109: 185–89. [PubMed]
- McMichael, Anthony J., Rosalie E. Woodruff, and Simon Hales. 2006. Climate change and human health: Present and future risks. *The Lancet* 367: 859–69. [CrossRef]
- Milligan, Michael, Bethany Frew, Brendan Kirby, Matt Schuerger, Kara Clark, Debbie Lew, Paul Denholm, Bob Zavadil, Mark O'Malley, and Bruce Tsuchida. 2015. Alternatives No More: Wind and Solar Power Are Mainstays of a Clean, Reliable, Affordable Grid. *IEEE Power and Energy Magazine* 13: 78–87. [CrossRef]
- Mufson, Steven. 2014. Vintage U.S. Coal-Fired Power Plants Now an 'Aging Fleet of Clunkers'. *Washington Post*. Available online: http://www.washingtonpost.com/business/economy/a-dilemma-with-aging-coal-plants-retire-them-or-restore-them/2014/06/13/8914780a-f00a-11e3-914c-1fbd0614e2d4_story.html (accessed on 15 November 2018).
- Mukhopadhyay, Kakali, and Osmo Forssell. 2005. An empirical investigation of air pollution from fossil fuel combustion and its impact on health in India during 1973–1974 to 1996–1997. *Ecological Economics* 55: 235–50. [CrossRef]
- Murray, Christopher J. L., and Alan D. Lopez. 1997. Global mortality, disability, and the contribution of risk factors: Global Burden of Disease Study. *The Lancet* 349: 1436–42. [CrossRef]
- Noonan, Kyle. 2011. The Case for a Federal Corporate Charter Revocation Penalty Note. *George Washington Law Review* 80: 602–31.

- Pearce, Joshua M., and David C. Denkenberger. 2015. Aligning executive incentives with global public health goals. *Progress in Health Sciences* 5: 16–23.
- Penney, Sarah, Jacob Bell, and John Balbus. 2009. *Estimating the Health Impacts of Coal-Fired Power Plants Receiving International Financing*. New York: Environmental Defense Fund.
- Peto, Richard, and Alan D. Lopez. 2000. Future worldwide health effects of current smoking patterns. *Tobacco and Public Health: Science and Policy* 37: 154–61.
- Prehoda, Emily W., and Joshua M. Pearce. 2017. Potential lives saved by replacing coal with solar photovoltaic electricity production in the U.S. *Renewable and Sustainable Energy Reviews* 80: 710–15. [CrossRef]
- Raby, John. 2018. U.S. Coal Mining Deaths Surge in 2017 after Hitting Record Low. Available online: <https://www.chicagotribune.com/business/ct-coal-mining-deaths-20180102-story.html> (accessed on 15 November 2018).
- Ramirez, Mary Kreiner. 2005. The Science Fiction of Corporate Criminal Liability: Containing the Machine through the Corporate Death Penalty. *Arizona Law Review* 47: 933–1002.
- Ramirez, Mary Kreiner, and Steven A. Ramirez. 2017. *The Case for the Corporate Death Penalty: Restoring Law and Order on Wall Street*. New York: NYU Press.
- Rose-Ackerman, Susan, and Bonnie J. Palifka. 2016. *Corruption and Government: Causes, Consequences, and Reform*. Cambridge: Cambridge University Press. ISBN 978-1-107-08120-8.
- Ross, Andy B., Jenny M. Jones, Suparin Chaiklangmuang, Mohamed Pourkashanian, Alan Williams, Krystyna Kubica, Jan T. Andersson, Melanie Kerst, Pavel Danihelka, and Keith D. Bartle. 2002. Measurement and prediction of the emission of pollutants from the combustion of coal and biomass in a fixed bed furnace. *Fuel* 81: 571–82. [CrossRef]
- Schane, Sanford A. 1986. Corporation is a Person: The Language of a Legal Fiction. *Tulane Law Review* 61: 563–610.
- SIICODE. 2018a. Description—NAICS Code 3122—Tobacco Manufacturing. Available online: <https://sicode.com/en/naicscodes/3122/tobacco-manufacturing-1> (accessed on 7 February 2018).
- SIICODE. 2018b. Description—NAICS Code 42494—Tobacco and Tobacco Product Merchant Wholesalers. Available online: <https://sicode.com/en/naicscodes/42494/tobacco-and-tobacco-product-merchant-wholesalers-1> (accessed on 7 February 2018).
- SIICODE. 2018c. Description—NAICS Code 453991—Tobacco Stores. Available online: <https://sicode.com/en/naicscodes/453991/tobacco-stores> (accessed on 7 February 2018).
- Simpson, Sally S. 2002. *Corporate Crime, Law, and Social Control*. Cambridge: Cambridge University Press. ISBN 978-0-521-58933-8.
- Smith, Kirk R., Howard Frumkin, Kalpana Balakrishnan, Colin D. Butler, Zoë A. Chafe, Ian Fairlie, Patrick Kinney, Tord Kjellstrom, Denise L. Mauzerall, Thomas E. McKone, and et al. 2013. Energy and Human Health. *Annual Review of Public Health* 34: 159–88. [CrossRef] [PubMed]
- Statista. 2014. U.S. Coal Mining Revenue 2014. Available online: <https://www.statista.com/statistics/296501/revenue-coal-mining-in-the-us/> (accessed on 7 December 2018).
- Stott, Peter A., Myles Allen, Nikolaos Christidis, Randall M. Dole, Martin Hoerling, Chris Huntingford, Pardeep Pall, Judith Perlwitz, and Dáithí Stone. 2013. Attribution of Weather and Climate-Related Events. In *Climate Science for Serving Society: Research, Modeling and Prediction Priorities*. Edited by Ghassem R. Asrar and James W. Hurrell. Dordrecht: Springer, pp. 307–37. ISBN 978-94-007-6692-1.
- Stretesky, Paul B., Michael A. Long, and Michael J. Lynch. 2013. *The Treadmill of Crime: Political Economy and Green Criminology*. London: Routledge. ISBN 978-1-135-12942-2.
- Swanson, Ana, and Brad Plumer. 2018. Trump's Solar Tariffs Are Clouding the Industry's Future. *New York Times*, January 23.
- Toumey, Chris. 2017. Science policy in the days of Trump. *Nature Nanotechnology* 12: 934.
- Treisman, Daniel. 2000. The causes of corruption: A cross-national study. *Journal of Public Economics* 76: 399–457. [CrossRef]
- Twidale, Susanna. 2018. Britain Outlines Plans for 2025 Coal-Power Phase out. Reuters. Available online: <https://www.reuters.com/article/us-britain-coal-phase-out/britain-outlines-plans-for-2025-coal-power-phase-out-idUSKBN1EU11P> (accessed on 7 February 2018).
- U.N. General Assembly. 2018. Universal Declaration of Human Rights. Available online: <http://www.un.org/en/universal-declaration-human-rights/> (accessed on 15 November 2018).
- U.S. Bureau of Labor Statistics. 2018. Usual Weekly Earnings of Wage and Salary Workers Thirdquarter 2018. Available online: <https://www.bls.gov/news.release/pdf/wkyeng.pdf> (accessed on 7 December 2018).

- U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. 2014. *The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General*; Atlanta: U.S. National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. Available online: https://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/index.htm (accessed on 15 November 2018).
- U.S. Department of Health and Human Services. 2018. Ending the Tobacco Epidemic: A Tobacco Control Strategic Action Plan for the US Department of Health and Human Services. Available online: <https://www.hhs.gov/sites/default/files/ash/initiatives/tobacco/tobaccostrategicplan2010.pdf> (accessed on 15 November 2018).
- U.S. Energy Information Administration. 2014a. AEO2014 Projects More Coal-Fired Power Plant Retirements by 2016 Than Have Been Scheduled. Today in Energy. Available online: <http://www.eia.gov/todayinenergy/detail.cfm?id=15031> (accessed on 15 November 2018).
- U.S. Energy Information Administration. 2014b. Market Trends: Coal. Annual Energy Outlook 2014. Available online: http://www.eia.gov/forecasts/aeo/MT_coal.cfm (accessed on 15 November 2018).
- U.S. Energy Information Administration. 2014c. What is the Role of Coal in the United States? Energy in Brief. Available online: http://www.eia.gov/energy_in_brief/article/role_coal_us.cfm (accessed on 15 November 2018).
- U.S. Energy Information Administration. 2016. Annual Coal Report 2016. Table 18. Average Number of Employees by State and Mine Type, 2016 and 2015. Available online: <https://www.eia.gov/coal/annual/pdf/table18.pdf> (accessed on 15 November 2018).
- U.S. Environmental Protection Agency (EPA). 2018. Mortality Risk Valuation. Available online: <https://www.epa.gov/environmental-economics/mortality-risk-valuation> (accessed on 7 December 2018).
- Vaughan, Adam. 2019. Germany Agrees to End Reliance on Coal Stations by 2038. *The Guardian*, January 26.
- Wakefield, Melanie A., Sarah Durkin, Matthew J. Spittal, Mohammad Siahpush, Michelle Scollo, Julie A. Simpson, Simon Chapman, Victoria White, and David Hill. 2008. Impact of Tobacco Control Policies and Mass Media Campaigns on Monthly Adult Smoking Prevalence. *American Journal of Public Health* 98: 1443–50. [CrossRef] [PubMed]
- Weisser, Daniel. 2007. A guide to life-cycle greenhouse gas (GHG) emissions from electric supply technologies. *Energy* 32: 1543–59. [CrossRef]
- World Health Organization. 2003. *WHO Framework Convention on Tobacco Control*. Geneva: World Health Organization.
- World Health Organization. 2004. *Global Status Report on Alcohol 2004*. Geneva: World Health Organization.
- World Health Organization. 2009. *WHO Report on the Global Tobacco Epidemic, 2009: Implementing Smoke-Free Environments*. Geneva: World Health Organization. ISBN 978-92-4-156391-8.
- World Health Organization. 2011. *WHO Report on the Global Tobacco Epidemic, 2011: Warning about the Dangers of Tobacco*. Geneva: World Health Organization.
- World Health Organization. 2013. *WHO Report on the Global Tobacco Epidemic, 2013: Enforcing Bans on Tobacco Advertising, Promotion and Sponsorship*. Geneva: World Health Organization. ISBN 978-92-4-069160-5.
- World Health Organization. 2015. *WHO Report on the Global Tobacco Epidemic, 2015*. Geneva: World Health Organization. ISBN 978-92-4-150912-1.
- World Health Organization. 2017. *Monitoring Tobacco Use and Prevention Policies*. Geneva: World Health Organization. ISBN 978-92-4-151282-4.
- Yaron, Gil. 2000. *Awakening Sleeping Beauty: Reviving Lost Memories and Discourses to Revoke Corporate Charters*. Vancouver: University of British Columbia.
- You, C. F., and X. C. Xu. 2010. Coal combustion and its pollution control in China. *Energy* 35: 4467–72. [CrossRef]
- Zeng, Dao-Zhi, and Laixun Zhao. 2009. Pollution havens and industrial agglomeration. *Journal of Environmental Economics and Management* 58: 141–53. [CrossRef]
- Zyglidopoulos, Stelios, Paul Hirsch, Pablo Martin de Holan, and Nelson Phillips. 2017. Expanding Research on Corporate Corruption, Management, and Organizations. *Journal of Management Inquiry* 26: 247–53. [CrossRef]

