

New solutions for environmental balance through taxation

Novas soluções para o equilíbrio ambiental através da tributação

Andrei Cesar Schneider*

Paulo Antonio Caliendo Velloso da Silveira**

Abstract: Over the years, command and control mechanisms have been insufficient to motivate ecologically appropriate behaviors. Thus, new proposals are necessary to induce the adequation of a new development model. In this sense, this work aims to demonstrate the relationship of Brazilian constitutional premises with the possibility of introducing tax instruments capable of lead environmentally desirable actions. The comparative and empirical methodology were applied in order to analyze the tools used by other countries and the data from different institutions regarding environmental taxation and environmental degradation. Therefore, this work is based on the grounds of inducing behaviors that prevent pollution, promote the best use of resources, and seek to restore natural ecological processes. For this reason, this research intends to add recent studies that point to successful results from the use of environmental taxation, as well as bringing the recent Chinese experience that provides new approaches to the use of this methodology. Finally, it suggests the need for the elaboration of a well-structured apparatus that promotes not only “green-behavior” induction, respecting tax principles, but also indicates the need of other tools capable of putting in practice what the taxes are designed to induce.

Key-Words: Environmental Tax, Green Behaviors.

Resumo: Ao longo dos anos, os mecanismos de comando e controle têm se mostrado insuficientes para motivar comportamentos ecologicamente corretos. Dessa forma, novas propostas se mostram necessárias para induzir a adequação a um novo modelo

* Mestre em Direito pelo Programa de Pós-Graduação em Direito da PUC-RS.

** Possui graduação em Direito pela Faculdade de Direito da Universidade Federal do Rio Grande do Sul (1992), mestrado em Direito pela Universidade Federal do Rio Grande do Sul (1996) e doutorado em Direito, na área de Concentração de Direito Tributário, pela Pontifícia Universidade Católica de São Paulo (2002), Doutorado Sandwich na Ludwig-Maximilians Universität em Munique (Alemanha) (2001). Doutorando em Filosofia na PUCRS (Capes 6), na área de Ética e Inteligência Artificial. Atualmente, é professor permanente da Pontifícia Universidade Católica do Rio Grande do Sul, no Programa de Pós-Graduação, Mestrado e Doutorado (Capes 6).

Submissão: 05.08.2021. **Aceitação:** 24.04.2023.

de desenvolvimento. Neste sentido, este trabalho tem como objetivo demonstrar a relação de premissas constitucionais brasileiras com a possibilidade de introduzir instrumentos tributários capazes de conduzir ações ambientalmente desejáveis. Dessa maneira, foram utilizados métodos de pesquisa comparativa e empírica que analisaram as ferramentas utilizadas por outros países e dados de diversas instituições referentes à tributação ambiental e degradação do meio ambiente. Para tanto, se tem como base a indução de comportamentos que evitem a poluição, promovam a melhor utilização dos recursos e busquem restaurar os processos ecológicos naturais. Dessa forma, esta pesquisa procura acrescentar estudos recentes que apontam resultados exitosos da utilização da tributação ambiental, assim como trazer a recente experiência chinesa que sugere novas abordagens para utilização dessa metodologia. Ao fim, aponta-se a necessidade da elaboração de um aparato bem estruturado que promova não apenas a indução de “comportamentos-verdes”, respeitando princípios tributários, mas também ofereça outras ferramentas capazes de colocar em prática o que as taxas se propõe a induzir.

Palavras-chave: Tributo Ambiental, Comportamentos Ecológicos.

Introduction

The Brazilian constitutional statement, anchored in article 225, has reached a status that goes further than a command, a right, or even a fundamental right. It is an urgency. The right to an ecologically balanced environment and the duty to defend and preserve it by the Government and community represent the need for a turning point able to guide not only the land of the largest biome in the world but all the countries in their public policies.

This urgency can be represented by many worrisome data from international agencies. According to the “Economic cost of the health impact of air pollution in Europe” report, from the World Health Organization, it estimates 7 million premature deaths in the world yearly caused by the effects of ambient and household air pollution. The cost of these premature deaths in the countries of the WHO European Region stood at US1.431 trillion. At the same time, the report from the OECD Development Centre, by Rana Roy, “The Cost of Air Pollution in Africa”, shows the increase in the pollution costs, which represents, in 2013, USD 215 billion due ambient particulate matter pollution and USD 232 billion due household air pollution in this continent. The World Bank report of “Cost of Pollution in China” estimated the economic cost of mortality and morbidity related to air pollution was 157.3 billion yuan in 2003, which represents 1,16 percent of GDP; at the same time, the pollution causing water scarcity costs 147 billion yuan, another 1 percent of GDP. Despite it, “The Global Burden of Disease Study 2017” estimated that 1.24 million people die due to air pollution in this country. In the United States, the picture is similar. It is evaluated that aggregate

pollution damages from the market sectors of all industries were US\$184 billion in 2002, most of it coming from agriculture and utilities. The United States also occupied the seventh position in premature pollution-related deaths reaching 196,930, according to the Global, Regional, and Country Analysis from the Global Alliance on Health and Pollution.

The Brazilian scenario follows the same path as the rest of the planet. According to the aforementioned analysis, Brazil has 109,438 premature deaths per year. One of the biggest concerns, in this case, is the fires in forests, which in 2019 were responsible for more than two thousand hospitalizations. At the same time, only in São Paulo, the biggest Brazilian city, the cost of pollution was estimated, by Veronez et. al., in US\$208 million per year. Finally, the Brazilian Amazonia and Pantanal have been experiencing exponential deforestation growth, which represented, in the year of 2019, the highest rate of deforestation since 2009; also, in the last 12 months, considering 2020, the deforestation has increased by 34% in relation the same period of the antecedent year. The Pantanal Biome was drastically damaged by the fires, which has begun in nine farms, and now has already destroyed 141.773 hectares of vegetation. The destruction of almost 150 thousand square kilometers is equivalent to the sum of the destruction that has occurred in the last six years.

These pieces of information indicate two simple conclusions: pollution and environmental degradation have an economic cost and, most importantly, they are responsible for the yearly death of people equivalent to the entire population of Paraguay in 2019. Therefore, the harm caused by pollution and degradation is not the pure violation of a fundamental right found in the art. 225 of the Brazilian Constitution, but it reaches the fundamental rights of life, health, dignity, and even free enterprise, what is frequently considered opposed to the right to an ecologically balanced environment. In order to reach the stated goal in the Brazilian Constitution, it is necessary to include more than mechanisms of command and control, but elaborate mechanisms capable of inducing ecological behaviors. The inducing mechanism of environmental protection does not intend to end its utilization, what would turn the productive process unviable; instead of it, the purpose is finding the equilibrium between its utilization and the need to safeguard it.

The process of inducing green behaviors has the purpose of determining individuals' actions not only by coercion but establishing economical advantages, which has not only a dissuading aspect but also a promotional one; it arrives due to the promise from an advantage, what can be expressed by a positive sanction. At the same time, it is possible to establish a cost for the use of the environment,

which influences the will of the passive subject once the transaction costs may be considered during the decisions. In both cases, one adequate instrument to include the positive sanctions and internalize the environmental production costs is the taxation. By relieving the tax burden of some ecologically oriented behaviors and charging environment harmful activities, the tax is a tool for the promotion of the fundamental right in the grounds of the Brazilian Constitution and the position of international institutions as the Organisation for Economic Co-operation and Development (OECD).

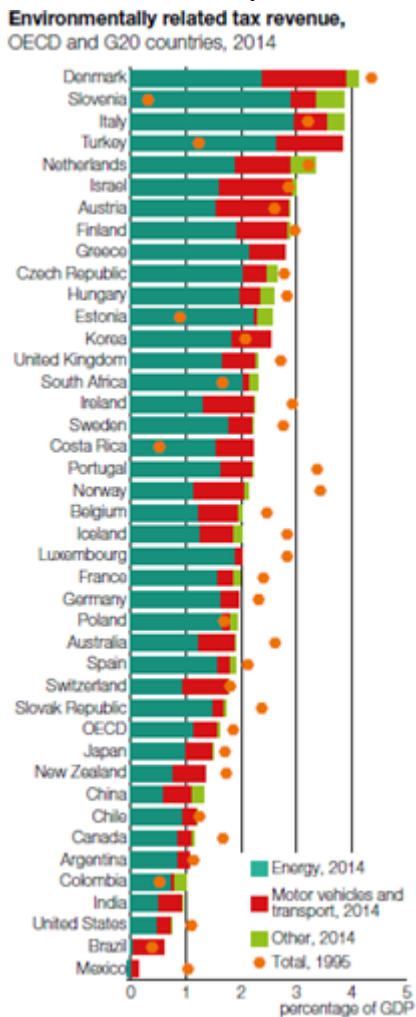
Therefore, this work aims to present the two sides of the taxation coin. It means the possibility of introducing the environmental element in the existent tax or introducing a tax specifically for internalizing the costs of pollution. For this reason, considering the deductive approach, which can be summarized by the theory of environmental taxation capability to represent a new solution for inducing ecologically adequate behaviors, this study applies a comparative methodology from other legal experiences of green taxes (China and some European Countries) and also includes an empirical analysis to demonstrate through data the impacts of taxes and pollution worldwide. It intends to verify through different studies, which have already been produced, the effectiveness of this fiscal tool and its motivation above summarized. Moreover, this work aims to evaluate, from international and national experiences, the fulfillment of the orientations present in art. 225 of the Brazilian Constitution (“All have the right to an ecologically balanced environment, which is an asset of common use and essential to a healthy quality of life, and both the Government and the community shall have the duty to defend and preserve it for present and future generations”), concerning pollution (“V – control the production, sale and use of techniques, methods or substances which represent a risk to life, the quality of life and the environment”), restoration of the natural ecological process (“I - preserve and restore the essential ecological processes and provide for the ecological treatment of species and ecosystems”), and, in relation to the art. 170 (“The economic order, founded on the appreciation of the value of human work and on free enterprise, is intended to ensure everyone a life with dignity, in accordance with the dictates of social justice, with due regard for the following principles:”), the scarcity (VI – environment protection, which may include differentiated treatment in accordance with the environmental impact of goods and services and of their respective production and delivery processes;).

1. From the basics

The first carbon tax started in 1990 in Finland. Later, in 1991, it was applied in Norway and Sweden, and in 1994 Denmark also introduced it, which nowadays,

as presented in the aside table, is the country with the highest environmentally related tax revenue. However, despite its first application in the 1990s, its origin comes from Arthur Cecil Pigou, in 1920, through his book “The Economics of Welfare”. According to the author, the divergence between private costs and social costs creates externalities. These externalities, when defined as negative, might be considered as market failures. It can be represented by a company eviction of pollutants in a river, which implies a social cost for the community, while the company has been able to produce without paying for the cost of pollution. The author, as the founder of the “Welfare School”, proposes the internalization of this cost for the agent through the State intervention by imposing an overprice related to the use of the environment; otherwise, the negative externalities would be imposed on third parties.

Graphic 1: Environmentally related tax revenue



Source: OECD.

The foundation of this reasoning is the polluter-payer principle. Torres argues it is a principle of environmental tax justice, which requires that the agents responsible for the pollution must bear the responsibility for the payment of the expenses related to the prevention and restoration caused by the environmental damages. The author reinforces the third dimension of this fundamental right by emphasizing the need to avoid the economic repercussions of pollution by the

collectivity³. The premise that the one who contaminates may also pay for its consequences permits the internalization of the loss produced by the own activity⁴.

In the Brazilian Law, it is possible to find this principle declared in the Law nº 6.938 from 1981. In its art. 4th, VII, it is expressed the duty of the polluter repair or indemnify the damages caused, and the duty of the user to contribute to use the natural resources with economical ends⁵. According to Souza, this principle represents “an efficient management of natural resources, whereupon the Government tries to internalize the damages caused by the contamination process[...]”⁶. The author also continues pointing that charging this negative externality represents the achievement of an equalitarian treatment, once it would be unfair, as an example, an industry obtaining profit while contaminating the environment and affecting the community without paying for it. Notwithstanding, it is important to address the polluter-payer principle does not mean that by paying the agent could freely discharge any kind of pollutant residue. Some kind of debris, due to its toxicity or the limits of discharge, must continue to be prohibited in reason of the danger it may impose to the society, otherwise, the principle would be manipulated to justify and endless release of pollution.

2. Environmental tax

The environmental tax is not only about paying for the use of natural resources or internalizing the cost of production, its main purpose is changing behaviors to turn them into more environmentally adequated ones. Therefore, it is important to perceive the difference between these two objectives. Taxation can be directed to obtain resources for the development of State activities, which represents a fiscal role, or it can be an instrument to dissuade and promote certain practices deliberately intended by the legislator, which represents an extrafiscal role. In the second case, as it was pointed by the Brazillian Supreme Court of Justice, it is necessary to indicate the distinctness which motivates a different treatment for this case; it also must respect the contributive capacity and it is forbidden an

³ TORRES, Ricardo Lobo. Princípios e Teoria geral do Direito Tributário Ambiental. In: Torres, Heleno Taveira (org.). *Direito Tributário Ambiental*. São Paulo: Malheiros, 2005. p. 27.

⁴ VALADARES, André García Leão Reis. *Tributação ambiental e sua compatibilidade com o Sistema Tributário brasileiro*. *Revista de Direito Ambiental e sociedade*. v. 5. n. 1. 2015. p. 140. Available in: <http://www.ucs.br/etc/revistas/index.php/direitoambiental/article/view/3209>.

⁵ BRAZIL. Law nº 6.938 from August 31, 1981. Brasília. DF. Available in: http://www.planalto.gov.br/ccivil_03/Leis/L6938.htm.

⁶ SOUZA, Sarah Maria Linhares de Araújo Paes. *Políticas Públicas na Tributação Ambiental*. Belo Horizonte: Fórum, 2017. p. 115.

expropriation tax⁷. As noticed by Sarlet and Fensterseifer this model of taxation finds two goals: supporting the administrative structure of environmental oversight and adjusting behaviors from economic agents⁸.

The two goals intended by environmental taxation can coexist as the two sides of the same coin. However, some authors like Souza insist that the main purpose of this kind of instrument must be the extrafiscality, which means that it must focus on influencing behaviors and not in collecting revenue for the State, even if it is destined to improve the environment. According to her, a fundraiser nature would make this mechanism lose its nature of environmental protection⁹. Therefore, it has a different aim concerning the principle of the polluter-payer. The main concern is encumbering inconvenient actions to the State; as a consequence, it is not a punishment, once the mentioned action is not against the law, but it is a disincentive of some situation¹⁰. Notwithstanding, in both cases, it arises the difficulties to define which kind of taxation (tax, fee, or contribution) may be used to internalize and how to define the amount that must be charged.

Due to these difficulties, it is possible to find doctrine positions against the possibility of conjugating extrafiscality and contributive capacity, as Carlos Palao Taboada, and also authors like Heleno Taveira Tôrres and Denise Lucena Cavalcante, who are against the environmental tax, once they consider it as a sanction, what would be against the art. 3º of the Brazillian National Code of Taxation¹¹. The understanding of this positioning requires to comprehend the distinctions among the tax species. A tax will relapse over wealth demonstrations; a fee will relapse due to the exercise of police power by the State or for the use of some specific public service that must be divisible; and the contributions may be applied when the taxpayers have some return but it must have specific ends and it is directed for some group of taxpayers¹².

In the environmental tax case, the production and its consequent pollution will be considered as a wealth manifestation, therefore it will be the taxable event that justifies the origin of charging. However, the main purpose might not be the

⁷ PAULSEN, Leandro. Curso de Direito Tributário. 10ª Ed. São Paulo: Saraiva Jur, 2019. p. 33-36.

⁸ SARLET, Ingo Wolfgang; FENSTERSEIFER, Tiago. Curso de Direito Ambiental. Rio de Janeiro: Forense, 2020. p. 429-430.

⁹ SOUZA, Sarah Maria Linhares de Araújo Paes. Políticas Públicas na Tributação Ambiental. Belo Horizonte: Fórum, 2017. p. 131.

¹⁰ RIBEIRO, Ricardo Lodi. A extrafiscalidade ambiental no ICMS. In: Carli, Ana Alice de. et. al. Tributação e sustentabilidade ambiental. Rio de Janeiro: Editora FGV, 2015. p. 47.

¹¹ SOUZA, Sarah Maria Linhares de Araújo Paes. Políticas Públicas na Tributação Ambiental. Belo Horizonte: Fórum, 2017. p. 144 and 166-167.

¹² PAULSEN, Leandro. Curso de Direito Tributário. 10ª Ed. São Paulo: Saraiva Jur, 2019. p. 54-61.

revenue, but the extrafiscality found in the purpose of inducing the reduction of pollution in the linked process due to the imposed overprice. It would increase the transaction costs, but it is necessary to address that it can be dislocated by the companies to the price of the product, and, as a consequence, increasing the product price for the consumer. At this point, by the use of this kind of tax instrument, it is expected that the free market and concurrence of companies act as a vital element. Once a company reduces the amount of released pollutants it would be affected by a lower tax burden, therefore, it could set more competitive prices and have an economic advantage in relation to those not concerned in reducing emissions. In this scenario, the taxation is not a sanction, but the price for using the natural resources and the instrument able to dissuade the market agents. The same reasoning can be applied to positive sanctions. A company enjoying an exemption of tax designed for ecofriendly behavior would be affected by lower transaction costs and could set more competitive prices, enjoying an economic advantaged caused by the promoted behavior. At the same time, in accordance with what might be designed by the legislator, the revenue, which reveals the fiscal aspect, might be oriented to recover the degraded environment. It is possible to identify this reasoning in studies from the Fiscal Affairs Department from the International Monetary Fund, prepared by Lightart¹³:

Compared with standards, Pigovian taxes are a lower-cost method of achieving a given reduction in pollution (Baumol and Oates, 1988). When faced with a Pigovian tax, firms are encouraged to install abatement equipment (e.g., installing scrubbers and filters in outlets or sewage treatment) to reduce pollution while such incentives are absent with standards. From a dynamic point of view, Pigovian taxes are also more desirable than standards. Taxes stimulate firms to search continually for pollution-saving technologies. The revenue potential of pollution taxes may be another reason to prefer taxes to standards. Governments face different options in using ecotax revenues: reducing public deficits, increasing spending on “traditional” public goods, earmarking for specific environmental projects or reducing distortionary taxes on labor or capital.

Therefore, there are two stages in the application of environmental taxation. In the first moment, the market does not solve by itself the failure conceived by the negative externality created by the production process, which affects third parties and generates profit for the agent. As a consequence, it demands the State intervention to force the internalization or avoid the emergence of pollution. In the

¹³ LIGTHART, Jenny E. INTERNATIONAL MONETARY FUND. The Macroeconomic Effects of Environmental Taxes: A Closer Look at the Feasibility of “Win-Win” Outcomes. Fiscal Affairs Department. WP/98/75. May 1998. p. 8. Available in: <https://www.cbd.int/financial/fiscalenviron/g-fiscalmacro-imf.pdf>.

second moment, the self-market regulation comes to the scene as the reasoning to adequate behaviors and enjoy an economic advantage resulted from the compliance to oriented ecologic practices induced by the State intervention. At the same time, the preponderant nature of extrafiscality of this instrument aims to promote environmental education through the awareness of manufacturers and consumers about their consumers' standards and break the complacency for a system that reproduces the degradation of natural resources¹⁴.

However, the tax is not the only instrument that can be used to raise environmental accountability. Fees can also play an important role following its limitation of being related to some consideration made by the Government. According to Amaral, they can be created for environmental oversight, licensing, and the installment of potential pollutant activities¹⁵. What it is possible to realize in the process of the development of Brazillian Environmental Impact Studies and Report of Environmental Impact (EIA/RIMA). At the same time, they can also be used to compensate public services directed to environmental scouring and recovery¹⁶. Although it is important to stress that according to the Brazillian Constitution, in its art. 145, II, they must be linked to some State performance, otherwise, they would be considered as unconstitutional. Therefore, if the State does not act, the fee can not be charged. On the other side, the contributions could be used following the Brazilian constitutional forecast present in art. 174, as the Contribution of Intervention in the Economic Domain (Cide). In this case, the State is allowed to intervene in the purpose of oversight, promote, and plan to avoid abuses and distortions by economic sectors. In this case, considering the Constitutional Amendment 42/2003, it presents the possibility of a different treatment for products and services in accordance with the environmental impact¹⁷. Conjugating this forecast with the art. 225 of the Brazillian Constitution, the Contribution of Intervention in the Economic Domain would be an instrument to

¹⁴ OLIVEIRA, Thaís Soares de. VALIM, Beijanicy Ferreira da Cunha Abadia. *Tributação Ambiental: A Incorporação do Meio Ambiente na Reforma do Sistema Tributário Nacional*. In *Reforma Tributária*. Og. Adolfo Sashesida, Erich Endrillo Santos Simas. Rio de Janeiro: OAB/DF, 2018. p. 138. Available in: <http://repositorio.ipea.gov.br/handle/11058/8641#:~:text=No%20Brasil%2C%20as%20pr%C3%A1ticas%20adotadas,entre%20outros%20exemplos%20indicados%20no>.

¹⁵ AMARAL, Paulo H. *Direito Tributário Ambiental*. São Paulo: Revista dos Tribunais, 2007. p. 173.

¹⁶ OLIVEIRA, José Marcos Domingues de. *Direito Tributário e meio ambiente*. 2 Ed. São Paulo: Renovar, 1999. p. 57.

¹⁷ VALADARES, André García Leão Reis. *Tributação ambiental e sua compatibilidade com o Sistema Tributário brasileiro*. *Revista de Direito Ambiental e sociedade*. v. 5. n. 1. 2015. p. 150. Available in: <http://www.uces.br/etc/revistas/index.php/direitoambiental/article/view/3209>.

induce behaviors compatible with the establishment of an ecologically balanced environment.

Aside from the taxation species that may be used to induce green behaviors, the contributive capacity and proportionality remain as concerns that guide these instruments. As has already been mentioned above, the taxation cannot impose a burden that prevents a business activity; in reason of it, the principles of proportionality, reasonableness, and contributive capacity can be used to set the balance and help to build new standards of development. According to Souza, some authors reject the possibility to apply the contributive capacity for environmental taxation and others advocate for its full appliance. However, the author disagrees and suggests a medium effectiveness, where the vital minimum and the non-expropriation are respected, but the contributive capacity is not the thermometer to define the amount of tax, once the extrafiscality nature must prevail¹⁸.

2.1 Inducing behaviors: reducing pollution

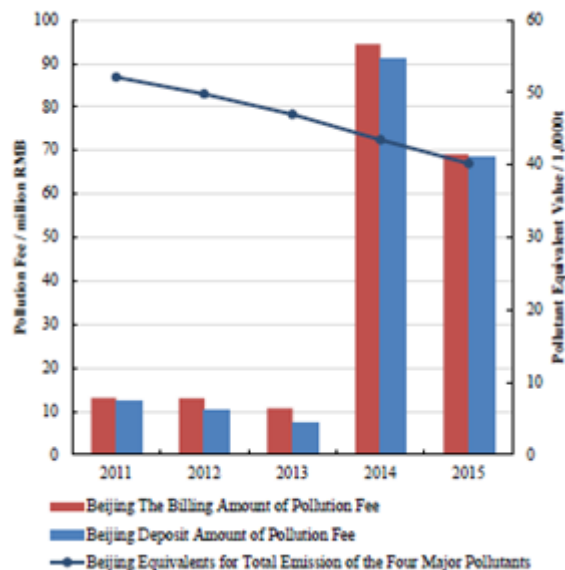
As has been shown in “Graphic 1”, Brazil has the second-lowest environmentally related tax revenue. Therefore, it represents the lack of an organized apparatus capable of charging and internalizing the costs of production; as a consequence, a lack of tax mechanisms designed to promote the reduction of pollution. However, despite the absence of the instrument, and the tax limitations present in the Brazillian Constitution, the art. 225, in item V, shows the concern in controlling the process and substances that represent risks to the environment and life. This practice, may not found the grounds and the practice in Brazil, and may have a long history in Europe since 1990, but the recent experience in China, adds a different perspective that can be related to the Brazillian constitutional guidance.

In the previous sino-experience, the environmental tax has already been successful, which goes beyond the mere theory above demonstrated, when discussing the relation between the free market and the State intervention. According to Wu et. al, “in 2003, China formalized its pollution charge system (Chinese State Council, 2003). This is one of the most important reform of China’s pollution fee: charged levy item from single pollutant to multi-pollutant, replaced levy base of concentration by total emission, rased fee rates, doubled the fee rates if effluents exceeded the standards”. According to the authors, “Beijing raised the fee rates up to 15 times since 2014. Although the four major pollutants emissions decrease sharply, the pollution fee income of Beijing still enlarged 5 to 9 times” as it can

¹⁸ SOUZA, Sarah Maria Linhares de Araújo Paes. Políticas Públicas na Tributação Ambiental. Belo Horizonte: Fórum, 2017. p. 139.

be illustrated in the above graphic¹⁹. Therefore, it represents that environmental taxes are not enemies of the economy.

Graphic 2: Relation between pollution emissions and pollution fee in Beijing.



Source: Wu et. al.

Therefore, this example shows the effectiveness of environmental taxes, once the equivalent for total emissions has a considerable reduction after the fee improvement. However, the Chinese experience has not stopped there, and at the end of 2016, it was promulgated the new “Environmental Protection Tax law of the People’s Republic of China”. The important consideration that must be pointed out in this case, is the possibility of a different approach which allows understanding a new path to include the contributive capacity in a different way from Souza’s reasoning above mentioned. The art. 8 from the Law defines a new form to implement the taxation²⁰:

Art. 8: The pollution equivalent quantity of atmospheric and water pollutants are calculated by dividing the emission amount of each pollutant by the specific pollution equivalent value of said pollutant. The specific pollution equivalent value of

¹⁹ WU, Jian et. al. From Pollution Charge to Environmental Protection Tax: A Comparative Analysis of the Potential and Limitations of China’s New Environmental Policy Initiative. *Journal of Comparative Policy Analysis: Research and Practice*. v. 20. n.2. 2018. p. 225.

²⁰ REPUBLIC OF CHINA; Environmental Protection Tax Law of the People’s Republic of China. Standing Committee of the National People’s Congress. Order of the President No. 66 of the 12th Congress. 2016.

each taxable atmospheric and water pollutant is determined in accordance with the “Taxable Pollutants and Equivalent Values Table” appended to this Law.

Therefore, it will measure the amount of tax considering each kind of pollutant, its pollution equivalent, which is defined according to the pollutant toxicity, the amount of pollutant released, and the defined price per unit that may change for each province. The equation can be represented as above:

Equation 1: Tax Calculation Method from the new Chinese Environmental Tax

$$\text{Environmental Tax} = \frac{\text{Equivalent Value}}{\text{Amount of Pollution}} \times \text{Price per Unit}$$

In the new Chinese experience, it is possible to see the concern in putting in the tax calculation all the elements that may influence changing behaviors: amount, toxicity, and price. However, adequacy is not a costless process and also needs to be measured. Therefore, the Law shows a holistic and realistic perspective that balances economic demands and environment objectives. It includes the importance of Government action to provide subsidies for companies' adequation, which represents not only the concern in demanding from companies the adequation but providing tools that allow it without jeopardizing the economic advances and keeping track of emissions and discharges.

Art. 10: The discharge amount of taxable atmospheric pollutants, water pollutants, and solid waste, and the number of decibels of noise are calculated according to the following methods and order:

(1) Where taxpayers install and use automatic pollutant monitoring equipment that comply with national provisions and monitoring standards, [the aforementioned items] are calculated according to the automatic monitoring data of the pollutant sources;

Art. 24: The people's governments at all levels shall encourage taxpayers to increase their input in the promotion of environmental protection, and provide financial and policy support to the taxpayers for investments in automatic pollutant monitoring equipment.

These provisions may seem distant from the Brazilian context. However, although there is not a similar experience of charging pollution, there are instruments for improvement and adequacy provided by the Government. As an example, through the Brazilian Regional Bank for Development of the Far South (which embraces the States of Mato Grosso do Sul, Paraná, Santa Catarina, and Rio Grande do Sul)²¹, the Government provides more than 425 million reais

²¹ BRDE. BRDE e AFD contratam mais de R\$425 milhões para investimentos sustentáveis na Região Sul. August 11, 2020. Available in: <https://www.brde.com.br/noticia/brde-e-afd-contratam->

for investments in sustainable projects. Therefore, it is possible to realize the accomplishment of inducing ecological behaviors capable of reaching the purpose present in item V, from art. 225, of the Brazilian Constitution by offering resources to improve the production and techniques to make them more adequate to the environment and developing better process which allows the maximum use of resources as it operates in Nature.

2.2 Inducing behaviors: restoring ecological processes

The ecological process in Nature can be represented by the food chain. There is a cyclic and constant use of matter in the food chain to achieve the maximum utilization of energy²². The item I, from art. 225, states the aim to follow the Nature standard in the anthropic actions, once it intends to preserve and restore the same established treatment present in the ecosystems. This reasoning comes from Sarah Maria Linhares de Araújo Paes de Souza, who explains that reducing externalities makes the human production process cyclic imitating nature, as it happens when recycling²³.

Therefore, recycling brings the waste back to the cycle by reusing it and allowing its maximum utilization. As an example, the Chinese Law aforementioned includes positive sanctions, which exempt taxation in case of the discharge in treatment sites, where processes like recycling are executed²⁴.

Art. 4: Each of the following cases does not amount to direct discharge of pollutants into the environment, and is exempt from the environmental protection taxes for relevant pollutants:

- (1) Where enterprises, public institutions, and other production operators discharge taxable pollutants in centralized sewage treatment or centralized domestic waste treatment sites that have been established in accordance with law;
- (2) Where enterprises, public institutions, and other production operators store or dispose of solid wastes in facilities or sites that comply with national and local environmental protection standards.

These provisions address the importance of inducing behaviors through positive sanctions in a country that produced 2.3 million tons of electronic waste

mais-r-425-milhoes-para-investimentos-sustentaveis-na-regiao-sul/.

²² UOL. *Biologia*. Access in May, 2021. Available in: <https://vestibular.uol.com.br/resumo-das-disciplinas/biologia/fluxos-de-energia-e-ciclo-de-materia-da-cadeia-alimentar.html>.

²³ SOUZA, Sarah Maria Linhares de Araújo Paes. *Políticas Públicas na Tributação Ambiental*. Belo Horizonte: Fórum, 2017. p. 123.

²⁴ REPUBLIC OF CHINA; Environmental Protection Tax Law of the People's Republic of China. Standing Committee of the National People's Congress. Order of the President No. 66 of the 12th Congress. 2016.

in 2010²⁵. Fortunately, Art. 4 is not a Chinese exclusivity. In 2015, the Brazilian Commission for Economic, Industry, and Trade Development approved the proposition to include, in four Laws (9.249/95, 11.196/05, 12.305/10, and 12.375/10), the reduction of the Tax for Industrialized Products, for companies engaged in recycling activities for solid waste or related to the preparatory activities for recycling. At the same time, it is also applied the tax levy for equipment related to recycling and for the production of renewable energy²⁶. Europe, where countries like Germany have already been using related recycling taxes, has move fone step further, and, in 2021 it will apply a tax specifically designed for plastic. According to the independent Commodity Intelligence Services “the tax, to be introduced as of 1 January 2021, will be calculated on the weight of nonrecycled plastic packaging waste with a call rate of €0.80/kilogramme with a mechanism to avoid excessively regressive impact on national contributions”. The tax was developed in a context of 63% rate of plastic collection in 2018, which has increased by 3% per year, what was not considered enough²⁷.

The rationale in recycling is reproducing the ecological process by reaching the best utilization from materials. This concern is important when some resources are scarce and the process for its recovery can take thousand of years, as it happens with fossil fuels. Thereupon, the resources demand the better possible use, which has implications in waste production and consumption patterns.

2.3 Inducing behaviors: scarcity and better use of resources

Recognizing the finitude of resources is vital to comprehend the need to induce green behaviors capable of improving its utilization. Therefore, art. 170, item VI, from the Brazillian Constitution introduces the possibility to include differentiated treatment in accordance with the environmental impact of goods and services. It allows the use of mechanisms that can be applied to guide the rethink and redirect the production and delivery process.

In the European experience, it introduces a path that goes under the concept of sustainability from Juarez Freitas, which embraces a broader comprehension

²⁵ WEI, Lin; LIU, Yangsheng. Present Status Of E-Waste Disposal and Recycling in China. *Procedia Environmental Sciences*. v.16. 2012. p. 506. Available in https://www.researchgate.net/publication/257728768_Present_Status_Of_E-Waste_Disposal_and_Recycling_in_China.

²⁶ CÂMARA DOS DEPUTADOS. Comissão aprova incentivos fiscais para empresas de reciclagem. Brazil. November 11, 2015. Available in: <https://www.camara.leg.br/noticias/475637-comissao-aprova-incentivos-fiscais-para-empresas-de-reciclagem/#:~:text=Pela%20proposta%2C%20as%20empresas%20que,equipamentos%20destinados%20%C3%A0%20reciclagem%20ou>.

²⁷ BAUMGARTEN, Stefan. INDEPENDENT COMMODITY INTELLIGENCE SERVICES. EU agrees tax on plastic packaging waste. London. July 07, 2020. Available in: <https://www.icis.com/explore/resources/news/2020/07/21/10532318/eu-agrees-tax-on-plastic-packaging-waste>.

of it related not only to the environmental aspect but also stating the commitment with intragenerational and intergenerational equity and also the liquid social, economic and environmental benefits²⁸. In the “Environmental tax reform in Europe: Implications for income distribution” from the European Environment Agency, it is present the commitment in not only using the environmental tax as a tool for preventing natural resources degradation but also as an instrument to direct the revenue for social advance²⁹. However, despite the goodwill from this reasoning, it moves away from the pure extrafiscality, what must be stressed in this work, once the purpose of environmental taxation is not the revenue but the redirection for eco-friendly behaviors. Souza underlines this problem in the Spanish case, where the loose of this characteristic made some environmental tax be considered as unconstitutional due to this distortion³⁰.

The aforementioned report, from the European Environment Agency, intends to demonstrate the different impacts caused by environmental damage and the use of Environmental Tax Reform (ETR)³¹:

At the most basic level, therefore, ETR comprises two elements. First, it deters environmentally damaging activities by making them more costly. This can obviously be desirable for numerous reasons, including reducing harm to environments that we value for recreation or their cultural importance; alleviating the pollution that can impact human health and standards of living; and preserving the natural resources and systems that sustain our societies and economies — both today and for future generations.

But the second aspect of ETR is no less important. It involves recycling the revenues gained from increased environmental taxes and using them to create positive economic and social outcomes, such as increasing employment and boosting incentives to work. The recycling of revenues is especially important for the acceptability and equity of the tax reforms. This is because shifting the burden of tax increases some costs and reduces others, and since no two individuals in society will have exactly the same earning and spending patterns, the impacts will vary.

In fact, ETR can produce (at least) four different types of impacts, each of which may be distributed unequally across society. These comprise the direct consequences of increasing taxes (e.g. higher prices for certain goods); the consequences of

²⁸ FREITAS, Juarez. *Sustentabilidade Direito ao Futuro*. 4 ed. Belo Horizonte: Fórum, 2019. p. 16-17.

²⁹ EUROPEAN ENVIRONMENT AGENCY. *Environmental tax reform in Europe: implications for income distribution*. Luxembourg: Publications Office of the European Union, n. 16, 2011, p. 5. Available in: <https://www.eea.europa.eu/publications/environmental-tax-reform-in-europe>.

³⁰ SOUZA, Sarah Maria Linhares de Araújo Paes. *Políticas Públicas na Tributação Ambiental*. Belo Horizonte: Fórum, 2017. p. 182.

³¹ EUROPEAN ENVIRONMENT AGENCY. *Environmental tax reform in Europe: implications for income distribution*. Luxembourg: Publications Office of the European Union, n. 16, 2011, p. 6. Available in: <https://www.eea.europa.eu/publications/environmental-tax-reform-in-europe>.

recycling (e.g. direct transfers or alleviation of taxes); the broader economic impacts of ETR (e.g. job creation or inflation); and the environmental effects of ETR (e.g. a cleaner environment).

Thereupon, the European guidance suggests most of what can be found in the art. 225 from the Brazilian Constitutions. It represents the broader comprehension of the environment and the need to beware of the uneven impact of tax and pollution. It is well-known that pollution shall affect low-income people in a burdensome way than high-income people, who may, for example, have access to better health care. In the same way, taxation policies must be aware of not increasing prices in a way that might affect the vital minimum of people who need the products and suffer the transferring of the tax burden to the product. However, the first economy of the world still seems to not be implementing this kind of instrument. The United States of America was only above Brazil and Mexico in relation to the revenue from environmental taxes. This scenario, is not new, in accordance with Williams III³²:

Metcalf (2009) compared environmental tax revenue in the United States with that of other countries in the Organisation for Economic Co-operation and Development (OECD), using data from the mid-2000s. Environmental tax revenue as a share of gross domestic product (GDP) was lower for the United States than for all but one other country (Mexico), and was far less than the average (US environmental tax revenue was 0.9 percent of GDP, compared with 2.23 percent for the average OECD country). Looking at environmental tax revenue relative to total tax revenue yields a similar picture: the United States had the lowest figures of all countries in the sample. Using more recent data would, if anything, strengthen that pattern: the United States has not imposed any substantial new federal environmental taxes, and the tax rate for the biggest environmental tax in the United States—the motor fuels excise tax—has remained constant in nominal terms per gallon since 1993, thus falling in real terms.

In the American case, taxation does not represent the main tool for environmental protection as a public policy. However, the author also points out the relation between taxation and the scarcity of resources that may motivate this kind of mechanism. In the Brazilian case, the State of Parana has stated in 2003, through the Law 14.260/2003, the reduction of the tax for vehicles using natural gas, which is less pollutant than other fossil fuels. In this case, it is clear the use of economic mechanisms to induce more desirable green behaviors, which later, through the Laws 19.971/2019 and 19.982/2019, was improved including a zero

³² WILLIAMS III, Robertson C. Environmental Taxation. Resources for the Future. Washington DC. June 2016. p. 7. Available in: <https://media.rff.org/archive/files/document/file/RFF-DP-16-24.pdf>.

tax for electric cars property (IPVA) and electric cars acquisition (ICMS)³³. In this case, the measure not only induces a green behavior but also facilitates the introduction of a new economy, which is essential once cars represent 72.6% of greenhouse emissions in the Brazillian state of São Paulo, for example³⁴.

At this point, it is important to address the need for environment protection not as an enemy of free enterprise, but as one of the instruments capable to sustain the free enterprise. “Since the 1970s, humanity has been in ecological overshoot, with annual demand on resources exceeding what Earth can regenerate each year. Today humanity uses the equivalent of 1.6 Earths to provide the resources we use and absorb our waste”³⁵. Therefore, inducing “green” behaviors has the purpose of rethinking the use of resources once the world has already not been able to replace it in the same rhythm it is consumed. This aspect is essential for the maintenance of free enterprise once it needs natural resources for production. As an example, many factory activities need water to produce, however, if it was heavily polluted, it would impede the production process and, as result, limit the free enterprise. In this case, it is possible to perceive the relation of balance and dependence and not opposition between environment protection and economic advance.

3. The environmental tax and the tax with environmental elements

Environmental Taxation can be a tool to induce behaviors through environmental tax or adding the environmental element in existing ones. In the first case, the tax is designed specifically for the environmental situation, as it happens in the Chinese case aforementioned. On the other side, the tax may not be designed for this specific purpose, but it shall have “green” elements in its structure or its revenue can be settled to ecological ends³⁶. In the Brazilian case, it is possible to say that there is no environmental tax but only ecological elements in environmental taxation. A good example is the Brazillian Urban Property and Land Tax (IPTU). In this case, if the property stays in a Permanent Preservation Area, it will not be taxable or the tax must be reduced, once the ecological element limits the use of the

³³ PARANA. Law N° 14.260 from December 22, 2003. Brazil. Available in: <https://www.legislacao.pr.gov.br/legislacao/exibirAto.do?action=iniciarProcesso&codAto=6253&codItemAto=46159#46159>.

³⁴ EXAME. Carros representam 72,6% da emissão de gases efeito estufa em SP. May 05, 2017. Available in: <https://exame.com/brasil/carros-representam-726-da-emissao-de-gases-efeito-estufa-em-sp/>.

³⁵ GLOBAL FOOTPRINT NETWORK. Ecological Footprint. 2019. Available in: <https://www.footprintnetwork.org/our-work/ecological-footprint/>.

³⁶ SOUZA, Sarah Maria Linhares de Araújo Paes. Políticas Públicas na Tributação Ambiental. Belo Horizonte: Fórum, 2017. p. 221.

property. As a consequence, it decreases the utilities, and the economic value from the property, which justifies the exemption or reduction³⁷. In this scenario, the State intends to preserve some natural area, however, this intervention imposes a loss to the owner. Therefore, as compensation for preserving this area, and for losing the possibility of fully enjoying the utilities, the State must abstain from the tax charging. Following this reasoning, the exemptions made by the Government for eco-friendly behaviors can be placed in the same concept of ecological elements, once despite the different aim of the tax, adding these elements can turn the tax into an instrument capable of changing negative behaviors to the environment and inducing an eco-revolution through positive sanctions.

Conclusion

This work aimed to demonstrate the reasoning of inducing behaviors through environmental tax or green elements in tax concerning pollution, better use of resources, and the restoration of ecological processes. These pillars explain and justify the reasoning in building legal instruments capable of changing behaviors which represent a risk for the ecologically balanced environment and the maintenance of assets essential to human development related to fundamental rights like health, life, and even free enterprise. However, despite the statements present in the arts. 170 and 225 from the Brazilian Constitution, it does not allow an unbounded elaboration of inducing instruments even though the aspiration of what could be called as the “best green interest”. As a result, tax principles, international treaties, and the constitutional competences will establish limits for organizing these mechanisms.

As has been shown, recent experiences, like the Chinese Environmental Protection Tax Law, allows the inclusion of contributive capacity without excluding the extrafiscality. According to Luciano Amaro, the contributive capacity has a close affinity with the principle of tax personalization, which expresses the adequacy of the tax concerning the personal condition of the taxpayer. According to the author, it places the contributive capacity in consideration of the principle of equality, which demands attention to the differences among taxpayers³⁸. Therefore, by introducing all the aspects involving the production process and pollution, the sino-experience permits a balance between the purpose of inducing adequate

³⁷ CATÃO, Marcos André Vinhas. CORDEIRO, Luciana Prates Caldas. A cobrança do Imposto sobre a Propriedade Predial e Territorial Urbana nas áreas de preservação permanente. In: Carli, Ana Alice de. et. al. *Tributação e sustentabilidade ambiental*. Rio de Janeiro: Editora FGV, 2015. p. 209.

³⁸ AMARO, Luciano. *Direito Tributário Brasileiro*. 21 ed. São Paulo: Saraiva, 2016. p. 164-165.

ecological behaviors, what expresses the extrafiscality, and the protection of the tax graduation that must respect the vital minimum, which represents the protection against expropriation that could be caused by the tax. However, it is important to notice that this balance will depend on the rates defined by the Chinese Government.

In its turn, the extrafiscality must be the core of the tax, otherwise, it would establish a different nature from the objective of inducing green behaviors. Although collecting revenue and use it for environmental purposes might help its preservation, the environmental tax purposes differ from it. As Caliendo et. al argue, the extrafiscality is an effective tool to promote public policies also representing the authorization to the State act in economic relations seeking to motivate desirable behaviors for the environment based on the principle of solidarity³⁹. Therefore, it is possible to realize that the extrafiscality will start the process of environmental taxation, while the contributive capacity can measure the amount of possible, desirable, and necessary “persuasion” for changing behaviors.

On the other hand, it is important to understand that the outcomes from environmental taxes or the positive sanctions, represented by exemptions or reductions, are not definitive. However, some older studies have already presented shy results in Scandinavian countries. In Norway, “emissions are estimated to be 30% less per produced unit as a result of measures which the tax has either made profitable or to which it has drawn attention”, and in Denmark, “the Danish CO2 tax is the one that has been most frequently analysed but the estimated effect depends on the method of analysis. Analysis based on time-series analysis show that industry’s CO2 emissions have been reduced by 7%, while production has increased by 27% in the 1990s”⁴⁰. However, recent results, due to the need for long-term analysis concerning environmental tax have offered more considerable results that deserve to be transcribed here. According to Pinglin He⁴¹:

³⁹ CALIENDO, P.; MUNIZ, V. C.; RAMME, R. S.. Tributação e sustentabilidade ambiental: a extrafiscalidade como instrumento de proteção do meio ambiente. *Revista de Direito Ambiental*, v. 76, 2014, p. 8. Available in: http://repositorio.pucrs.br/dspace/bitstream/10923/11540/2/Tributacao_e_sustentabilidade_ambiental_a_extrafiscalidade_como_instrumento_de_protecao_do_meio_ambiente.pdf

⁴⁰ ANDERSEN, Mikael et. al. An Evaluation of the Impact of Green Taxes in the Nordic Countries. *TemaNord*. 2002. p. 91. Available in: https://pure.au.dk/portal/files/56716516/NMR2001_566.pdf.

⁴¹ PINGLIN, He et. al. Can Environmental Tax Policy Really Help to Reduce Pollutant Emissions? An Empirical Study of a Panel ARDL Model Based on OECD Countries and China. *Sustainability*, MDPI, Open Access Journal, vol. 11, n.16, 2019, p. 29. Available in: <https://ideas.repec.org/a/gam/jsusta/v11y2019i16p4384-d257266.html>.

Based on the “green dividend” theory of environmental taxes, this paper compares and analyzes the emission reduction effects of environmental taxes in 35 OECD countries and 31 inland provinces of China. Through the establishment of the panel ARDL model, the empirical tests found that on the whole, environmental tax policy helps to reduce pollutant emissions to a large extent, both in OECD countries and Chinese countries. Further analysis shows that, firstly, the environmental taxes have significant short-term emission reduction effects in both OECD member countries and Chinese administrative provinces with small or medium scales of environmental tax collection [...]. This proves that the scale of environmental tax collection is not the decisive factor affecting the effect of environmental tax on reducing pollutants [...]. Secondly, the short-term emission reduction effects of environmental taxes in OECD countries with low industrial added value are relatively good, while in China, the emission reduction effects are better in provinces with high industrial added value. [...]. Thirdly, the environmental taxes of OECD countries and Chinese provinces with high economic growth levels have good short-term emission reduction effects, and the environmental taxes of OECD countries with high economic growth levels significantly reduce greenhouse gas and sulfur dioxide emissions in the long term. This shows that reducing pollution requires sufficient capital, while attaching importance to economic development as well as levying environmental taxes can provide financial support for environmental protection.

Besides, Xinghua Fan et. al found similar results that also must be quoted⁴²:

This paper confirms the view in the literature mathematically that imposing environmental tax plays an active part in green development. The role of environmental tax on green development is reflected in this study by the comparison of the evolution of green development indicators between different scenarios.[...]. The relative locations of the indicator curves show that environmental tax can promote economic growth, save resources, and reduce pollution. The influence becomes significantly greater in the long run. On the other hand, results of the differences in the evolution paths under selected environmental tax parameters indicate possible ways to promote green development. The ways include reinforcing government control, increasing consumers awareness as well as improving technology level. Among them, the government control surpasses the others. This indicates the necessity to enhance the government’s functions such as further improve China’s government supervision system, establish and improve various environmental tax systems, formulate strict emission standards, and continuously supplement multiple standards.

Therefore, the study conclusions reveal some of the mentioned concerns stated by the Brazilian Constitutional arts. 170 and 225 that have guided this work. These instruments can be used to redirect economic decisions and public

⁴² FAN, Xinghua. Impact of environmental tax on green development: A nonlinear dynamical system analysis. *Plos One*. v.14. n.9. 2019. p. 19. Available in: <https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0221264&type=printable>.

policies to internalize the externalities without blocking economic advances. However, it must follow the financial support for environmental protection, as it was mentioned in the Brazilian case about the offered subsidies. In reason of it, it is clear that inducing behavior for reducing pollution, improving the use of resources, and restoring the ecological processes relies not only upon taxes, but also the development of the entire apparatus that provides tools for adequation to green behaviors.

Bibliography

- AMARAL, Paulo H. *Direito Tributário Ambiental*. São Paulo: Revista dos Tribunais, 2007.
- AMARO, Luciano. *Direito Tributário Brasileiro*. 21 ed. São Paulo: Saraiva, 2016.
- ANDERSEN, Mikael et. al. *An Evaluation of the Impact of Green Taxes in the Nordic Countries*. TemaNord. 2002. Available in: <https://pure.au.dk/portal/files/56716516/NMR2001566.pdf>.
- BAUMGARTEN, Stefan. INDEPENDENT COMMODITY INTELLIGENCE SERVICES. *EU agrees tax on plastic packaging waste*. London. July 07, 2020. Available in: <https://www.icis.com/explore/ressources/news/2020/07/21/10532318/eu-agrees-tax-on-plastic-packaging-waste>.
- BRAZIL. *Constitution of the Federative Republic of Brazil from 1988*. Brasília, DF. Available in: https://www2.senado.leg.br/bdsf/bitstream/handle/id/243334/Constitution_2013.pdf?sequence=11&isAllowed=.
- BRAZIL. *Law n° 6.938 from August 31, 1981*. Brasília, DF. Available in: http://www.planalto.gov.br/ccivil_03/Leis/L6938.htm.
- BRDE. *BRDE e AFD contratam mais de R\$425 milhões para investimentos sustentáveis na Região Sul*. August 11, 2020. Available in: <https://www.brde.com.br/noticia/brde-e-afd-contratam-mais-r-425-milhoes-para-investimentos-sustentaveis-na-regiao-sul/>.
- CALIENDO, P.; MUNIZ, V. C.; RAMME, R. S. *Tributação e sustentabilidade ambiental: a extrafiscalidade como instrumento de proteção do meio ambiente*. Revista de Direito Ambiental, v. 76, 2014. Available in: http://repositorio.pucrs.br/dspace/bitstream/10923/11540/2/Tributacao_e_sustentabilidade_ambiental_a_extrafiscalidade_como_instrumento_de_protecao_do_meio_ambiente.pdf
- CÂMARA DOS DEPUTADOS. *Comissão aprova incentivos fiscais para empresas de reciclagem*. Brazil. November 11, 2015. Available in: <https://www.camara.leg.br/noticias/475637-comissao-aprova-incentivos-fiscais-para-empresas-de-reciclagem/#:~:text=Pela%20proposta%2C%20as%20empresas%20e,equipamentos%20destinados%20%C3%A0%20reciclagem%20ou.>
- CATÃO, Marcos André Vinhas. CORDEIRO, Luciana Prates Caldas. *A cobrança do Imposto sobre a Propriedade Predial e Territorial Urbana nas áreas de preservação permanente*. In: Carli, Ana Alice de. et. al. *Tributação e sustentabilidade ambiental*. Rio de Janeiro: Editora FGV, 2015.

- EUROPEAN ENVIRONMENT AGENCY. *Environmental tax reform in Europe: implications for income distribution*. Luxembourg: Publications Office of the European Union, 2011. n. 16. Available in: <https://www.eea.europa.eu/publications/environmental-tax-reform-in-europe>.
- EXAME. *Carros representam 72,6% da emissão de gases efeito estufa em SP*. May 05, 2017. Available in: <https://exame.com/brasil/carros-representam-726-da-emissao-de-gases-efeito-estufa-em-sp/>.
- FAN, Xinghua. *Impact of environmental tax on green development: A nonlinear dynamical system analysis*. Plos One. v.14. n.9. 2019. Available in: <https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0221264&type=printab>.
- FERNÁNDEZ, Maria Jesús García-Torres. *El concepto del tributo medioambiental em el Derecho Tributario español*. Revista Fórum de Direito Tributário – RFDT, Belo Horizonte, ano 10, n. 58, p73-99, jul/ago. 2012.
- FOLHA DE SÃO PAULO. *Fogos em nove fazendas destruíram 141 mil hectares no Paraná*. September 23, 2020. Available in: <https://www1.folha.uol.com.br/ambiente/2020/09/fogos-em-nove-fazendas-destruiram-141-mil-hectares-no-pantanal.shtml>.
- FREITAS, Juez. *Sustentabilidade Direito ao Futuro*. 4 ed. Belo Horizonte: Fórum, 2019.
- G1. *Queimadas na Amazônia estão associadas a mais de 2 mil hospitalizações em 2019, diz relatório*. August 26, 2020. Available in: <https://g1.globo.com/natureza/amazonia/noticia/2020/08/26/queimadas-na-amazonia-estao-associadas-a-mais-de-2-mil-hospitalizacoes-em-2019-diz-relatorio.ghtml>
- VALADARES, André García Leão Reis. *Tributação ambiental e sua compatibilidade com o Sistema Tributário brasileiro*. Revista de Direito Ambiental e sociedade. v. 5. n. 1. 2015. Available in: <http://www.ucs.br/etc/revistas/index.php/direitoambiental/article/view/3209>.
- GLOBAL ALLIANCE ON HEALTH AND POLLUTION. *Global, Regional, and Country Analysis*. December 2019. Available in: https://gahp.net/wp-content/uploads/2019/12/PollutionandHealthMetrics-final-12_18_2019.pdf
- GLOBAL FOOTPRINT NETWORK. 2019. *Ecological Footprint*. Available in: <https://www.footprintnetwork.org/our-work/ecological-footprint/>.
- JORNAL DA USP. *Desmatamento da Amazônia dispara de novo em 2020*. August 07, 2020. Available in: <https://jornal.usp.br/ciencias/desmatamento-da-amazonia-dispara-de-novo-em-2020/>
- LIGHTHART, Jenny E. INTERNATIONAL MONETARY FUND. *The Macroeconomic Effects of Environmental Taxes: A Closer Look at the Feasibility of “Win-Win” Outcomes*. Fiscal Affairs Department. WP/98/75. May 1998. Available in: <https://www.cbd.int/financial/fiscalenviro/g-fiscalmacro-imf.pdf>.
- LOSANO, Mário G. *Prefácio à edição brasileira: o pensamento de Norberto Bobbio, do positivismo jurídico à função do Direito*. In: Bobbio, Norberto. *Da estrutura à função: novos estudos de teoria do Direito*. p. XLI. 2007.
- MONTERO, Carlos Eduardo Peralta. *Tributação Ambiental*. São Paulo: Saraiva, 2014.

NORDHAUS, William et. al. *Environmental Accounting for Pollution in the United States Economy*. *American Economic Review*. V.101. n.5. 2011. Available in: https://www.researchgate.net/publication/2273572_08_Environmental_Accounting_for_Pollution_in_the_United_States_Economy.

NOTÍCIAS UOL. *Volume de queimadas no Pantanal em 2020 equivale à destruição dos últimos 6 anos*. September 9, 2020. Available in: <https://noticias.uol.com.br/ultimas-noticias/agencia-estado/2020/09/08/volume-de-queimadas-no-pantanal-em-2020-equivale-a-destruicao-dos-ultimos-6-anos.html>.

OECD. *Environmental Taxation, A Guide for Policy Makers*. Paris: Organization for Economic Cooperation and Development. 2011. Available in: <http://www.oecd.org/env/tools-evaluation/48164926.pdf>.

OLIVEIRA, José Marcos Domingues de. *Direito Tributário e Meio Ambiente*. 2 Ed. São Paulo: Renovar, 1999.

OLIVEIRA, Thaís Soares de. VALIM, Beijanicy Ferreira da Cunha Abadia. *Tributação Ambiental: A Incorporação do Meio Ambiente na Reforma do Sistema Tributário Nacional*. In Reforma Tributária. Og. Adolfo Salsinha, Erich Endrillo Santos Simas. Rio de Janeiro: OAB/DF, 2018. Available in: <http://repositorio.ipea.gov.br/handle/11058/8641#:~:text=No%20Brasil%2C%20as%20pr%C3%A1ticas%20adotadas,entre%20outros%20exemplos%20indicados%20no>.

PARANA. *Law N° 14.260 from December 22, 2003*. Brazil. Available in: <https://www.legislacao.pr.gov.br/legislacao/exibirAto.do?action=iniciarProcesso&codAto=6253&codItemAto=46159#46159>.

PAULSEN, Leandro. *Curso de Direito Tributário*. 10ª Ed. São Paulo: Saraiva Jur, 2019.

PINGLIN, He et. al. *Can Environmental Tax Policy Really Help to Reduce Pollutant Emissions? An Empirical Study of a Panel ARDL Model Based on OECD Countries and China*. Sustainability, MDPI, Open Access Journal, vol. 11, n.16, 2019. Available in: <https://ideas.repec.org/a/gam/jsusta/v11y2019i16p4384-d257266.html>.

REPUBLIC OF CHINA. *Environmental Protection Tax Law of the People's Republic of China*. Standing Committee of the National People's Congress. Order of the President No. 66 of the 12th Congress. 2016.

RIBEIRO, Ricardo Lodi. *A extrafiscalidade ambiental no ICMS*. In: Carli, Ana Alice de. et. al. *Tributação e sustentabilidade ambiental*. Rio de Janeiro: Editora FGV, 2015.

ROY, Rana. *The cost of air pollution in Africa*. OECD Development Centre Working Papers. No. 333. OECD Publishing, Paris. 2016. Available in: <https://doi.org/10.1787/5jlqzq77x6f8-en>.

SARLET, Ingo Wolfgang Sarlet; FENSTERSEIFER, Tiago. *Curso de Direito Ambiental*. Rio de Janeiro: Forense, 2020.

SOUZA, Sarah Maria Linhares de Araújo Paes. *Políticas Públicas na Tributação Ambiental*. Belo Horizonte: Fórum, 2017.

TORRES, Ricardo Lobo. *Princípios e Teoria geral do Direito Tributário Ambiental*. In: Torres, Heleno Taveira (org.). *Direito Tributário Ambiental*. São Paulo: Malheiros, 2005.

UOL. *Biologia*. 2021. Available in: <https://vestibular.uol.com.br/resumo-das-disciplinas/biologia/fluxos-de-energia-e-ciclo-de-materia-da-cadeia-alimentar.htm>

VALADARES, André Garcia Leão Reis. *Tributação ambiental e sua compatibilidade com o Sistema Tributário brasileiro*. Revista de Direito Ambiental e sociedade. v. 5. n. 1. 2015. Available in: <http://www.uces.br/etc/revistas/index.php/direitoambiental/article/view/3209>.

VERONEZ, Diego et. al. *A Cost-Benefit Evaluation of the Air Quality and Health Impacts in São Paulo, Brazil*. Journal of Environmental Protection, v. 3, 2012. Available in: https://www.scirp.org/pdf/JEP201229_00001_73572404.pdf.

WEI, Lin; LIU, Yangsheng. *Present Status Of E-Waste Disposal and Recycling in China*. Procedia Environmental Sciences. v.16. 2012. Available in: https://www.researchgate.net/publication/257728768_Present_Status_Of_EWaste_Disposal_and_Recycling_in_China.

WHO Regional Office for Europe, OECD. *Economic cost of the health impact of air pollution in Europe: Clean air, health and wealth*. 2015. Copenhagen: WHO Regional Office for Europe. p. viii Available in: https://www.euro.who.int/__data/assets/pdf_file/0004/276772/Economic-cost-health-impact-air-pollution-en.pdf

WILLIAMS III, Robertson C. *Environmental Taxation. Resources for the Future*. Washington DC. June 2016. Available in: <https://media.rff.org/archive/files/document/file/RFF-DP-16-24.pdf>.

WORLD BAK. *Cost of pollution in China : economic estimates of physical damages*. Washington. 2007. Available in: <http://documents.worldbank.org/curated/en/782171468027560055/Cost-of-pollution-in-China-economic-estimates-of-physical-damages>.

WU, Jian et. al. *From Pollution Charge to Environmental Protection Tax: A Comparative Analysis of the Potential and Limitations of China's New Environmental Policy Initiative*. Journal of Comparative Policy Analysis: Research and Practice. v. 20. n.2. 2018.

YIN, Peng et el. *The effect of air pollution on deaths, disease burden, and life expectancy across China and its provinces, 1990–2017: an analysis for the Global Burden of Disease Study 2017*. The Lancet Planetary Health. 2020. Available in: <https://www.thelancet.com/action/showPdf?pii=S2542-5196%2820%2930161-3>.