



A bibliometric analysis of research on carbon tax from 1989 to 2014



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ABSTRACT

As one of the most cost-effective means of emission reduction, carbon tax has attracted considerable attention from economists and international organizations and has led to a large number of related research. Using the bibliometric method, this paper characterizes the carbon tax literature from 1989 to 2014 based on the Network Database Platform of Web of Science. The results indicate that the USA occupies a leading position in the carbon tax field. The Vrije University Amsterdam, Massachusetts Institute of Technology and Stanford University were the most productive research institutes. Energy Policy (143) has been the most productive journal followed by Energy Economics (44) and Energy (38). In general, the cooperation of authors, institutes and nations are continuing to strengthen; however, the growth rate at the author level was significantly higher than the others. In addition, the current key research areas in the carbon tax field based on Co-Keyword Analysis are as follows: climate change and relevant policy, carbon emissions trading, socio-economic effects of carbon tax, renewable energy, endogenous technological change and carbon capture and storage. The results of this paper will help researchers grasp the current research in the carbon tax field but also provide a supporting role for future work.

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1. Introduction

Public opinion and the political ecology environment of the reduction of global carbon dioxide emissions has been formed, although the scientific evidence of climate change is controversial and uncertain (particularly quantifying the relation between atmospheric greenhouse gas concentrations and temperature increment) [1]. Climate change may be enhanced if no measures are taken; furthermore, it may have serious, widespread and irreversible effects on humans and ecological systems [2]. For example, climate change is likely to cause adverse weather events in agriculture, such as drought, excessive moisture, hail, frost and flooding, which explain a high proportion of yield losses [3]. In the IPCC's recently released fifth assessment synthesis report, it once again stressed the following: currently, measures should be taken to encourage significant emission reductions over the next several decades to achieve the temperature target at the end of the 21st century, which limits the temperature rise to less than 2°C relative to pre-industrial levels [2]. Compared with the traditional measures (command and control policies) and technology mandates in reducing greenhouse gas emissions, market-based instruments have advantages in motivating the research and development in the technology of reducing emissions, thereby reducing the marginal cost [4,5]. Currently, there are generally two types of market-based instruments, one is the emission trading policy based on the amount of pollution control, namely, the carbon trading market [6,7]; the other is through the tax system or sewage charging policy based on price, namely, the carbon tax [5]. This paper will focus on the carbon tax.

Carbon tax is a tax levied on carbon dioxide for the purpose of mitigating global climate change. CO₂ emitted from the burning of fossil fuels (such as coal, oil and natural gas) is a major source of global carbon dioxide, and considering the practical operability, the carbon tax is usually taxed on the carbon content share of the fossil fuels. In other words, first, calculation of the carbon emissions from the fossil fuels is straightforward because a direct linear relation exists between the carbon content of fossil fuels and carbon emissions. Additionally, there are previously existing mature calculation methods (e.g., [8]) attributed to the long-term and outstanding work of the IPCC and other organizations. However, the method of establishing a reference system in the production process or deforestation to effectively measure carbon stock changes as well as devising an appropriate monitoring system has been a difficult technical problem [9]. Second, carbon dioxide emissions resulting from the fossil fuel combustion dominates total greenhouse gas (GHG) emissions. For example, of the 49 (± 4.5) GtCO₂eq/yr in total anthropogenic GHG emissions in 2010, fossil fuel-related CO₂ emissions attained 32 (± 2.7) GtCO₂/yr, and grew further by approximately 3% between 2010 and 2011 and by approximately 1–2% between 2011 and 2012 [10]. Therefore, imposing a carbon tax on fossil fuel is prevalent among the current carbon tax practices; alternatively, the carbon tax structure is being designed because it can cover massive emissions at relatively low administrative costs.

A carbon tax is essentially a form of Pigovian tax. In 1920, the American economist Pigou (AC. Pigou) pointed out in his famous book of welfare economics: there is a gap between net marginal private cost and net marginal social cost because of the external environment, that is, an economic subject in its own activities did not get the corresponding reward or punishment when causing a beneficial or adverse impact on society and other people [11]. To eliminate this gap, national intervention is conducted to internalize externalities. That is, nations tax the unfavorable producers and move the economy into a healthy balance. This behavior is known as a Pigovian tax [11]. The carbon dioxide is a typical negative externality; economic subjects did not bear the

corresponding cost for emitting CO₂ while in pursuit of maximizing economic benefits; therefore, differences between marginal private cost and social cost exist. However, carbon dioxide emissions can be effectively reduced, and social welfare can be increased through a carbon tax that internalizes the external costs of emitting CO₂ [12]. Although carbon tax, compare with carbon trading, has weaknesses such as lower political feasibility and greater uncertainty regarding the effect of emission reductions, much more economists are in favor of carbon tax due to its high and sustainable economic efficiency. For example, carbon taxes can provide continuous emission reduction incentives to potential emissions without limit, create sustained fiscal income, lower transaction costs; in addition, with carbon taxes the rent seeking and speculative possibility is small and there are greater incentives for increasing technological innovation. Furthermore, it will be easier to cooperatively entice the small emitter to the incentive system when compared with carbon emissions trading [13,14].

The international debate regarding the carbon tax originated in the 1990s when the world's largest economic and trade partner, the European Community (now the European Union), made a political commitment to reduce CO₂ emissions. After evaluating a series of measures to reduce emissions, the European Union finally selected carbon tax measures because these can produce long-term market signals and thus improve energy efficiency and reduce the use of fossil fuels [15]. In the 21st century, the European Union proactively introduced a carbon tax and has proposed an aviation or marine carbon tax; however, thus far the implementation of a carbon tax remains in stasis due to strong resistance by other countries. Conversely, the implementation process of carbon taxes in France can be described as twists and turns. France was ready to be the first to introduce a carbon tax: however, this forward progress was eventually canceled by the French Constitutional Council's veto. Compared with the EU or France, the US carbon tariff policy was proffered with highly controversial as well as bleak prospects because many countries have been very clearly against carbon tariffs.

Academic research on the issue of a carbon tax can be traced to the early 1990s; in addition, the number of documents will rapidly increase with the deepening of research on carbon tax. However, there remains a lack of research on the use of the bibliometrics method to sort and on the characteristic of carbon tax documents. Furthermore, it is necessary to strengthen such research to systematically assess the publishing features of carbon tax documents and understand the current research in the carbon tax field. The purpose of this study is to quantitatively and qualitatively evaluate the research literature related to carbon tax from 1989 to 2014 based on bibliometrics analysis. The main objective of this research is to address the following issues: (1) to investigate the growth trend of carbon tax literature production and the quantity of references; (2) to explore the literature from the perspective of the country of publication, publisher, and journal type of carbon tax documents; (3) to examine the prolific authors and highly cited literature; and (4) to discuss the current key research field and the carbon tax hot spots.

The remainder of the paper is structured as follows. Section 2 describes the research methods. Major results and their discussion are presented in Section 3. Section 4 presents the study's conclusions.

2. Methodology

In addition to basic statistical analyses, the methods used in this paper include: collaboration degree analysis, social network analysis, co-keyword analysis, as well as two types of evaluation

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