ABSTRACT

Since the creation of the European Union Emissions Trading Scheme (EU ETS) in 2005, a burgeoning academic literature has emerged to identify the factors that shape the price of carbon, where one European Union Allowance is equal to one ton of CO$_2$-equivalent emitted in the atmosphere. Thus, there is a need for an updated and thorough literature review on the state-of-the-art on this topic that this paper aims to fulfill. Namely, the author considers the main econometric studies that have been recently published in the academic literature, which feature the influence of the following determinants to explain the variation of the price of carbon: institutional decisions; energy prices and weather events; macroeconomic and financial market shocks. The paper concludes with some directions for future research in this area.

Keywords: Banking Borrowing, Carbon Price, Econometrics, Energy Prices, Financial Markets, Macroeconomy

1. INTRODUCTION

Ellerman and Buchner (2007), and Convery and Redmond (2007) masterly produced an early literature review on the carbon price development in their respective articles for the first issue of the Review of Environmental Economics and Policy. This work was further elaborated by Convery (2009) alone in his reflections on the emerging literature on emissions trading in Europe, and compiled in an edited volume by Ellerman, Convery and De Perthuis (2010). Zhang and Wei (2010) provided further insights, based on evidence from the operating mechanism and economic effects of the newly created EU Emissions Trading Scheme (EU ETS).

Building upon these initial contributions, this paper provides a systematic update on the cutting-edge literature of carbon price drivers from 2007 onwards. It reviews mainly economic and econometric studies which have identified inter-relationships between the price of CO$_2$ on the one hand, and its main fundamentals that allow to explain and forecast its variation overtime on the other hand. By doing so, this paper calls for more research in this promising area, since many puzzles remain to be solved by researchers in empirical work, especially concerning the adjustment of carbon prices to the macroeconomic environment.

At first glance, this paper features that the price of carbon is classically driven by the balance between supply and demand, and by other factors related to market structure and institutional policies. On the supply side, the number of allowances distributed is determined by each Member-State through National Allocation Plans (NAPs), which are then harmonized at

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the EU-level by the European Commission. On the demand side, the use of CO\textsubscript{2} allowances is a function of expected CO\textsubscript{2} emissions. In turn, the level of emissions depends on a large number of factors, such as unexpected fluctuations in energy demand, energy prices (e.g., oil, gas, coal) and weather conditions (temperatures, rainfall and wind speed). The demand for allowances can be affected by economic growth and financial markets as well, but that latter impact needs to be further assessed in the academic community.

The remainder of the paper is structured as follows. Section 2 explains how institutional decisions affect the price path of carbon. Section 3 introduces the mechanisms at stake between the price of CO\textsubscript{2} and the price of other energy markets. In addition, it provides the main intuition behind the influence of extreme weather and temperatures events. Section 4 develops the links with the macroeconomic and financial markets. Section 5 briefly concludes.

2. INSTITUTIONAL DECISIONS

In this section, we consider two main categories of institutional decisions that are likely to impact the price of carbon: (i) the emissions shortfall factor, defined as the difference between verified emissions and allocated allowances within a given compliance year, and (ii) the effects of banning banking from phase I to phase II of the scheme.

2.1. The Emissions Shortfall Factor

The best example of the influence of institutional decisions on the price development of carbon may be found during the year 2006. Indeed, during that year Ellerman and Buchner (2008) report that the first report of verified emissions published by the European Commission at the aggregated EU-wide level has had a dramatic impact on the carbon price, which fell by almost fifty percent in a few days. The main reason behind this structural change in the price of carbon may be found in the ratio of allocated allowances to actual emissions: as all installations surrendered their quotas and sent their information to the regulator, it could be assessed for the first time that the carbon market was over-supplied, or “over-allocated”.

As too many allowances were obviously distributed during the first phase going from 2005 to 2007, economic agents have rationally integrated this reliable information in the price signal of CO\textsubscript{2}, which has broadly fluctuated ever since in the range of fifteen to twenty euros per ton. Alberola et al. (2008a) provide a rigorous econometric analysis of such institutional effects, based on the detection of structural changes in the data, which may be dated back to the announcements by the European Commission during the so-called “first compliance event”, which is due to happen on a yearly basis by May 15. Chevallier et al. (2009) extended this analysis to the 2006 compliance event by using option price data.

2.2. Banking Restrictions

Another equally important effect of institutional decisions, which is often disregarded by analysts and academics, is the decision by the European Commission to ban the transfer of any banked or borrowed allowances from phase I (2005-2007) to phase II (2008-2012). As a consequence, any allowances in surplus as of December 31, 2007 would be worthless on January 1, 2008. The main reason behind that decision may be found in Alberola and Chevallier (2009), who advocate that the European Commission did not want to transfer market design imperfections from the “warm-up” period of the scheme to the corresponding period of commitment of the Kyoto Protocol.

Therefore, the banking instrument, which allows industrial operators to smooth emissions and to manage their stock of allowances in a flexible inter-temporal way (see Chevallier (2011a) for a theoretical literature review), has been “sacrificed” in October 2006 in an official press release from the European Commission. From that date until the end of phase I, two price signals have been coexisting: CO\textsubscript{2} spot and futures prices valid for phase I which were gearing towards zero (their actual value as of December 2007), and CO\textsubscript{2} futures prices valid...
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