Journal of Cleaner Production 116 (2016) 40–49

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

The efficacy of the European Union Emissions Trading Scheme: depicting the co-movement of carbon assets and energy commodities through wavelet decomposition

Eduardo Ortas [a,*], Igor Álvarez [b,1]

[a] Accounting and Finance Department, Faculty of Business and Economics, University of Zaragoza, C\ Gran vía nº2, 50005, Zaragoza, Spain
[b] Financial Economics Department, Faculty of Economics and Business Administration, University of Basque Country, C\ Oñati nº1, 20018, San Sebastián, Spain

A R T I C L E I N F O

Article history:
Received 22 May 2015
Received in revised form
31 December 2015
Accepted 31 December 2015
Available online 11 January 2016

Keywords:
Climate change
EU-ETS
Cleaner production processes
Econometric modeling
Wavelet coherence analysis

A B S T R A C T

Environmental system thresholds have been crossed for a number of dimensions of global environmental pollution, such as greenhouse gas emissions. Under this scenario, institutions and corporations are required to implement sustainable policies as a condition for humanity staying within planetary boundaries. Accordingly, the European Union created the largest Emissions Trading Scheme in the world with the aim of properly managing corporations' carbon dioxide reductions. This paper aims to contribute to the literature focused on testing the effectiveness of institutional environmental management policies. Specifically, this research evaluates whether the objectives of the European Union Emissions Trading Scheme are partially achieved by analyzing the dynamics of carbon assets and the main energy commodities worldwide. This paper provides relevant information both for policy makers and company managers so that contributions towards the common goal of developing a clean energy future and curbing climate change are ameliorated. Based on wavelet coherence analysis, this paper proposes a model-free way of estimating the time-varying correlations between carbon assets and energy commodities at both high and low frequencies. Our central results reveal that carbon assets and energy commodities present a changing lead/lag behavior at different frequencies. The energy commodities lead the European Union Allowances returns at medium frequencies, but the contrary was true for the highest investment horizons. This finding should be in line with the goal of significantly reducing emissions because during long cycles if the majority of companies have not switched to cleaner industrial processes, they must buy more carbon assets, increasing their prices. In that case, energy commodities would be more expensive because of the energy commodities' market behavior during long-term horizons with European Union Allowances lead. The Certified Emissions Reductions lead in a negative way most of the energy commodities at medium frequencies, thus indicating that investors handling energy commodities-oriented portfolios could incorporate the mentioned carbon assets for diversification purposes. These specific findings suggest that polluting activities would be more expensive, which would provide an incentive to companies to implement environmentally–friendly industrial processes. The European Union Emissions Trading Scheme can result in significant emission reductions and compliance of the European Union with the objectives of the Kyoto Protocol.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

The development of a clean energy future represents one of the major challenges that has been discussed in international forums over the last 15 years, mainly due to the growing concern about global warming which was addressed by the Kyoto Protocol (International Energy Agency, 2012). Among other initiatives to prevent indiscriminate greenhouse gas emissions (GHG), the European Union (EU) and its members created the largest Emissions Trading Scheme (ETS) in the world; it has been used as the main tool to manage the reduction of CO_2 (Bing et al., 2015), as established in the EU Climate Policy (EU, 2003). The EU ETS is composed

* Corresponding author. Tel.:+34 974239373.
E-mail addresses: edortas@unizar.es (E. Ortas), igor.alvarez@ehu.es (I. Álvarez).
[1] Tel.: +34 943015771.

http://dx.doi.org/10.1016/j.jclepro.2015.12.112
0959-6526/© 2016 Elsevier Ltd. All rights reserved.

of three phases: Phase I took place from 2005 to 2007; Phase II took place from 2008 to 2012; Phase III runs from 2013 to 2020; and Phase IV will take place from 2021 to 2028. It represents an emissions "cap and trade" system that seeks to find the most cost-effective methods for reducing emissions (Uddin and Holtedahl, 2013; Jin et al., 2014) without significant government intervention. This innovative system that ensures flexibility and cost efficiency of climate change policy (De Cian and Tavoni, 2012) represents a shift in paradigms, since environmental policy has historically been a command-and-control-type regulation, where companies had to strictly comply with emission standards or implement specific technologies (Benz and Trück, 2009). Acting as an emissions cap system (Böhringer and Rosendahl, 2009), EU ETS allowed industrial operators to receive free allocations from the EU Allowances (EUA) within the National Allocation Plans (NAPs) at the beginning of the Phase I. Phase II saw a sharp reduction in the number of allowances allocated and Phase III should try to reach the abolition of free allocations in favor of auctioning (Castagneto-Gisser, 2014). These allowances represent the right to emit one tonne of CO_2 into the atmosphere (Zhang et al., 2012). Moreover, the EU has further considered emission reductions by importing credits generated by the Clean Development Mechanism (CDM) known as Certified Emission Reductions (CER) (Nazifi, 2013). Both EUA and CER can be purchased and sold in a secondary market; the political and financial strategy is to have CO_2 emissions become a tradable commodity. Under this scheme, polluting companies must buy carbon assets in the secondary market in order to support their activities; cleaner companies can enhance their financial performance by selling their excess allowances.

Under this scenario, a growing number of academics have focused on examining the price and volatility dynamics of both types of carbon assets (Koop and Tole, 2013; Chevallier, 2011a, 2013). In general, these studies aim to address the possible links between EUA and CER prices and the behavior of some variables such as: i) financial indicators (Chevallier, 2011b); ii) market microstructure variables; and iii) economic activity indicators, (Aatola et al., 2013; Daskalakis et al., 2009; Paolella and Taschini, 2008). These papers have focused on determining the co-movement between carbon assets and some energy commodities (Creti et al., 2012; Nazifi, 2013; Rickels et al., 2007). The economic ideal behind the link between energy commodities and carbon assets pricing unfolds as follows: a stable economic setting fosters demand for industrial consumer goods and services; thus, companies increase their production which results in their emitting more CO_2 into the atmosphere. At the same time, industrial companies must buy more carbon assets and energy commodities in order to cover their emissions and attend to the demand of their products. This process results in the increase of carbon and energy commodity prices. An increase in energy commodities prices can motivate companies to switch to cleaner production processes; this means that firms will have an excess of carbon assets which will result in a price drop. However, previous literature provides mixed empirical evidence of this relationship, mainly due to the existence of differences in the following: i) regulatory issues (Benz and Trück, 2009); ii) attitudes to risk (Chevallier et al., 2009); iii) market participants' decisions (Daskalakis et al., 2009; iv) institutional events (Chevallier, 2009b); and, v) the negative impact of the European economic crisis (Bel and Joseph, 2015).

Ultimately, the determining factors of carbon prices and their interaction with other variables (such as energy commodities) are of great interest for several reasons. At a governmental level, policy makers can test to see if the assumed quantity-based policies represent a better approach than tax-based policies or other political decisions. Furthermore, they can draw general conclusions about how reliable and robust the climate policy is, allowing them to adjust emissions caps and increase trading efficiency (Aatola et al., 2013). Compliant traders can improve strategies and investment decisions related to their industrial activity, which allows them to develop cleaner and more environmentally–friendly production technologies or maintain their current industrial models. Finally, this information is also very useful to portfolio managers who can select carbon price information to adjust or rebalance their investment portfolios.

This research aims to expand the conclusions obtained by Sousa et al. (2014) who focused on modeling the time-varying co-movement between the EUA and certain energy commodities. In order to do so, this research also offers an update overview of the interaction between other carbon assets (i.e., the CER allowances), the gap between the EUA and CER called spread (SPREAD) and a wider range of energy commodities worldwide. Although previous works on carbon assets pricing focus mostly on time domain, this paper follows the approach implemented by Sousa et al. (2014) by developing a model-free way of estimating time-varying correlations between carbon assets and energy commodities at both high and low frequencies, thus focusing on a wider time–frequency domain. Wavelet coherence analysis is provided by using wavelet transforms and frequency decomposition (Rua and Nunes, 2009). This approach constitutes a very promising tool as it provides a refinement in terms of analysis where both time and frequency domains are taken into account (Rua and Nunes, 2009). Specifically, wavelet analysis offers a unified framework to measure co-movement in the time–frequency space. The application of this approach will allow light to be shed on the return interdependences between carbon asset and energy commodities, and adduces implications of the empirical findings on carbon assets and energy commodities management strategies. In the context of carbon assets, it is interesting to note that the use of the wavelet coherency approach presents the following advantages compared to traditional approaches such as Vector Auto-Regressive (VAR), Markov-switching, multivariate GARCH and jump-diffusion models. Firstly, it is worth mentioning that previous research about EU carbon markets reveal the potential appearance of nonlinearities in carbon assets prices caused mainly by frequent market imperfections, heterogeneous investors and instable episodes in financial markets (Arouri et al., 2012). Under this scheme, works using univariate and multivariate linear models have strongly been challenged by the plausibility of nonlinear dynamics for the carbon assets prices (Seifert et al., 2008; Benz and Trück, 2009; Arouri et al., 2012). In this context, wavelet analysis allows capturing the nonlinear dependencies in energy markets (Kyrtsou et al., 2009). Secondly, previous research demonstrates how the dynamics of energy prices in different energy markets are often nonstationary (Sousa et al., 2014), and therefore it is crucial to implement methods that do not require stationarity such as the wavelet analysis (Vacha and Barunik, 2012; Vacha et al., 2013).

The entirety of Phase II of the EU ETS is taken into consideration, which differs from Phase I in terms of characteristics (depth and liquidity), market experience, and regulation. This will result in obtaining a better overview of the interactions between carbon assets and the main energy commodities and to test whether the co-movements identified in Phase I still hold for Phase II and move toward a stable, long-term relationship. This paper also contributes to existing literature by revealing the actual structure of dependence between carbon assets and energy commodities, avoiding the underestimation the risk portfolios, combining EUA, CER, commodities, or equity investments. Our results indicate significant links between carbon assets and energy commodities at different investment horizons (i.e., at different frequencies). Furthermore, these linkages are time-varying during the analyzed period with a complex lead–lag structure.

Download English Version:

https://daneshyari.com/en/article/1744182

Download Persian Version:

https://daneshyari.com/article/1744182

Daneshyari.com