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# Temporal restrictions on emissions trading and the implications for the carbon futures market: Lessons from the EU emissions trading scheme

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ABSTRACT

Prohibiting the intertemporal trading of emission allowances induces positive risk premia in futures prices when the trading of the contracts and their expiry take place in time periods separated by this trading ban. In Phase I of the EU Emissions Trading Scheme (EU ETS) these were in the order of about 28% of the futures price on average, depending on the contract's expiry in Phase II. Environmental policy makers should avoid such restrictions as they result in increased hedging costs for polluters that are, since emission allowances represent opportunity costs, potentially borne by consumers.

## 1. Introduction

The cost effectiveness of environmental policies based on cap-and-trade systems for emission allowances (or permits) is intimately related to the flexibility given to polluters with respect to the timing, extent and manner of emissions abatement (see Montgomery, 1972 and the review by Cropper and Oates, 1992). This flexibility is thought to be enhanced if the intertemporal trading of the permits is allowed (e.g., Rubin, 1996; Kling and Rubin, 1997). Contrary to the consensus view in the environmental economics literature however, the EU member states decided in 2003 to restrict flexibility by prohibiting the trading of the carbon dioxide ($CO_2$) emission allowances from Phase I (2005–2007) to Phase II (2008–2012) of the EU ETS (Directive 2003/87/EC). This was based on concerns that unless this policy was adopted, the achievement of the Kyoto obligations for the EU could be jeopardized (see, for example, Parsons et al., 2009 for a discussion of this issue). Specifically, the rationale was that by not allowing the 'banking' of Phase I emission allowances to Phase II, a stricter cap would be essentially in place for Phase II. However, a simpler approach would have been to impose directly stricter caps in Phase II in order to account for any Phase I emission allowances banked. As expected, the decision attracted considerable criticism, with both academics and practitioners pointing out its negative implications from an environmental (Schleich et al., 2006), economic (Godal and Klaasen, 2006) and financial perspective (Daskalakis and Markellos, 2008). In response, the EU Commission started reviewing in 2006 the functioning of the EU ETS and adopted a year later several improvements regarding its operation from 2008 onwards. The main and most anticipated one was the removal of the inter-phase trading ban of the carbon permits (Directive 2009/29/EC). For a thorough description of the EU ETS, along with a discussion regarding the scheme's operation during its first two phases see Daskalakis et al. (2011).

The implications of the intertemporal trading ban in the EU ETS from a financial perspective have been extensively discussed in the extant literature (see Daskalakis et al., 2011, inter-alia). The focus, however, has been on the spot market, whereas little has been said on the consequences of this policy for the futures market. This is the issue I address in this note, with my objective being to provide environmental policy insights from the standpoint of the participants in the carbon futures market. Such insights are both topical and important as there are currently about 100 emissions trading schemes being planned (or considered) around the world after the 'Paris Agreement' for a worldwide effort to keep the global average temperature increase below 2 °C came into force in November 2016 (World Bank, Ecofys, Vivid Economics, 2016). Naturally, further than the establishment of a spot market, each of these schemes is expected to eventually develop a corresponding futures market so that, on the one hand, polluters are able to manage their carbon risk exposure and, on the other hand, speculators to enter the market, bring the necessary liquidity and in turn, improve market efficiency. The latter highlights that the role of the carbon futures market is not limited to providing a hedging platform for polluters, but in fact is central in the success of an emissions

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trading scheme. The reason is that the achievement of the required emissions reductions in a cost-effective manner depends on whether the market itself is efficient and, therefore, the prices of the traded permits reflect their fundamentals (i.e., marginal abatement costs), as only then polluters will be able to reach optimal abatement decisions (see Daskalakis, 2013 for a discussion). Consequently, when deciding the different aspects of an emissions trading scheme, policy makers need to have a clear understanding of the implications of their decisions for the futures market. Whether to allow the trading of the permits between different periods of the scheme is one of the first decisions to be made. Hence, the policy insights regarding this issue that can be drawn from the experience gained from the operation of the largest and oldest mandatory emissions trading scheme in the world, the EU ETS, are indeed invaluable.

## 2. Relationship between spot and carbon futures prices: Background

A main function of the EU ETS futures market is to provide a platform for polluters to hedge carbon price risk. To facilitate this, carbon futures (i.e., futures contracts with underlying carbon emission allowances) with expiry within not only the current but also the next phase of the scheme are traded. For example, in 2005 (beginning of Phase I) contracts with expiry up to December 2012 (end of Phase II) were available. Similarly, in 2008 (beginning of Phase II) futures with expiry up to December 2020 (end of Phase III) were traded. Thus, carbon futures can be classified either as 'intra-phase' or 'inter-phase' contracts. The former, are those that initiate and expire within the same phase of the scheme while, the latter, are those that initiate in one phase and expire within the next one. This categorization allows highlighting the key implication of the intertemporal trading ban for the carbon futures market. When the permits cannot be transferred from the current phase to the next, the spot emission allowances underlying the inter-phase futures are a different asset than the underlying spot permits of the intra-phase contracts. More importantly, as the underlying of the inter-phase futures is not a traded asset in the current period, the spot-futures price relationship (or equivalently the pricing mechanism) between these two categories of contracts differs.

To illustrate this, Fig. 1 presents the daily price evolution of the spot permits and of the most liquid inter- and intra-phase carbon futures traded in Phase I of the EU ETS. Spot prices are from the French PowerNext, the primary spot carbon exchange in that period. Futures prices are for contracts with December expiry in the years 2006–2010 (Dec-06 to Dec-10 contracts) traded in the London-based Intercontinental Exchange (ICE), the main carbon futures exchange in the EU ETS. For the specification of the carbon futures and a description of the spot and futures exchanges in the two first phases of the EU ETS see Daskalakis et al. (2011). Based on the classification of the carbon futures introduced above, Dec-06 and Dec-07 were intra-phase contracts and the remaining three (Dec-08, Dec-09 and Dec-10) inter-phase futures. The key observation from this figure is that although intra-phase futures prices followed very closely the price evolution of the spot permits, this was not the case for the inter-phase contracts.

Further insights are gained from Fig. 2 that plots the prices of the three inter-phase futures in the period 2008–2010, that is, from the beginning of Phase II up to the expiry of the longest expiring contract (Dec-10). Spot prices from BlueNext (PowerNext was acquired by BlueNext in 2007) are also presented for comparison purposes. As seen in this figure, when the trading of the inter-phase futures was taking place in the same period as their expiry, their prices followed closely the prices of the spot permits, similarly to the case of the intra-phase futures in Phase I.

For explaining this behavior, Daskalakis et al. (2009) argued that since storing the permits is costless, and there is no advantage of holding a long futures position in comparison to holding a long spot one, intra-phase futures prices should be related to spot prices through the cost-of-carry model of Kaldor (1939), Working (1948) and Telser (1958), with zero storage costs and no convenience yield. They further pointed out that this should also be the case for the inter-phase futures when their trading takes place in the same period as their expiry. Indeed, the empirical evidence they provided suggest that any mispricing of the cost-of-carry model in these two cases is in the order of the transaction costs. For the inter-phase futures when traded in a different period than their expiry however, they explained that since the underlying of these contracts is not at that point traded, the cost-of-carry model is no longer applicable. Instead, they proposed a futures pricing model based on an empirically consistent continuous-time process for the spot prices.

## 3. Risk premia in inter-phase carbon futures prices

I revisit here the relationship between inter-phase futures and spot

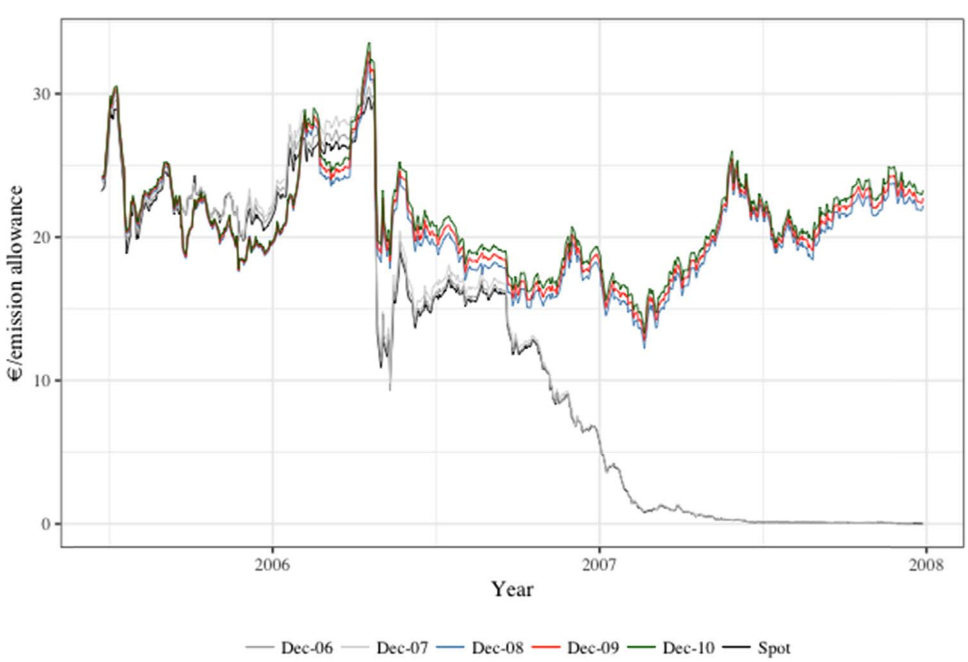


**Fig. 1.** Emission allowance spot and futures prices in Phase I.