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The globalization of steam coal markets and the role of logistics: An empirical analysis ☆

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ABSTRACT

In this paper, we provide a comprehensive multivariate cointegration analysis of three parts of the steam coal value chain — export, transport and import prices. The analysis is based on a rich dataset of international coal prices; in particular, we combine data on steam coal prices with freight rates, covering the period December 2001 until August 2009 at weekly frequency. We then test whether the demand and supply side components of steam coal trade are consistently integrated with one another. In addition, export and import prices as well as freight rates for individual trading routes, across regions and globally are combined. We find evidence of significant yet incomplete integration. We also find heterogeneous short-term dynamics of individual markets. Furthermore, we examine whether logistics enter coal price dynamics through transportation costs, which are mainly determined by oil prices. Our results suggest that this is generally not the case.

1. Introduction

The price formation for steam coal, the most important type of coal and its dynamics is often unclear even to many insiders, and widely unknown even to the specialized economics community. Although coal is one of the most important commodities traded internationally, the market remains largely non-transparent, and is far less sophisticated than the markets for oil and natural gas. The international markets have remained segmented for a long time, in particular between the Atlantic and Pacific basins, but also with respect to coal qualities, shipping vessel size, and sectoral demand.

To our knowledge there has been no systematic analysis of global coal price dynamics. Most of the common knowledge about how coal markets function appears to be based upon anecdotal evidence promulgated by market participants. Even the most "standardized" prices, such as the API-2 (CIF[1] price received in the ARA-region Amsterdam–Rotterdam–Antwerp) and the API-4 (FOB South African coal price out of Richards Bay), derive from individual statements by selected traders willing to reveal the prices of their latest deals. We note in passing that an environment in which information brokers pay for information is ripe for market manipulation. Also, a high market concentration on the supplier side (China, the US, South Africa, Indonesia and Australia together comprise 78% of world steam coal production) adds to the potential to drive prices away from competitive levels.[2]

This potential may have diminished due to increased competition around the turn of the century with the advent of new shipping sizes, fewer constraints on downloading and uploading port facilities, and the emergence of liquid "hubs" in several market segments, such as South Africa and Australia. Furthermore, the price spike during the recent "oil price crisis", where coal prices have peaked similarly drastically as oil prices, may have caused greater awareness by potential new market participants about the available rents in this business. Increasing price pressure on the major buyers of steam coal, i.e. electric utilities, is an additional factor driving towards price integration. The fact that even Australia has entered the Atlantic

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[1] CIF is the price including cost, insurance and freight; FOB is free on board, i.e. the price paid at the export location.

[2] Even though there are many smaller producers involved in steam coal mining and international trade, four large companies dominate the international market, i.e. export capacities: BHP Billiton, Rio Tinto, XStrata, and Anglo. The four were responsible for almost one-third of global steam coal export capacity in 2007 (Rademacher, 2008).

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market is also considered as an indication that the globalization of coal markets has advanced.[3]

On the other hand, a closer look at the technical aspects of the markets and the anecdotal evidence about the lack of reliable marker prices for globally traded steam coal suggest a less sanguine interpretation of coal market activity. The use of steam coal in boilers for electricity generation critically hinges upon the tight specification of coal composition, e.g., heat value, ash, sulphur, moisture content, granularity, etc. Steam coal is not easily standardized, which greatly reduces the applicability of commodity price indices, such as the API-2 and the API-4. Today, there is no world-wide price index for this important commodity that is based on publicly quoted supply and demand. Even the most commercialized route, South Africa to ARA, has been unable to produce a market price that can serve as a basis for liquid spot and forward trading.

Furthermore, an analysis of the international steam coal trade would be incomplete without taking into account that logistics are of paramount importance for the industry. International steam coal prices depend very strongly on logistics costs, such as railway or domestic shipping (inland), transhipment, sea transport (international trade) and transportation to the final customer (inland). In turn, logistics costs depend on both fuel oil prices and the availability of transport capacities, since steam coal competes for capacity with other dry bulk products, such as coking coal. Thus, a comprehensive market analysis must incorporate both extraction costs and the price and availability of the logistical services needed to bring steam coal to the end-users.

Specific segments of international coal markets have been analyzed in the academic literature, albeit with heterogeneous results. There is no clear consensus whether the "globalization" of steam coal trading has already occurred. Ellerman (1995) documents that the U.S. was the price setter in a unified world coal market from the 1970s until the 1990s. The two papers by Ekawan and Duchêne (2006) and Ekawan et al. (2006) suggest that the international markets for steam coal were already integrated in the early 2000s[4]; however, the papers do not provide econometric evidence to support this hypothesis. Warell's (2005) empirical work on quarterly import prices suggests regional markets but without a clear trend towards integration. In an extension, Warell (2006) argues that the integration of markets in Europe and Japan was interrupted during the 1990s. Li et al. (2010) show that monthly export prices from the main steam coal exporting regions are generally highly integrated, with the exception of Indonesia. EPRI's (2007) analysis also tends to indicate global price transmission via freight rates (and exchange rates), showing that "the role of Australian coal price is similarly important now to the Atlantic market" (EPRI, 2007, 1–8). It suggests that due to a change in relative prices the U.S. lost its position as a swing supplier in the Atlantic basin, and was replaced by Colombian (and Venezuelan) producers with lower delivery costs to the U.S. East Coast, and thus to Europe as well.

In this paper we provide a comprehensive analysis of the global price dynamics of steam coal. We compile a richer dataset than was used in the literature so far in terms of scope and frequency, and conduct a comprehensive multivariate cointegration analysis of three major pieces of the value chain of steam coal, namely export, transport and import prices, both separately and jointly. We perform our analysis at the level of individual routes, at the regional (i.e. basin) level, and at the global (i.e. inter-basin) level. We propose that although the industry is gradually moving from a segmented, OTC-dominated activity to a higher degree of commoditization and international integration, a truly integrated single-world coal market has yet to be achieved.

Our data are sampled at weekly frequency, whereas existing literature on international coal market integration is based on monthly or even quarterly data. In addition to coal prices our dataset includes freight rates which have not previously been used in an analysis of coal market integration. We test whether the demand side of the steam coal market, proxied by the CIF price, and the supply side, i.e. export prices plus freight rates, are integrated among each other, and whether systems of demand and supply are integrated when exports, imports, and freight rates are combined for individual trading routes, across basins, and globally. We find evidence of significant yet incomplete integration. Using the weekly frequency of our data we also estimate short-term dynamics of individual markets. Furthermore, we examine whether logistics enter the steam coal market via the direct transmission of the oil price, the main driver of seaborne transport costs, in coal prices and freight rates. Finding that the oil price is not linked to export, import, or transport prices in any systematic way, we conclude that logistics enter the system of steam coal prices in a more complex manner.

The remainder of the paper is structured as follows. In Section 2 we present a descriptive analysis from which we derive testable hypotheses. Section 3 introduces the main method of analysis, Johansen Cointegration methodology, and analyzes route-specific, intra-basin, and global steam coal market integration. Section 4 discusses the evidence on market integration. Section 5 summarizes the main findings, and suggests topics for further research.

2. Data and hypotheses

2.1. A brief geography of international steam coal markets

International seaborne coal trade developed rapidly in the 1970s and has increased manifold since. In 2009, a total of 1.882 million tonnes (mt) of steam, coking and hard coal were traded of which about 91% account for seaborne trade, i.e. international trade across the basins. International steam coal trade amounted to 706 mt (that is 13.5% of total steam coal production) of which more than 90% was seaborne steam coal trade (IEA, 2010). Indonesia, Australia, Russia, Colombia and South Africa account for more than three quarters of all exports. Steam coal imports in the Asian-Pacific region in 2009 represent more than half of total steam coal trade. Another third of total world trade was received by the European market while the North and Latin American markets only imported 6% of total internationally traded volumes. The main international trade routes are Indonesia to Asia (210 mt), Australia to Asia (144 mt), China to Asia (20 mt), South Africa to Europe (38 mt), Colombia to Europe (30 mt), Colombia to North America (18 mt), and Indonesia to Europe (13 mt). Hence, the main trade is still taking place within the Atlantic and Pacific basins, respectively (Fig. 1).

2.2. Data

In this section we perform a descriptive analysis of steam coal prices, freight rates, and the prices of residual fuel oil. The results motivate the remainder of our analysis. We present descriptive statistics and a principal component analysis (PCA), from which we derive three main testable hypotheses. We use weekly time series data on CIF and FOB prices as well as on a number of freight rates between major export and import locations for steam coal provided by Platts.[5]

[3] "The inability of producers in the Atlantic to completely meet the coal trade demand in that region has allowed Australia to be the price setter in the Atlantic market as well" (EPRI, 2007, 1–6).

[4] "With regard to regional markets, coal from any of the major exporters will find markets in either Europe or Asia, depending principally on freight costs" (Ekawan and Duchêne, 2006, 1487).

[5] The price data are collected by interviewing "trusted" traders, so that transparency on price formation is far from complete.