



Editorial

Introduction to the special issue on recent developments in energy commodities markets



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Energy markets have been undergoing dramatic transformations in recent decades. Deregulation in the electricity and gas markets has forced a whole new world of trading and risk management. Risk managers, scholars, and experts of energy matters are more and more challenged with the choice of the adequate instrument or risk management strategy. The 51st international conference of the EWGCFM devoted 3 days to this topic with 140 participants from academia and the commercial world presenting new tools and ideas on how to face these challenges. Sixty-five of the 120 researches presented during the conference provided original and interesting contributions on this topic and were submitted for publication in this special issue.¹ One third of the papers submitted, precisely twenty-seven, were finally accepted for publication.

The 27 papers deal with five main areas of research:

1. The role of fossil fuels in the energy commodity risk management.
2. The role of renewable energy sources in power market's dynamics.
3. Recent developments in technological and institutional interventions affecting the power markets.
4. The level of integration of energy commodities in Europe.
5. Recent dynamics in energy commodity markets: volatility issues, the role of speculation, the role of derivative contracts in providing efficient information, the performance of energy companies.

1. Fossil fuels

Fossil fuels still represent the main risk factors in the world's economies and provide interesting opportunities for investigation. The large growth of unconventional gas production that occurred in the last 5 years caused profound changes in the distribution and use of fossil fuels around the world. How to model crude oil volatility or understanding its dynamics and how crude oil affects global economic growth or the emerging countries are some of the issues dealt with by eight of the 27 papers presented in this issue.

Paola Zerilli and Christopher Baum, using high-frequency data, employ various models of stochastic volatility in order to analyze the uncertainty of crude oil futures returns and to evaluate the predictability of their volatility. They model jumps as extreme events using a generalized method of moments (GMM) estimator. They find that both jumps and stochastic volatility in oil futures returns are key features to measure crude oil futures dynamics. *Sajal Ghosh and Kakali Kanjilal* identify the effects of movements in international crude oil price on the Indian stock market unfolding many important insights for investors and policy makers. They measure the cointegration and long-term causal relationship between international crude oil price and Indian stock market in a multivariate framework taking into account the role of nominal exchange rate which results related to the crude oil price movements. They find a cointegrated relationship only in the last period after the 2008 GFC showing a change in the functioning of the Indian stock market; as a consequence, the crude oil price does no longer provide an efficient tool for diversification. *Qiang Ji and Ying Fan* study the oil market integration and represent its interaction and organizational structure on a tree. They are able to measure the level of globalization of this market. They assess how the structure of the world oil market and its leading/lagging role in the major oil-producing and oil-consuming countries have changed in response to the new global economic and energy environment. They find that crude oil produced in different countries constitutes a unified market and represent it as a minimal spanning tree (MST) for oil markets. *Rangba Gu and Bing Zhang* study the level of efficiency of the crude oil market and how it can be affected by multifractality. They use an econophysics approach and find that crude oil market efficiency is lowered by multifractality. *Michael Dowling, Mark Cummins and Brian Lucey* study the role of psychological barriers in the setting of crude oil price. They find that psychological barriers affect the setting of Brent but not WTI. They argue that Brent exhibits resistance due to the greater uncertainty in Brent fundamental value determination. Their results suggest that behavioral

¹ This Special Issue has been supported by 2013 EWGCFM funding.

finance theory may be useful to understand energy markets dynamics. *Lin Zhao, Xun Zhang, Shouyang Wang and Shanying Xu* study the response of China's macro-economy to global oil price changes. They construct an open economy DSGE model to distinguish and analyze the effects of different oil price shocks on China's output and inflation. They treat China as a large open economy so its oil demand to some extent can affect oil prices outside of China. They find that oil supply shocks driven by political events have permanent effects on US output, while they only bring about temporary fluctuations to China's output; under the aggregate demand shocks of oil price, US output responds in the short-term, while China's output response is in the long-term. *Bing Zhang and Xiaoming Li* examine the long-run trends and the short-run fluctuations of the oil-equity correlations using a novel DCC decomposing method. They find long-run positive trend in correlations between returns of oil and most stock indices (except for Germany and US), and their correlation trends elevated notably during the period of recent financial turmoil (except for Brazil and Russia). Conditional correlations between four equity markets and the oil market move toward or above their long-run trends when equity market volatilities increase. *Hayette Gafnaoui* studies the interaction between the US natural gas and crude oil markets and how they may depend on the US stock market. She uses the multivariate copula methodology to assess the link between the natural gas and the crude oil market. She analyses the implications for portfolio optimization when investors hold US stocks, which are diversified by investments in both natural gas and crude oil assets. The linkages between the US crude oil, natural gas, and stock markets are unstable over time, which renders forecasting difficult. Hayette is able to give an interesting description of the joint behavior of energy commodity prices and the US stock market index level over time in a regime switching framework.

2. Renewable energy

The power sector plays a central role in the European energy transition. The decarbonization of EU economies is at the core of the EU's agenda for climate change and energy. The initial goal set by the 2008 Climate and Energy Package is to cut greenhouse gas emissions by 20%, to produce 20% of primary energy from renewable sources, and to reduce gross primary energy consumption by 20%. In October 2014, Member States agreed to set targets for 2030, viz. 40% for domestic greenhouse gas emissions reduction, at least 27% for the share of renewable energy and at least 27% for energy consumption. The role of renewables and its impact in the cost of electricity and in the generation and distribution process therefore represents a crucial topic to study. Five of the 27 papers analyze the role of renewable energy sources.

Joachim Bertsch, Christian Growitsch, Stefan Lorenczik and Stephan Nagl analyze whether there is a need for additional incentive mechanisms for flexibility in electricity markets with a high share of renewables. They use an integrated analysis of all flexibility possibilities to study how an electricity system can adapt to an increasing share of renewables. They determine the cost-effective capacity mix, ensuring adequate capacity and fulfillment of flexibility requirements. They consider the long-term developments in transitioning to a largely renewable electricity system in Europe, especially with regard to a renewable-dependent provision of balancing power. They find that an increase in fluctuating renewables has a tremendous impact on the volatility of the residual load and therefore flexibility requirements. In a competitive market, the cost-effective technologies most likely to be installed, i.e., gas-fired power plants or flexible CCS plants, provide flexibility as a by-product. Assuming a realization of the EU 2050 goals, however, can be seen as an upper bound of flexibility demand in a very high RES-E share energy system. They show that even in such an optimistic RES-E scenario, flexibility does not become an issue of system adequacy. The role of RES in the energy market and how they affect the welfare have been investigated in the papers by *Daniel Hach and Stefan Pinder*, who investigate the necessity and effectiveness of capacity

payments on investments in gas-fired power plants in presence of different level of renewable energy technology penetration. They find that capacity payments are an effective measure to promote new gas-fired generation projects especially in times of high renewable feed in.

Paolo Pisciella, Maria Teresa Vespucci, Marida Bertocchi and Stefano Zigrino consider a power producer who has to determine the optimal technology mix between conventional and RES generation, in order to plan power generation capacity expansion over a long-term horizon. They design a risk-averse time-consistent multistage stochastic mixed integer optimization model. It gives information about how many plants of each technology should be built in the medium to long run and when these installations should be initiated. The model is intended for a price-taker power producer and determines the investment plan associated to an optimal trade-off between the net present value of profits and the risk of getting a negative impact on the profit due to the realization of undesired scenarios. *Ingmar Ritzenhofen and Stefan Spinler* focus on quantifying the impact of feed-in tariffs (FIT) design features and regulatory uncertainty on the propensity of private investment into RES. They derive implications for policy design. They provide numerical solutions reflecting current and expected future revisions in FIT levels and potential changes in regulatory regimes. They contribute to explaining currently observed investment behavior and provide insights both to investors regarding optimal investment timing and regulators regarding the impact of specific FIT design features and changes to existing FIT schemes. *Roula Inglesi-Lotz* determines quantitatively the impact of RES use to the economic conditions in a panel data framework including all OECD countries for the period 1990–2010. The results have important implications for the implementation of future policies on promoting RES in combination with macroeconomic policies. The author takes into account the importance not only of the volumes of RES consumed but also their share in the total energy mix of each country.

3. Electricity

The power sector has been the main sector experiencing decarbonization over the last decade. It is expected to support the economy in reducing its dependence on fossil fuels, notably in the transport and heating and cooling sectors. Public and private investments play a crucial role for consumers who can benefit from this strategy. The substantial investment in low-carbon technologies that will be needed to achieve these goals will have to be supported by an economic and institutional framework capable of facilitating this transition.

The role of transmission network and the institutional support for market coupling or interconnection play also an important role. Four papers in this special issue deal with the analysis of transmission improvements, pollution control, the role of investments in the distribution system and the pricing system. *Danny Pudjianto, Manuel Castro, Goran Strbac, Zongyu Liu, Lou van der Sluis and George Papafthymiou* analyze the economic impact of investments in transmission system on market power in a restructured market environment. They assess the effect that these investment decisions have on different market participants such as producers, consumers, and the market operator, under various decarbonization pathways toward a low-carbon economy. They find "asymmetric" impacts for different stakeholders in importing and exporting zones in the future European electricity system when large scale of RES will be integrated into the system. *Giuseppe Travaglini and Enrico Saltari* study the problem of pollution control in the presence of emission constraints set by the regulator. They study how high emissions should be set to optimally control pollution accumulation in order to maximize the net social benefits and assess the optimal flow of emissions given an upper constraint to the quantity of pollutants released in the environment at each time. *Izabela Zoltowska* studies the role of incentives for demand side bidding in an efficient but non-convex auction. She finds that applying symmetric rules to the buyers, fair prices result while consumer requirements are fulfilled. *Rahmatallah Poudineh and Tooraj Jamash* analyze the determinants of the investments in the

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