Energy Economics 100 (2021) 105323

Contents lists available at ScienceDirect

Energy Economics

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

Editorial

Introduction to "New Developments in Econometrics of Energy and Climate"

This virtual special issue of *Energy Economics* is loosely organized around a workshop series on energy and climate economics that began in February 2018 with the International Conference in Rio de Janeiro, Brazil. The series continued in Seoul and Jeju Island, Korea in May 2019, and, as with many conference series, has been paused during the COVID-19 pandemic. We plan to continue the series in Oslo in 2022. These workshops seek to bring together academic researchers from around the world specializing in applying cutting-edge econometric tools to issues in energy and climate change, and policy makers and business leaders in positions to use those tools.

Submissions to the special issue were solicited from participants of these two conferences in addition to other similarly themed conferences that took place at about the same time. Articles published in the special issue were subject to the journal's usual standard of peer review. They feature state-of-the-art econometric tools with a sharp eye on energy and climate applications, or, the reverse, they focus on important applications in these fields and bring to bear novel tools.

Articles are loosely organized around four themes: energy markets, price forecasting, energy consumption and macroeconomics, and climate change and unintended consequences of energy consumption.

1. Energy markets

Econometric techniques are useful to quantify market movements through supply and demand. Duarte, Gaglianone, Guillén, and Issler seek to tie energy prices and commodity prices more generally to global demand in their paper "Commodity prices and global economic activity: a derived-demand approach" (Duarte et al., 2021). Using the tools of the common-feature literature, they first show the synchronicity of oil-price and global activity cycles. They then demonstrate how to improve forecasts of global activity using commodity prices, before showing the usefulness of optimal forecast combinations for oil prices that employ a wide array of macroeconomic and financial variables.

Of critical importance in the demand for oil is the economic growth of China over the past few decades, an issue taken up by Cross, Hou, and Nguyen in their paper "On the China factor in the world oil market: a regime switching approach" (Cross et al., 2021). Using a Markov-switching vector autoregression model, the authors identify key regimes in the structural shocks, given by periods of low and high oil price volatility, and they find that supply and demand shocks from China and the rest of the world have different impacts on the real price of crude oil depending on the regime.

Energy demand has received much attention in the literature in the last few decades, but Shioji (2021) reminds us of the importance of supply shocks, once thought to be the main driver of oil price movements, in his paper "Pass-through of oil supply shocks to domestic gasoline prices: evidence from daily data." Using a structural VAR with external instruments coupled with high frequency identification, he shows that the pass-through of supply shocks to gasoline prices in Japan is indeed very fast: about 70% of the adjustment process is completed within just 18 days.

2. Forecasting

Speaking of daily price data, forecasting volatile daily data is an important concern of regulators, and forecasting electricity prices is the main concern of the next two papers, "Regularized quantile regression averaging for probabilistic electricity price forecasting" by Uniejewski and R. Weron (Uniejewski and Weron, 2021), and "Enhancing load, wind and solar generation for day-ahead forecasting of electricity prices" by Maciejowska, Nitka, and T. Weron (Maciejowska et al., 2021). The authors of the first of these papers modify the quantile regression averaging approach by using only relevant regressors selected by LASSO and offer it as an efficient tool to boost the profitability of energy trading activities, help with bidding in day-ahead markets, and improve risk management practices in the power sector. The authors of the second of these papers improve predictions of renewable energy sources with a simple regression method, and they show that use of such enhanced forecasts leads to more accurate predictions of both the spot and the intraday electricity prices and results in a substantial revenue increase.

Ferrari, Ravazzolo, and Vespignani are also concerned with forecasting in their paper "Forecasting energy commodity prices: a large global dataset sparse approach" (Ferrari et al., 2021), but their aim is much more inclusive, both in the type of energy they forecast and in their geographical scope. The authors apply a dynamic sparse factor model for forecasting energy prices and show that estimated latent factors exhibit considerable sparsity and heterogeneity. Their model is shown to provide larger predictability gain for important energy commodities, such as oil, gas, and coal, compared to alternative models including those with machine learning techniques.

3. Energy consumption and macroeconomics

Forecasting is also the subject of the next paper, by Chang, Choi, Kim, Miller, and Park. Rather than forecasting prices, these authors forecast aggregate energy consumption using income as a proxy for production in their paper "Forecasting regional long-run energy demand: a functional coefficient panel approach" (Chang et al., 2021). The functional coefficient panel approach allows the authors to estimate and forecast time-varying patterns in energy consumption common to countries that use energy more intensively, which tend to be developing

https://doi.org/10.1016/j.eneco.2021.105323

countries, and those that use it less intensively, which tend to be developed countries.

Structural change in the long-run relationship between energy consumption and income is also the subject of the next paper, "Cointegration of electricity consumption and GDP in the presence of smooth structural changes," by Arčabić, Gelo, Sonora, and Šimurina (Arčabić et al., 2021). Controlling for smooth structural changes in the data using recently developed unit root and autoregressive distributed lag cointegration tests, they show that structural breaks in electricity consumption may exist in EU countries because of activities associated with the European Energy Union and country-specific idiosyncrasies.

Whereas the previous two papers address the relationship between energy consumption and the macroeconomy, the next one, "Do central banks respond to exchange rate movements? A Markov-switching structural investigation of commodity exporters and importers," by Alstadheim, Bjørnland, and Maih (Alstadheim et al., 2021), poses the question of how macroeconomic policymakers respond differently to exchange rate movements depending on whether or not their economies rely on importing or exporting energy and other commodities. The authors find that central banks in three commodity exporting countries, Canada, New Zealand and Norway, respond strongly to the exchange rate during certain periods. Furthermore, they show that policy rules with a high response to the exchange rate exacerbate the effects of external shocks on the domestic variables in advanced economies.

4. Climate change and unintended consequences of energy consumption

We all understand that energy consumption results in emissions, and the scientific consensus is that the correlation between of the accumulation of carbon dioxide emissions in particular with a warming climate is not spurious and that climate change has a substantial anthropogenic component. Pretis (2021) tackles the thorny issue of disentangling the effects of human activity on climate change from the effects of climate change on human activity in "Exogeneity in climate econometrics." He does so by considering a full empirical climate-economic system, and he examines the conditions under which such a system can be studied by looking exclusively at the conditional economic side or at the climate side.

If we accept that at least some component of climate change is anthropogenic and that climate change can have non-negligible economic costs, an important issue for elected policymakers is the perception of their electorate about climate change and its effects. Baiardi and Morana (2021), in their paper entitled "Climate change awareness: empirical evidence for the European Union," assess these public perceptions in Europe over time. They find that environmental concern is increasing in income, secondary education, media coverage, and both physical and economic distress attributed to weather. On the contrary, it is negatively related to age demographics, greenhouse gas emissions, and what they describe as relative power of right-wing parties in government.

Stepping back from the link between emissions and climate change *per se*, emissions are anthropogenic. Bennedsen, Hillebrand, and Koopman, in "Modeling, forecasting, and nowcasting U.S. CO_2 emissions using many macroeconomic predictors" (Bennedsen et al., 2021), put forth an augmented dynamic factor approach to modeling emissions using a diverse array of macroeconomic time series. Determining that of these series industrial production best explains carbon dioxide emissions, they utilize the former to forecast and nowcast the latter. They find a significant 2.6% impact on US emissions from a reduction of output in residential utilities in 2019.

Many climate-related analyses performed by economists, like the papers just mentioned, are concerned with economic policy and the economic costs of policy action or inaction to reduce carbon dioxide emissions, say. Yet, many econometricians have focused their statistical training and methods on climate series themselves, of which temperature is the leading example. In "Comparing long monthly Chinese and selected European temperature series using the vector seasonal shifting mean and covariance autoregressive model," He, Kang, Terasvirta, and Zhang (He et al., 2021) compare Asian and European temperature series over a more than a century and a half employing a vector shifting mean and covariance autoregressive model. According to their results, warming started later but has been more rapid in China than in Europe.

Coming full circle, we both open and close the special issue with commodity prices. While we begin with an investigation of the effect of commodity prices on the macroeconomy, we conclude with the effect of climate change uncertainty on commodity prices, highlighting the inherent difficulty of analyzing climate change without a full system as mentioned above. Specifically, the last paper of the virtual special issue by Nam (2021), "Investigating the effect of climate uncertainty on global commodity markets," uses a time-varying factor-augmented vector autoregression with stochastic volatility coupled with an endogenous regime-switching approach to show the increasing pressure that climate uncertainty places on commodities in the form of a negative supply shock.

We hope readers enjoy taking a dive into "New Developments in Econometrics of Energy and Climate" as much as we have!

References

Alstadheim, R., Bjørnland, H.C., Maih, J., 2021. Do central banks respond to exchange rate movements? A Markov-switching structural investigation of commodity exporters and importers. Energy Econ. 96, 105138. https://doi.org/10.1016/j.eneco.2021.105138.

Arčabić, V., Gelo, T., Sonora, R.J., Šimurina, J., 2021. Cointegration of electricity consumption and GDP in the presence of smooth structural changes. Energy Econ. 97, 105196. https://doi.org/10.1016/j.eneco.2021.105196.

Baiardi, D., Morana, C., 2021. Climate change awareness: empirical evidence for the European Union. Energy Econ. 96, 105163. https://doi.org/10.1016/j.eneco.2021.105163.

Bennedsen, M., Hillebrand, E., Koopman, S.J., 2021. Modeling, forecasting, and nowcasting U.S. CO_2 emissions using many macroeconomic predictors. Energy Econ. 96, 105118. https://doi.org/10.1016/j.eneco.2021.105118.

Chang, Y., Choi, Y., Kim, C.S., Miller, J.I., Park, J.Y., 2021. Forecasting regional long-run energy demand: a functional coefficient panel approach. Energy Econ. 96, 105117. https://doi.org/10.1016/j.eneco.2021.105117.

Cross, J.L., Hou, C., Nguyen, B.H., 2021. On the China factor in the world oil market: a regime switching approach. Energy Econ. 95, 105119. https://doi.org/10.1016/j.eneco.2021.105119.

Duarte, A.M., Gaglianone, W.P., de Guillén, O.T.C., Issler, J.V., 2021. Commodity prices and global economic activity: a derived-demand approach. Energy Econ. 96, 105120. https://doi.org/10.1016/j.eneco.2021.105120.

Ferrari, D., Ravazzolo, F., Vespignani, J., 2021. Forecasting energy commodity prices: a large global dataset sparse approach. Energy Econ. 98, 105268. https://doi.org/10.1016/j.eneco.2021.105268.

He, C., Kang, J., Terasvirta, T., Zhang, S., 2021. Comparing long monthly Chinese and selected European temperature series using the vector seasonal shifting mean and covariance autoregressive model. Energy Econ. 97, 105171. https://doi.org/10.1016/j.eneco.2021.105171.

Maciejowska, K., Nitka, W., Weron, T., 2021. Enhancing load, wind and solar generation for day-ahead forecasting of electricity prices. Energy Econ. 99, 105273. https://doi.org/10.1016/j.eneco.2021.105273.

Nam, K., 2021. Investigating the effect of climate uncertainty on global commodity markets. Energy Econ. 96, 105123. https://doi.org/10.1016/j.eneco.2021.105123.

Pretis, F., 2021. Exogeneity in climate econometrics. Energy Econ. 96, 105122. https://doi.org/10.1016/j.eneco.2021.105122.

Shioji, E., 2021. Pass-through of oil supply shocks to domestic gasoline prices: evidence from daily data. Energy Econ. 98, 105214. https://doi.org/10.1016/j.eneco.2021.105214.

Uniejewski, B., Weron, R., 2021. Regularized quantile regression averaging for probabilistic electricity price forecasting. Energy Econ. 95, 105121. https://doi.org/10.1016/j.eneco.2021.105121.

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Available online 15 May 2021