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RESEARCH BRIEF

Does the U.S. Export Global Warming? Coal Trade and the Shale Gas Boom

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This paper examines how a change in a country's consumption of fossil fuels impacts the global environment via trade flows. Specifically, we explore the impacts of the U.S. shale gas boom on global coal trade flows, emissions of CO2 and SO2, and welfare. We estimate a structural model that links the domestic to the international coal market and use it to simulate counterfactual scenarios. Our results show that the total quantity of coal traded around the world in the absence of the gas boom is essentially the same as the actual.

The U.S. shale gas boom dramatically boosted coal exports from the U.S. In the first quarter of 2009, the U.S. exported 4.2 million metric tons of steam coal for electricity generation while in the second quarter of 2012 it exported almost four times as much. In this paper, we explore the implications of the shale gas boom for coal trade flows and, consequently, its implications for the global environment and consumer welfare.

The implications of a rise in U.S. coal exports on coal trade are ambiguous. They depend both on the aggregate level and on the composition of world trade flows. On the one hand, additional supply from the U.S. could lead to greater coal consumption and emissions in importing countries. On the other, an increase in U.S. coal exports can lead to a moderate or no increase in emissions elsewhere if U.S. coal simply displaces domestic coal, or, if it displaces coal exported from other countries.

Environmental effects from increased U.S. exports also depend on differences in coal quality between countries. For example, U.S. exports may have a positive impact on air quality if they displace coal with a higher sulfur content.

Exploring the impact of the gas boom on the global coal trade ultimately depends on export supply and import demand elasticities, whose magnitude is determined by several factors. For example, the U.S. export supply elasticity is affected by the ability of domestic coal producers to ship coal outside the country. At the same time, the import demand elasticities for U.S. coal in major consuming regions

such as Western Europe, China, Japan, and Korea, depend on the availability of, or lack of, close substitutes.

We build an econometric model with an international and a domestic component. The international component allows us to estimate import demand and export supply elasticities. To do this, we use a nonlinear Seemingly Unrelated Regressions estimator and UN COMTRADE data from 1990 to 2014.

The domestic component provides a link between the international market for coal and the U.S. price for gas through the U.S. export supply curve. Having established this link, we calculate counterfactual world coal trade flows eliminating the drop in the U.S. price of gas caused by the gas boom. Our counterfactual gas price is based on a regression between U.S. and European gas prices between 1990 and 2006. Using information on the heat, carbon dioxide (CO2), and sulfur dioxide (SO2) content of coal, we translate trade flows into emissions to estimate the global environmental impact of the gas boom.

A distinguishing feature of our approach is that our trade model allows for upward-sloping export supply curves. We also allow export supply elasticities to exhibit heterogeneity across importers, goods, and exporters, We show that this heterogeneity has material implications for the conclusions of our analysis.

We find that, in contrast to commentary in the popular press, U.S. coal exports simply displaced other coal exports without increasing the total quantity of coal traded. Specifically, our model estimates that in the absence of the gas boom, the quantity of coal traded is only 0.16% higher than the actual quantity traded. The price and dollar value of coal also increase by less than 0.72%.

Our results also suggest that the gas boom had a negligible impact on total CO2 and SO2 emissions. After accounting for heterogeneity in the heat and sulfur content of coal across countries, we find the emissions of these compounds associated with coal trade flows are virtually the same in the actual and counterfactual cases.

We also report welfare effects for 40 countries that account for more than 90% of global coal trade. As one welfare measure, we use Compensating Valuation (CV), which measures the amount of money consumers would have to receive if they were to be compensated exactly for a price change. Across all importers in our model, the Compensating Valuation (CV) welfare measure is $38.6 billion, which is measure of how much lower welfare would have been in the absence of the boom. The greatest changes were found for Brazil ($7.7 billion) and Germany ($5.6 billion).

References

Knittel C.R., K. Metaxoglou, A. Soderbery, and A. Trindade, 2018, “Does the U.S. Export Global Warming? Coal Trade and the Shale Gas Boom.” MIT CEEPR Working Paper 2018-013.

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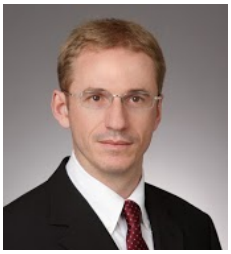

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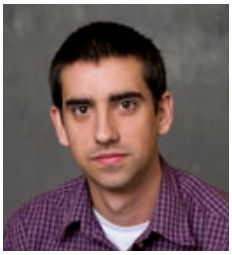

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