The Changing Nexus Between Battery Production and Non-Fossil Fuel Electricity Production in U.S. Markets

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Abstract

A key component of ongoing progress in reducing greenhouse gas emissions to limit climate change is more generation of electricity from non-fossil fuel sources (NFFS). The growth in intermittent electricity from wind and solar power generation has increased the need for battery storage to provide continuous electricity from wind and solar. As the cost of utility scale solar or wind, combined with battery storage, becomes cost competitive with fossil fuel sourced electricity generation, it becomes increasingly important to understand the linkages between battery production and electricity generation from NFFS. This paper investigates the causality linkages in the U.S. market between monthly battery production and monthly NFFS using seasonally adjusted data from January 2001 to June 2025. We first show that traditional Granger-causality testing over the entire sample period does not find causality from battery production to NFFS electricity production or vice-versa. Next, we implement a time-varying Granger-causality testing method relatively new to the literature which tests for causality using a rolling six-year window across the sample period. In contrast to the traditional causality tests, we find widespread evidence for causality in both directions: battery production causing NFFS electricity production, and/or NFFS electricity production causing battery production. Consistent causality findings arise with longer lag lengths in the testing, typically lags of 8 months or more, which is consistent with expected real-world lags in how shocks to either market will ultimately alter production in the other market. The frequency of findings of no causality versus uni-directional causality versus bi-directional causality varies over the sample period. These variations are discussed in detail along with potential policy implications. These findings will be of interest to analysts studying electricity production markets and policymakers.