

## Carbon Price Volatility in the New Zealand Emission Trading Scheme

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**Abstract :** The emission trading scheme (ETS), a market-based mechanism regulated by the government, is considered one of the most cost-effective ways to solve climate issues such as greenhouse gas emissions and consumption of fossil fuels. Although some existing ETSs have already shown their anticipative effectiveness, many still face challenges, such as carbon price volatility. Price volatility is a key measure of market uncertainty. Excessive carbon price volatility could lower ETSs' effectiveness and even reduce participants' investment confidence. Hence, it is necessary and important to explore the characteristics and drivers of carbon price volatility. However, prior studies on carbon price volatility mainly focused on the European Union ETS and China's national and regional ETSs. There is a lack of attention paid to the New Zealand ETS (NZ ETS), which is a crucial research gap given the special design of the NZ ETS and New Zealand's greenhouse gas emission sources. To fill in this, we are first to empirically pay attention to the NZ ETS's price volatility, systematically explore the supply-side, demand-side, and regulatory drivers of carbon price volatility, and initially examine the characteristics and drivers of carbon spot price volatility. We apply a series of autoregressive integrated moving averages (p, d, q)-exponential generalized autoregressive conditional heteroskedasticity (m, n)-X models to uncover the characteristics and drivers of carbon price volatility in the NZ ETS. Our key experimental results are (1) carbon price volatility in the NZ ETS is clustering, long-memory, and dynamically asymmetric. It tends first to increase more when positive shocks occur and then increases more in response to negative shocks in the large-lagged term. (2) Entitlement supply can impose significantly persistent impacts on the NZ ETS's price volatility, first positive influence because of increased supply and then negative impacts given mean reversion theory. (3) Demand-side factors only have a short-term influence on carbon price volatility due to participants' relatively stable demand for carbon allowances. (4) policy announcements regarding carbon allowances' supply and demand are likely to increase carbon price volatility in the NZ ETS, and successful auctions with different settings show different impacts on the price volatility of the NZ ETS' allowances. (5) the tightness of the entitlement transformation policy has significant potential to impact carbon price volatility, especially since too much tightening of this policy is able to cause high price volatility in this market. Our research enriches theories of regulating special ETSs, especially those with unique characteristics such as relatively inelastic demand, no real caps, unlimited usage of carbon credits, and a large potential supply of entitlements. More importantly, this study provides valuable references for Southeast Asian countries or regions, as most of them have abundant forestry resources and are operating or planning to establish an ETS to achieve their climate change targets.

**Keywords :** carbon, price volatility, NZ ETS, entitlement, free allocation, ARIMAR-EGARCH-X

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