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Mitigating market incompleteness with minor market distortions: the case of negative spot prices for electricity

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Market failures in electricity spot markets, among which market incompleteness and high risk aversion, pose serious obstacles to investment, as power generation requires large upfront costs, and electricity prices and exchanges are influenced by various uncertainties, such as regulatory changes and technological risks. Market incompleteness refers to the case where investors lack effective financial tools to hedge against some long-term risk drivers. As a result, risk-sharing mechanisms, such as contracts that provide financial security, have become essential to encourage investments, especially in renewable energy. In that vein, governments and regulators have recognized this issue, as seen in recent policy discussions across Europe, and have sought ways to mitigate risks and attract investment in green energy projects like solar and wind farms.

In parallel, another major concern in electricity markets today is the increasing occurrence of negative electricity prices. Negative prices happen when electricity supply exceeds demand, often due to rigid power generation constraints combined with an oversupply of renewable energy. While occasional negative prices are natural, frequent occurrences suggest inefficiencies in how production is managed. For example, in 2024, Germany experienced 457 hours of negative electricity prices, with similar trends seen in France, the Netherlands, and Belgium. This trend has been linked to risk-mitigating government subsidies, such as fixed-price contracts for renewable energy producers, which remove incentives to adjust production in response to market signals.

Research has shown that while risk-mitigation contracts are essential for securing investments, they can also create incentives for market distortions if not carefully designed. Fixed-price contracts, for example, which eliminate exposition to the price risk, encourage producers to generate electricity even when market prices are negative. To address this, policymakers are shifting toward more spot price related risk-mitigating instruments, as seen in the UK and Spain.

The challenge is to design financial instruments that balance two key objectives: encouraging investment in renewable energy while ensuring market efficiency and limiting market distortions. Our study aims to fill this research gap by developing a methodological framework that evaluates different contract structures and their impact on electricity

markets, welfare, emissions, and investments. Our approach is holistic as it models the whole power economy and the synergies between contracts, production, and storage. By simulating the French electricity market, we analyze how optimizing contract design can improve overall market efficiency, reduce the frequency of negative prices, and support a more balanced energy transition.

Ultimately, our research highlights the need for policymakers to adopt a balanced and holistic approach that protects investors from excessive risk while preserving the integrity of market price signals. By carefully structuring financial incentives, governments can promote renewable energy growth without compromising market efficiency, ensuring a stable and sustainable power system for the future.

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