AN OPTION ANALYSIS OF RENEWABLE SUPPORT MECHANISMS

Maria Paz Espinosa, University of the Basque Country (UPV/EHU)
Andrea Giralt Castellano, Sabadell Bank
Cristina Pizarro-Irizar, University of the Basque Country (UPV/EHU) and Basque Centre for Climate Change (BC3), +346013770,
mariacristina.pizarro@ehu.eus (corresponding author)

Overview

Energy policies to promote investment on renewable energy sources for the production of electricity (RES-E, hereinafter) have become crucial to tackle energy shortage and climate change issues. In particular, one of the main drivers in RES-E development are incentive-based regulatory schemes (i.e. financial subsidies). In this sense, regulation on RES-E promotion based on feed in tariffs (FITs, hereinafter) has proven to be very effective in delivering renewable capacity in many countries, but its economic efficiency has been put into question. Those incentives were thus reduced and even abolished in some countries, such as Spain, and substituted by a more market-oriented regulatory scheme, based on a risk-free Rate of Return (RoR, hereinafter) to investment and operation of the RES-E plant. In this paper, using option price theory, we evaluate the impact of these two different regulatory systems (FITs vs. RoR regulation) on the distribution of risk and we also quantify the value of the avoided risk. Our main conclusion is that both regulations transfer part of the risk from producers to consumers, although the RoR regulation exhibits higher avoided risk value. Finally, we also observe that the market price volatility induced by RES-E accounts for an important part of the quantified risk.

Methods

In this paper, using the Black and Scholes model [1], we evaluate the impact of two different incentive-based regulatory systems to promote RES-E on the distribution of risk between producers and consumers, and we quantify ex-post this risk value. We argue that RES-E regulations based on incentive schemes transfer part of the risk from producers (who are protected against the risk thanks to the type of incentives provided) to consumers (who bear the cost of the incentive schemes, since they are directly transferred to their electricity bills). Furthermore, we also defend that the volatility induced by renewable energy in the electricity market accounts for an important part of the quantified risk and this affects the economic valuation of the incentive scheme. Using Spanish data, we explore the FIT scheme that was in place in 2013 and compare it to the RoR regulation that was in force in 2016, after the regulatory changes in the incentives to renewable energy.

The central principle of the FITs is the establishment of granted prices for RES-E producers during fixed periods of time. On the contrary, the RoR regulation considers a fixed subsidy on investment and a premium on power generation on top of the market price, ensuring that an efficient and well-managed company could obtain a reasonable return of investment during the lifetime of the plant. Therefore, the special feature of the FITs guarantees in advance the price, thus decreasing uncertainty for the investment in RES-E by granting reliable revenue streams for a long timeframe, as long as the plant is able to produce. The RoR regulation, in contrast, does not guarantee prices but profits for RES-E investors, given that it considers both the revenues and the production costs of the plants. Since both incentive schemes are voluntary (i.e. renewable producers can decide to take the regulation or to sell their electricity directly in the market), our model can be used to evaluate investment opportunities on RES-E and to estimate the market value if the option to accept the regulation is taken.

Results

First, in order to evaluate the FITs scheme under an option analysis perspective, we evaluate the risk of 1 MWh produced in 2013, since FITs remunerate to renewable generators for each MWh sold in the market. The subsidy (K) is 77.94 euros per MWh, while the revenue (S) is 41.85 euros per MWh. Then, the payoff of the option is $K - S = 77.94 - 41.85 = 36.09$ euros per MWh. When we use Black and Scholes model to price this option, we obtain that the price is 43.89 euros per MWh. Therefore, the value of eliminating the risk is $43.89 - 36.09 = 7.80$ euros per MWh, which considering the total RES-E produced in 2013 corresponds to 858 millions of euros.

Second, in order to evaluate RoR regulation under an option analysis perspective, we evaluate the risk of the total amount of MWh produced in 2016, since the RoR regulation guarantees the subsidy to RES-E generators for their total annual activity. The subsidy (K) is 4,980 millions of euros, while the revenue (S) is 3,347 millions of euros. Then the payoff of the option is $K - S = 4,980 - 3,347 = 1,633$ millions of euros. When we use Black and Scholes model to price this option, we obtain that the price is 2,269 millions of euros. Therefore, the value of eliminating the risk is $2,269 - 1,633 = 636$ millions of euros.

Comparing both results, we obtain that covering the risk under the FITs system is more expensive than under the RoR regulation (858 > 636). However, since we are comparing two different years, this result could be due to differences in price volatility between the two years (the volatility in 2013 was higher than in 2016), which would affect the pricing of the underlying asset and, thus, its valuation.

In order to eliminate this volatility effect in our Black and Scholes model, we calculate the put option for 2013 with the volatility of 2016. The new put price for 2013 is 41.33 (previously it was 43.89), which proves that the put price reduces under lower volatility values. The value of eliminating the risk would then be 576 million of euros (previously it was 858 million euros).

Therefore, comparing FITs and RoR regulations with corrected volatilities, we observe that covering the risk under a RoR regulation is more expensive (636 > 576).

Conclusions

Our model allows us to compare the cost of eliminating the risk associated to investment in RES-E technologies for two different incentive schemes: FITs and RoR regulation. Using Spanish data, we explore a FIT scheme for the year 2013 and a RoR regulation for the year 2016. Our main conclusion is that both regulations transfer part of the risk from producers to consumers, although the RoR regulation exhibits higher avoided risk value. Finally, we also observe that market volatility induced by RES-E accounts for an important part of the quantified risk. These results have interesting policy implications for countries facing (or about to face) similar challenges concerning regulation of RES-E deployment. Furthermore, in the international context of the transition to low carbon economies, our model could be used to evaluate different incentive schemes.

References

[1] Black, F. and Scholes, M. The Pricing of Options and Corporate Liabilities. Journal of Political Economy 1973, 172 81(3), 637-654, doi:10.1086/260062.