

Prospects for an electricity futures market

A comment

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In a recent article in this journal Tussing and Hatcher (1994) have argued that the market for power sales will be unlikely to foster and sustain a viable futures market until significant policy changes are executed. They conclude that because of the market structure of electricity, dominated by vertically-integrated organizations, there is no need for futures contracts. In this article we show that the hedging effectiveness of electricity futures is high compared with traditional commodities such as crude oil. Introducing electricity futures will therefore change the market structure of the electricity business. Moreover, electricity futures can contribute to an efficient implementation of environmental policy.

On a futures market, transactions to do with commodity characteristics, time and location of delivery, and unit of trading are standardized. This standardization process is very complicated as far as commodities are concerned, especially with respect to location of delivery and commodity characteristics (such as sort and form). This contrasts with a futures market for electricity. Electricity is a perfectly homogeneous 'commodity' i.e. the underlying commodity is identical to the commodity in the cash market, implying that there are no problems with respect to delivery from a futures market perspective. Electricity futures have therefore, in contrast to traditional commodities such as crude oil, low residual risk at maturity of the futures contract (Black, 1986), which results in a relatively high hedging effectiveness compared with other commodities (Pirrong *et al.*, 1994). This characteristic is important for utilities that wish to reduce price risk. The utility might use a cash forward contract or a futures contract to manage its price risk. The advantages of cash forward sales/purchases over hedging in futures are fairly clear. As with futures, the price level is fixed before delivery, but unlike hedging in futures, there is no further adjustment of the firm's return as a result of any

subsequent change in the basis.¹ Moreover, the cash forward contract can be tailored more closely to meet the firm's needs, eg with respect to quantity, quality and place and time of delivery as well as other terms (Paul, 1976; Nelson, 1985; Antonovitz and Nelson, 1988). These advantages of cash forward sales/purchases over hedging in futures do not apply to electricity. In this case, the advantages of futures markets – the highly organized methods of trading with the extreme standardization of terms resulting in buyers having widespread and low-cost access to sellers (and vice versa) and great integrity of the contract – are not affected by the disadvantages of futures *vis-à-vis* cash forward contracts mentioned above. This implies that electricity futures are a more suitable price risk management tool for utilities than cash forward contracts.

These characteristics of electricity futures will have a positive impact on the minimum variance hedge ratio which has a one-to-one relation to the hedging

¹Where the basis is defined as the local spot price minus the futures price.

effectiveness. The risk minimizing or minimum variance hedge ratio is equal to the covariance between the changes in spot price and futures price divided by the variance in the change in the futures price (Ederington, 1979; Paroush and Wolf, 1989).

$$N^* = -\frac{COV(\Delta S_t, \Delta F_t)}{VAR(\Delta F_t)} \quad (1)$$

where N^* is the minimum variance hedge ratio, COV is the covariance, VAR is the variance, ΔS_t is the change in the spot price and ΔF_t is the change in the futures price.

Given the characteristics of electricity, the price change in the spot price of electricity will be almost equal to the price change in futures, which results in a minimum variance hedge ratio close to $N^* = -1$, indicating that hedging through electricity futures is very effective.

Firms in the marketing channel of electricity are connected in a web of extensive forward trading, as Tussing and Hatcher (1994) indicate. As a result electricity futures will affect the industrial organization of the electricity markets. The risks faced by the firms in the channel may be complementary, which might lead to a risk-reducing benefit to forward contracting. Therefore, we observe vertical integration to be a response to risks in the electricity business. Vertically-integrated producers are perfectly self-hedged by the offset between the quantity they sell to consumers and the spot price. The existence of a futures market would reduce the need to integrate vertically, especially when hedging effectiveness is high, as holds for electricity futures, in order to avoid price risks (see Equation (1)): a negative association of futures trading in a commodity with vertical integration has been predicted (Hirschleifer, 1988, 1989).

From a firm's perspective electricity futures are not only interesting instruments to cover against price risks, but they have also an important information function. It is even so that without the existence of futures markets there would be no efficient exploitation of energy resources. According to the Hotelling rule rent (royalty) resources should rise by the interest rate when maximum social efficiency out of the resource use is to be reached (Hotelling, 1931). Futures prices are an important source of information for the resource owner who has to decide on whether to speed up or to slow down exploitation. Theoretically, with the existence of a well-functioning futures market for electricity and energy resources (as-

suming that prices on both markets are linked) the optimum (Hotelling, 1931) price path will be approached more closely than without, because of the greater transparency of the electricity market (Bulte *et al*, 1996). So, one may conclude that both from the point of view of the firm that wants to cover against price risks by hedging and from that of society that wants to maximize welfare (social efficiency) out of resource exploitation, an electricity futures market is a desirable institution.

Conclusions

This article demonstrates that the characteristics of electricity make it very suitable for futures trading. Although the market structure of electricity is not favourable yet to futures trading, as argued by Tussing and Hatcher (1994), this structure may change by the high hedging effectiveness electricity futures provide. Moreover, electricity futures may be beneficial from a welfare point of view.

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