Westpac InstitutionalBank

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## Congestion Pricing and Negative Residue Management Arrangements for the Snowy Region

Westpac Energy is a registered market trader and financial intermediary in the National Electricity Market registering among the most active market risk management participants in OTC, Futures and SRA derivatives. Within its wider operations, Westpac has significant debt and equity interests in the Australian energy market. The following response represents the views of the Westpac Energy group (Westpac).

Westpac does not support the AEMC's decision to abolish the Snowy region. Reducing the number of regions under the current market design will introduce significant mispricing of both spot and forward markets which will be detrimental to the NEM.

Of all the financial instruments transacted in the NEM, only the SRA derives value from the price of more than one region. Futures, Half Hour Options etc. have payoffs which are a function of a single reference price. Hence the SRA is the only instrument which contains information about the joint distribution of price[1].

Hedgers require this information in order to accurately quantify risk, and arbitragers in order to identify (and in doing so eliminate) mispricing between forward prices. The effectiveness of both activities is determined by the 'firmness' or the SRA. This can be quantified by looking at the variance of the basis risk[2] when an SRA is used as a hedge.

Consider a portfolio created by selling forward in remote region B, buying forward in local region A and attempting to hedge the positive part of the price differential $(S_A\text{-}S_B)^+$ using a hypothetical firm instrument with a payoff function of:

$$\pi = (S_A - S_B)^+$$

If the hedge ratio (i.e. the number of SRA unit's required to minimise basis risk) is represented by $\Delta$ then in order to construct a firm hedge when $S_B > S_A$ the following must hold:

$$0 = \Delta\pi - (S_B - S_A)$$

i.e.

$$\Delta = 1$$

Hence the hedge ratio is a constant value which is known with total certainty and there is no basis risk. Using this relationship, arbitragers will attempt to take advantage of any relative mispricing which may exist in the forward prices $F_A$ and $F_B$.

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[1] Futures/Forwards provide the mean and options provide the variance of the price distribution but without an estimate of correlation the joint distribution cannot be determined completely.

[2] http://www.investopedia.com/terms/b/basisrisk.asp "The risk that offsetting investments in a hedging strategy will not experience price changes in entirely opposite directions from each other. This imperfect correlation between the two investments creates the potential for excess gains or losses in a hedging strategy, thus adding risk to the position."

If we now consider a case for which the SRA instrument was specifically designed, i.e. hedging price separation across an interconnector which has a fixed limit, i.e.

$$F_{A\to B} \le K$$

The residue which accrues and the proportion allocated to each SRA unit are as follows:

$$IRSR_{AB} = (S_B - S_A)F_{A\to B}$$
$$SRA_{A\to B} = \alpha \cdot IRSR_{AB} \cdot 1_{F_{A\to B}>0}$$

The total IRSR is always positive due to the relationship between flow and price differential[3] and the SRA from A to B is positive when flow is directed from A to B, and zero otherwise. Additionally, the factor α represents the % of the total residue allocated to the holder of a single SRA unit.

The required hedge ratio becomes

$$\Delta = \frac{1}{\alpha K}$$

We can interpret this in the following manner:

- Since α is constant, it doesn't affect the firmness of the SRA.
- The hedge ratio is proportional to the interconnector limit.
- If the interconnector limit is constant, then there is no basis risk.

The interconnector limit is almost never static though. Variance in the limit introduces basis risk. Provided the distribution of the limit is known, then the basis risk can be quantified. Participants would then choose a conservative hedge ratio and still be able to hedge reasonably effectively. Arbitragers on the other hand cannot construct an exact replicating portfolio and the variance in the hedge ratio will translate into a bid/ask spread which cannot be eliminated by reducing the number of regions. In fact the opposite occurs, as the number of regions decreases the ability to arbitrage the price differential is worsened and transaction costs may increase.

For example consider the case where two regions are merged as per Figure 1, creating a new intra-regional constraint between points B and C.

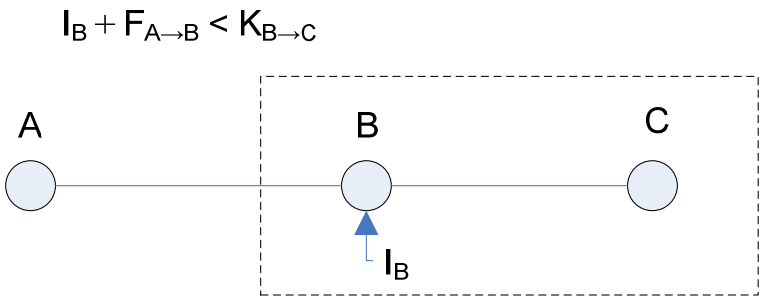


**Figure 1**

The SRA is now affected by the generation level at B, i.e.

$$IRSR_{AB} = (S_B - S_A)F_{A\to B}$$
$$F_{A\to B} = K - I_B$$
$$SRA_{A\to B} = \alpha \cdot IRSR_{AB} \cdot 1_{F_{A\to B}>0}$$

[3] This is not in fact the case in the NEM since the loss model is not symmetrical.

In this case the hedge ratio becomes

$$\Delta = \frac{1}{\alpha(K - I_B)}$$

This introduces a number of issues:

- Whilst the distribution on K may be known, a trader has no way of determining the distribution of $I_B$.
- As $I_B$ approaches K, the hedge ratio approaches infinity, i.e. no matter how many SRA unit's the hedger holds they cannot hedge their inter-regional exposure.
- If $I_B > K$ then the hedge ratio becomes negative

In the case under consideration, the size of the Snowy units approaches the import limits into NSW and VIC. Hence the proposal to merge the Snowy region into NSW and VIC will materially degrade the ability to hedge inter-regionally. Both alternative proposals are preferred since they both minimise the impact on the SRA by reducing the mispricing which reduces its firmness. The preferred alternative at this point in time is the Southern Generators Proposal since it requires minimal change to NEMMCO and participant systems.

It should also be noted that the Snowy region is not the only location where such mispricing is creating significant basis risk. For example on 12-Jan-2007 the constraint V>>V_NIL_3B_R caused negative residue on the V-SN interconnector due to excess generation in VIC. In fact the only generator in VIC which was not significantly mispriced in this instance was Yallourn PS[4]. It is in fact the introduction of option 4 constraints without regard to an effective hedging mechanism that is the real issue[5], and rectifying this should be the AEMC's main focus. An effective market design must consider the two in conjunction, i.e. the PJM market design (which uses locational marginal pricing) has as an integral component the FTR instrument; the two cannot be separated. The PJM market not only provides an effective mechanism for physical participants to hedge, it is also the most liquid financial power market in the world[6].

In order for participants to hedge, they first must have access to the entire residue generated by all binding constraints. The inter-regional settlement residue does not meet this requirement, since any generator on the left hand side is granted the right to receive the regional reference price regardless of output level. This 'right' diverts some of the residue which might otherwise be used for hedging. Secondly, the residue must be packaged in a form which makes the hedge effective.

Darryl Biggar's constraint based residue scheme (CBR) is an application of these principals (i.e. access to the entire residue generated by binding constraints, in a form which hedges the price risk introduced by the constraints). Westpac believes the approach looks promising and should be debated more widely. In particular Westpac would support the formation of a working group consisting of stakeholders from the AEMC, NEMMCO, generation, retail and financial market sectors. This working group would be responsible for developing the CBR (and/or competing proposals) into a package which can be implemented in the NEM.

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[4] Since it is the only generator which does not appear on the left hand side of the constraint, i.e. is effectively located at the regional reference node.

[5] This should not be taken as a criticism of option 4 constraints. Option 4 constraints allow NEMMCO to operate the grid closer to its limits whilst maintaining security of supply so they have a clear social value.

[6] Based on open interest of the PJM cleared power contracts listed on The Intercontinental Exchange.