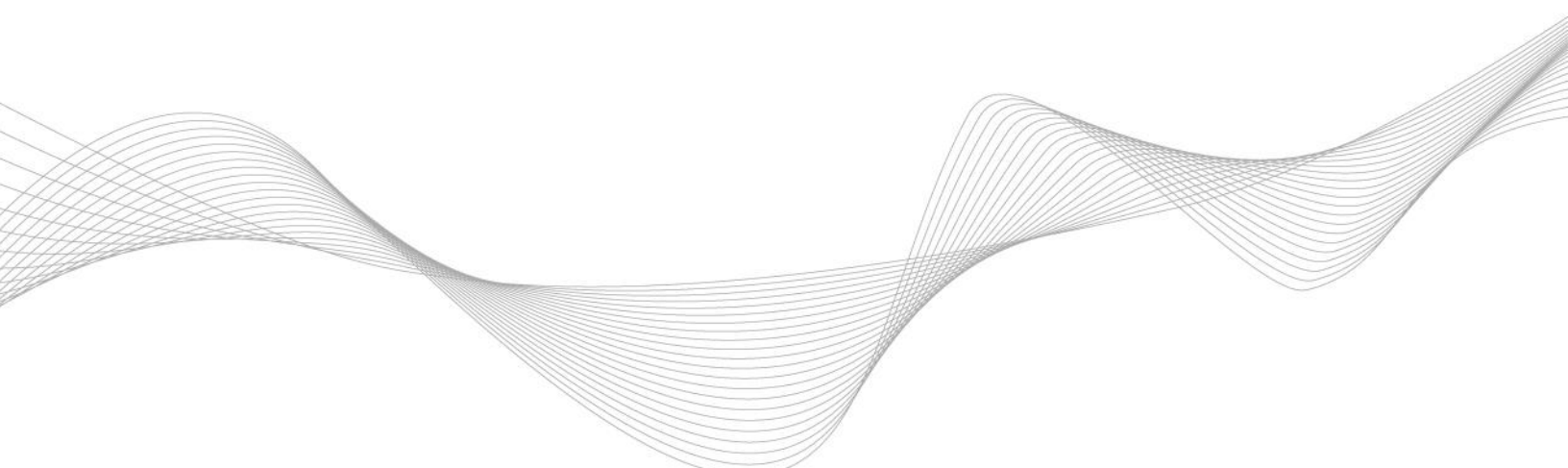# Financial Market Reform Project
Discussion Paper
Variation Margin and Post-Auction Settlement

July 2019

1 Purpose

This paper examines the subject of variation margining and how it could work for the FTR market, as well as other settlement options in the period following an FTR auction. It also considers the timing of FTR final settlement.

2 Note on Source Material

Large sections of the discussion on variation margining have drawn, with minor modifications, from Market Reform's June 2008 Findings & Recommendations Report[1], which recommended a number of credit improvements in the wake of the Tower Research default. As that report and this paper share authorship, this material is utilized without specific quotation or further attribution.

3 Summary

Recommendation A1 of the Independent Consultants' report[2] recommends the adoption of a variation margining process. In examining how this can be achieved, this paper examines how the process works in a regular derivatives market, and the specific implications for FTRs, where PJM, as Congestion Rent Holder, does not have Day-Ahead Market (DAM) congestion rents available to it until the DAM settles. This will require the use of an imbalance account in the interim period until final settlement. There are two variants to this approach:

- Two-Sided: In the case of traditional, two-sided variation margining, this imbalance account would need to be supported by a line-of-credit to cover the potential for negative balances in the account.
- One-Sided: The alternative would be to institute a policy where no individual participant could have a net cumulative variation margin across their portfolio greater than zero. This avoids the need for a line-of-credit, but is capital inefficient for affected participants.

An alternative is to retain the current approach of performing a collateral adjustment based on a mark-to-auction calculation, though this is not strictly variation margining.

The paper also considers the frequency of auctions, and the trade-off between the credit risk benefit of more frequent options, versus potential fragmentation of liquidity for less traded period. It recommends auctions on a monthly basis for all contract tenors/expiries, with later consideration of more frequent auctions for the more liquid part of the product set.

Finally, the paper considers other post-auction settlement matters, and recommends that:

- Up-front settlement of the 'fixed' component of the FTR runs counter to its derivative nature, with the contract more appropriately margined with properly calculated initial and variation margin.
- The 'premium' component of FTR option products be settled up-front, upon the position being entered.

These topics are discussed more fully in the following pages.

---

[1] Market Reform, *PJM Credit and Clearing Analysis Project: Findings and Recommendations*, June 2008

[2] Anderson, Wolkoff et.al., *Report of the Independent Consultants on the GreenHat Default*, March 26, 2019.

4   Variation Margining

In any market, settlement processes serve to reduce a participant's potential exposure, through the payment of monies that offset this exposure. The more frequently such settlement occurs, and the shorter the lag between liabilities being incurred and being settled, the smaller the overall exposure at any given time. This not only reduces the collateral required to cover this exposure to a given probability, it also lessens the size of any exposure that falls outside this probability range.

The principal settlement process used in organized derivatives markets is 'variation margining'. This process does not concern settlement for actual delivery of product, but is a periodic process to accrue incremental gains and losses, based upon price movements (i.e. variations) that occur as a result of ongoing trading. For this reason, the process is also known as 'mark-to-market'. The key requirement is to have a reference price to which positions are 'marked'. Where the principal trading mechanism is a periodic auction, such as the FTR market, this reference is the prices resulting from the auction – leading to this process also being termed 'mark-to-auction'. A simple example of variation margining is provided in Appendix A.

The Independent Consultants' report recommends the adoption of a variation margining process in its Recommendation A1:

> "Use the mark to auction values established in the more frequent auctions (see recommendation F) as the basis for "variation margin," charging as a <u>current debt</u> the value erosion between the purchase price and the current market value as determined by the latest auction." [emphasis added]

This recommendation focuses on portfolios with net losses, and is silent about the approach for portfolios with net gains – a topic addressed in Section 4.2 below. It clearly recommends, though, that the accumulated value erosion be charged as a 'current debt', i.e., settled in cash, not held as collateral.

If 'mark-to-auction' is a settlement process, what is PJM currently doing?

PJM is presently conducting a collateral-based proxy to mark-to-auction, for net accumulated losses only. With each fresh auction a 'mark' is calculated for all the participant's open positions. If there is a net paper loss (actual loss doesn't occur until liquidation/final settlement), this is assessed as additional collateral, rather than settled as cash. If this requirement reduces after further auctions, collateral is returned, but never results in a reduction below zero (i.e. an offset to initial margin requirements).

Assuming true, two-sided variation margining as practiced by clearing houses, the amount settled in each period would be:

$$VM_t = \sum_p Q_{p,t} \times (CP_{p,t} - CP_{p,t-1})$$

with the total variation margin accumulated to that juncture being:

$$CVM_t = \sum_t VM_t$$

where:

VM_t is the variation margin charged (-ve)/paid (+ve) in period t.

CVM_t is the cumulative variation margin charged/paid through period t.

$Q_{p,t}$ is the position held in period t in a given contract (path/expiry) p.

$CP_{p,t}$ is the price for contract (path/expiry) p for the current auction period t.

There are, however, some outstanding issues with respect to how variation margining can/should work for FTRs:

4.1 Frequency of Auctions

Variation margining is of greater utility the more frequently auctions occur, as it allows the valuation of positions to be re-baselined to the market's current view of their value. This, in turn, can serve to reduce the initial margin required to protect against potential losses. By contrast, if auctions only occur infrequently, circumstances can alter significantly between opportunities for incremental price adjustment, requiring more initial margin as cover against potential adverse moves.

However, one of the benefits of a multilateral auction mechanism is that it allows liquidity to consolidate at a specific time of trading (as well as around a specific product definition), and the countervailing concern around conducting auctions too frequently is that it will fragment this liquidity. But what is 'too frequently'? Not only is this difficult to define, it is likely to evolve over time. In the near-term, it is recommended that auctions for all FTR tenors and expiries be conducted on a monthly basis. As liquidity develops further in particular parts of the product set, it is recommended that consideration be given to conducting auctions for that part of the product set more frequently, e.g., weekly.

4.2 Inter-Period Imbalances

Variation margining works on a zero sum basis – for every change in price that results in payments to one set of parties, payments are required from other parties which, in aggregate, are exactly equal. For FTRs, the short side of many positions is the pool of congestion rents from the Day-Ahead Market (DAM), held by the conceptual role, discussed in the FTR Central Counter-Party paper[3], of the Congestion Rent Holder (CRH). If true variation margining is applied, the CRH could receive or be required to pay funds, depending on the movement of the market. However, the CRH does not have access to the congestion rents from the DAM until that market transacts, creating an inter-period imbalance.

This imbalance would need to be managed by the CRH via an imbalance account, to hold overs/unders until final settlement of FTRs, for a given period, against the DAM. Depending upon movements in FTR prices, such an account is likely to have a negative balance from time-to-time, and require a financial support mechanism, such as a line-of-credit, to sustain its operation. The cost of maintaining such a line of credit would be socialized to all FTR market participants.

An alternative to full variation margining would be a mechanism which required that no individual participant could have a net cumulative variation margin across their portfolio greater than zero (and thus induce a negative balance in the imbalance account), excepting contracts in final settlement. In other words, the participant would pay-in when its FTRs lost net value, and receive payment when its FTRs gained net value, but (excluding final settlement) the amount paid out to the participant could not exceed the net amount it had previously paid in. Expressed mathematically:

$$CVMA_t \leq 0$$

---

[3] PJM Interconnection, *Position Paper: FTR Central Counter-Party*, June 2019

And as a result, the amount settled in each period would be:

$$VM_t = Min\left(\sum_{pe} Q_{pe,t} \times (CP_{pe,t} - CP_{pe,t-1}), CVMA_{t-1}\right) +$$

$$\sum_{pf} Q_{pf,t} \times (CP_{pf,t} - CP_{pf,t-1})$$

where:

$CVMA_t$ is the cumulative variation margin charged/paid through period t for all contracts not in final settlement.

pf are those contracts in final settlement, and pe are those paths that are not.

This would ensure the value of the CRH's FTR imbalance account always remained positive, thus avoiding the need for a line-of-credit. On the other hand, the mechanism is distinctly one-sided, and would result in affected participants deploying more capital to sustain their positions than strictly required.

The final option to address the imbalance problem would be not to variation margin, but to utilize a collateral adjustment process based on a mark-to-auction calculation. This could maintain the current approach utilized by PJM, where only cumulative net negative movements in value are added to margin requirements, or it could be implemented as a two-sided process, where cumulative net positive movements are credited against collateral needs (subject to an appropriate floor). In either case, however, this option is inferior to variation margining; gains and losses are not crystallized through settlement, and the collateral posted remains subject to custody risk.

4.3   Timing of Settlement

For final settlement, the settlement process must align with the receipt of DAM funds, and as such, cannot take place until cash market settlement. As such, it is recommended that the current practice continue of conducting final FTR settlement in conjunction with DAM settlement.

Variation margin settlement can conceivably take place as soon as new settlement prices become available from each auction. From a risk management perspective, it is preferable to conduct the settlement as soon as possible after the mark-to-auction is calculated. From an implementation perspective, it may be simpler to align with the cash-market billing cycle, though this will involve delays in both billing and subsequent payment, during which a distressed participant's financial position could further erode.

5   Other Post-Auction Settlement

There are two other matters worthy of consideration related to FTR market settlement post-auction:

5.1   Should the 'Fixed' Charge Be Paid Up-Front?

Mechanically, FTRs are a 'fixed-for-floating swap', here the buyer is essentially exchanging a fixed payment – the 'strike' value of the contract – for a floating payment – the price differential in the DAM between the specified locations, average over the period of the contract. Some FTR market operators – notably ERCOT – require full payment for the 'fixed' component of the contract up-front (but only for those expecting to pay out; withholding up-front payment for those with 'counterflow' exposures), with the floating payment to flow once the DAM is settled.

While this approach is attractive from a risk manager's point-of-view (i.e., the more paid or collateralized up-front, the better), it flies in the face of standard derivatives market practice, to secure derivative contract risk with initial margin levied based on the replacement value of the contract, plus variation margin to cover incremental changes in market valuation. It could also be argued that any amounts paid up-front in such a manner should serve as an offset to any initial margin that would otherwise have been levied on the participant's portfolio of positions. The broader consideration is whether settlement of the fixed component up-front, by essentially over-collateralizing in most instances, would damage the participation and hence liquidity in the market, and as a result, its utility as a risk management tool.

Ultimately, given the derivative-like nature of this product, it is recommended that it be margined as such, with properly calculated initial and variation margin, rather than up-front settlement.

5.2 Treatment of FTR Options

The price paid for an FTR option can be thought of as having two components; the expected value of the path (the FTR obligation price), and the price paid for optionality (i.e. the protection from down-side risk). The latter of these is analogous to the option 'premium'. The two components should be settled separately:

- In each auction, the expected value component of the contract can be marked-to-market (subject to a limit that it not be marked below zero), and should be settled in the regular way.

- The option premium should be settled immediately (in the next payment cycle), as is standard practice for options in the organized derivatives markets.

Appendix A – Variation Margining Example

Figure 1 and the accompanying text below provide an example of how the variation margining process works, utilizing the example of a basic natural gas futures contract:
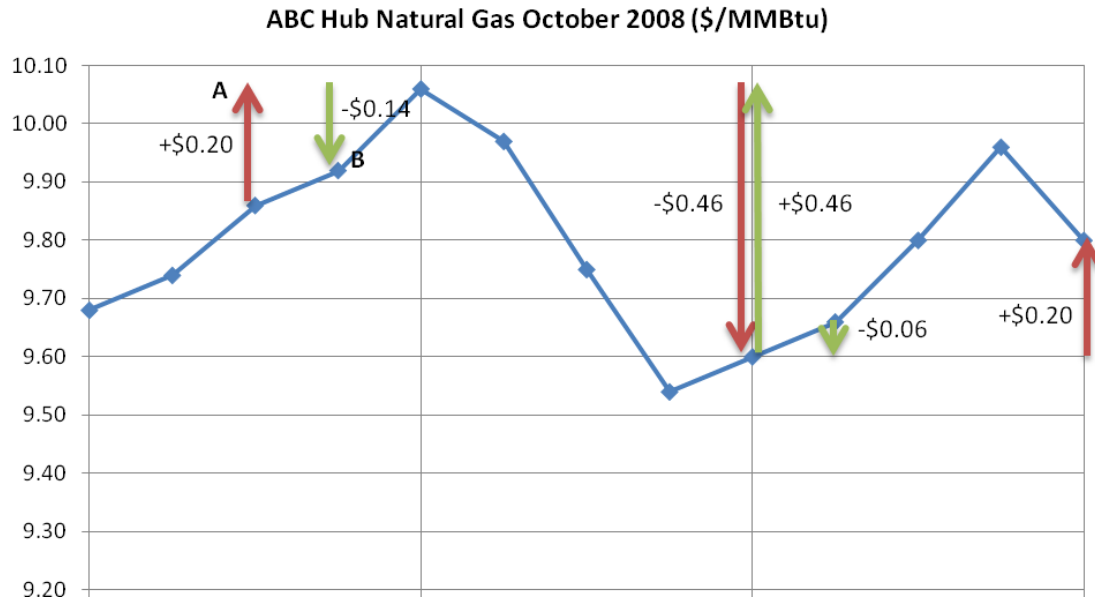

Figure 1 – Example Variation Margin Payments

- Party A buys Natural Gas at ABC Hub for October 2008 delivery at $9.86/MMBtu. A is deemed to have a 'long' position. Later on the same day, Party B sells ABC Hub Natural Gas for October 2008, at $9.92/MMBtu[4]. B has a 'short' position.

- At the end of the trading day, the final settlement price for the October 2008 contract is $10.06/MMBtu.

- Variation margin is calculated overnight and monies move the following day. A receives the differential of $0.20/MMBtu, between the price it traded-in at and final settlement. B must pay the differential of $0.14/MMBtu, between the price it traded-in at and final settlement.

- The following trading day, neither A nor B trade. The settlement price for the day falls to $9.60/MMBtu.

- A must now pay $0.46/MMBtu, the difference between the previous day's mark and today's. B receives $0.46/MMBtu. This demonstrates the 'zero sum game' nature of derivatives.

- The following day B trades out of its short position, by buying at $9.66. A holds its position. The final settlement price is $9.80.

---

[4] Obviously to someone other than A. Assume there is a diversity of buyers and sellers.

- B must pay $0.06/MMBtu, being the difference between the previous day's settlement price and the price it traded-out at. A receives $0.20/MMBtu, being the difference between the two day's marks.

- In the final analysis, it can be seen that the variation margin for A (+0.20, -0.46, +0.20) equals the difference between final settlement price and purchase price (9.80 - 9.86). Similarly, variation margin for B (-0.14, +0.46, -0.06) equals the difference between the price at which it initially sold (went 'short'), and the price at which it bought back in (-9.66 + 9.92).