Definition of UIG

For any Day for any LDZ

LDZ exit Vol = Shrinkage + $\sum_1^n y$ +$\sum_1^m x$ + UIG

Where y is the volume used by each DM site, x is the volume used by each NDM site, n is the number of DMs sites and m is the number of NDM sites.
y and x are unobservable.
We can define y as the sum of the estimate (from daily reads) and an error term.

$$\sum_1^n y \quad = \quad \sum_1^n y * + \sum_1^n e$$

Where y* is the estimated value of y and e is the estimation error
If meters have no measurement error and convertors and dataloggers communicate with 100% accuracy and operate without error then the meter reads will provide y, but in general they are not hence the assertion that y is unobservable.
We may expect that at D+5 every DM site has submitted reads (although this is not actually the case).
Under these assumptions the only errors should be due to resynch adjustments.

Similarly,

$$\sum_1^m x \quad = \quad \sum_1^m x * + \sum_1^m u$$

Where x* is the estimated value of x and u is the estimation error.
As reads are submitted for each NDM Supply Point during reconciliation the values of x* and u change.

Hence:

LDZ exit Vol = Shrinkage + $\sum_1^n y *$ + $\sum_1^n e$ + +$\sum_1^m x *$ + $\sum_1^m u$ + UIG

Re-arranging and putting the errors at the end.

LDZ exit Vol = Shrinkage + $\sum_1^n y *$ + $\sum_1^m x *$ + $\sum_1^m u$ +($\sum_1^n e$+ UIG)

<u>Profile error</u>
$\sum_1^m u$ is the profile error and will in general be non-zero, it will only be zero if m=0 that is if there are no NDM sites and daily settlement is mandatory.

We are trying to estimate$\sum_1^m u$ rather than trying to estimate u for each individual site.

The issue is how we estimate $\sum_1^m u$ for each Day.

Given the way the profiles are created over a year we might expect:

$$\sum_1^{365} \quad \sum_1^m u \ = 0 \text{ approximately}$$

If this assumption is correct it provides a potential way to estimate UIG over a year (see below)

<u>Long term UIG</u>
The other element of error is ($\sum_1^n e$+ UIG). As discussed above if all DM sites are submitting reads as they should by D+5 the term $\sum_1^n e$ should be nearly zero.

If $\sum_1^m u$ =0 (that is mandatory daily settlements) then the definition of UIG would be straightforward as all other elements would be known and we could assume that $\sum_1^n e$ = 0 although this would mean that the estimate of UIG was biased if the assumption was untrue.

Problems with estimation

Clearly unless we can produce an accurate estimate of either $\sum_1^m u$ or ($\sum_1^n e$+ UIG) then we cannot estimate the other. We can measure $\sum_1^m u$ + ($\sum_1^n e$+ UIG) but if the two parts of the error are distributed in different ways in the settlement process then the partition of the total error is commercially important to Shippers. Passing the calculation of one of the errors to a third party is not a solution as it just transfers the issue to the third party. Equally defining ($\sum_1^n e$+ UIG) as a fixed % of LDZ entry volume is subject to challenge and further modifications to change it to some other value.

Imperfect ways of estimating UIG

We can attempt to estimate UIG as described below but neither gives a value of UIG for a Day they only give an indication of what the value may be.

Estimating yearly UIG
We could estimate UIG, strictly (($\sum_1^n e$+ UIG)), **over a year** by assuming $\sum_1^{365}$ $\sum_1^m u$ = 0
But this would not allow us to estimate $\sum_1^m u$ on any one Day.

Estimating Daily UIG from actual Daily UIG for a small geography
Alternatively we may be able to estimate $\sum_1^m u$ for a part of an LDZ if we could find a location fed from a district governor which could be metered and where all the Supply Meter Points connected to that district governor (including IGT Supply Meter Points) were either DM or had Advanced or Smart Meters installed and providing reads for each Day. If this was done for a year it would show how UIG varied over the year.

Combining the two approaches
If the two approaches were combined it could provide a way of estimating UIG for each Day but this would be based on a number of assumptions that are open to challenge.

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