Documentation of the CWE FB MC solution as basis for the formal approval-request (Brussels, 9th May 2014)

Annex 16.11 Domain Reduction Study

Domain Reduction Study

CWE Market Coupling

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Related documents

Attachments

Contents

1 Introduction

Throughout the FB project numerous requests have been received by MPs asking for studies demonstrating the sensitivity of market outcomes to assumptions made by TSOs. Questions like "*how does the FB domain change under a different assumption (e.g. a unit close to a border is taken offline in the base case), and more importantly what are the corresponding changes in market results?*"

I.e. there are two questions that need to be answered:

1. What impact will changes in assumptions have on the FB domain?
2. What impact will changes to the FB domain have on market results?

To answer the first question precise scenarios need to be defined and only a limited number of individual cases can be considered, since the TSO capacity calculation processes require the involvement of operators, who will only have finite availability.

A first clue on the second question is easier obtained: market results for varying FB domains can be simulated easily enough. The varying FB domain however will be arbitrarily created, rather than corresponding to actual changes in the underlying FB capacity calculation inputs.

2 Domain Reduction Study

2.1. Introduction

To have an indication of the sensitivity of pricing under FBMC the FBV TF conducted a *domain reduction study*: exploring the effects on pricing when margins on CBs are (artificially) reduced.

This DRS has been conducted using data from the parallel run.

This text contains the results of this study.

2.2. Data

The data used for this study were:

- PTDF data from the external // run, for 2013
- PXs OBKs for 2013;

2.3. Simulation setup

Domain reduction has been simulated by varying levels of RAM between 110% of the original value down to 10%, in 10% decrements, while using the same OBKs.

2.4. Results

2.4.1. Impact on price

The first price indicator is to consider the average price across the whole period.

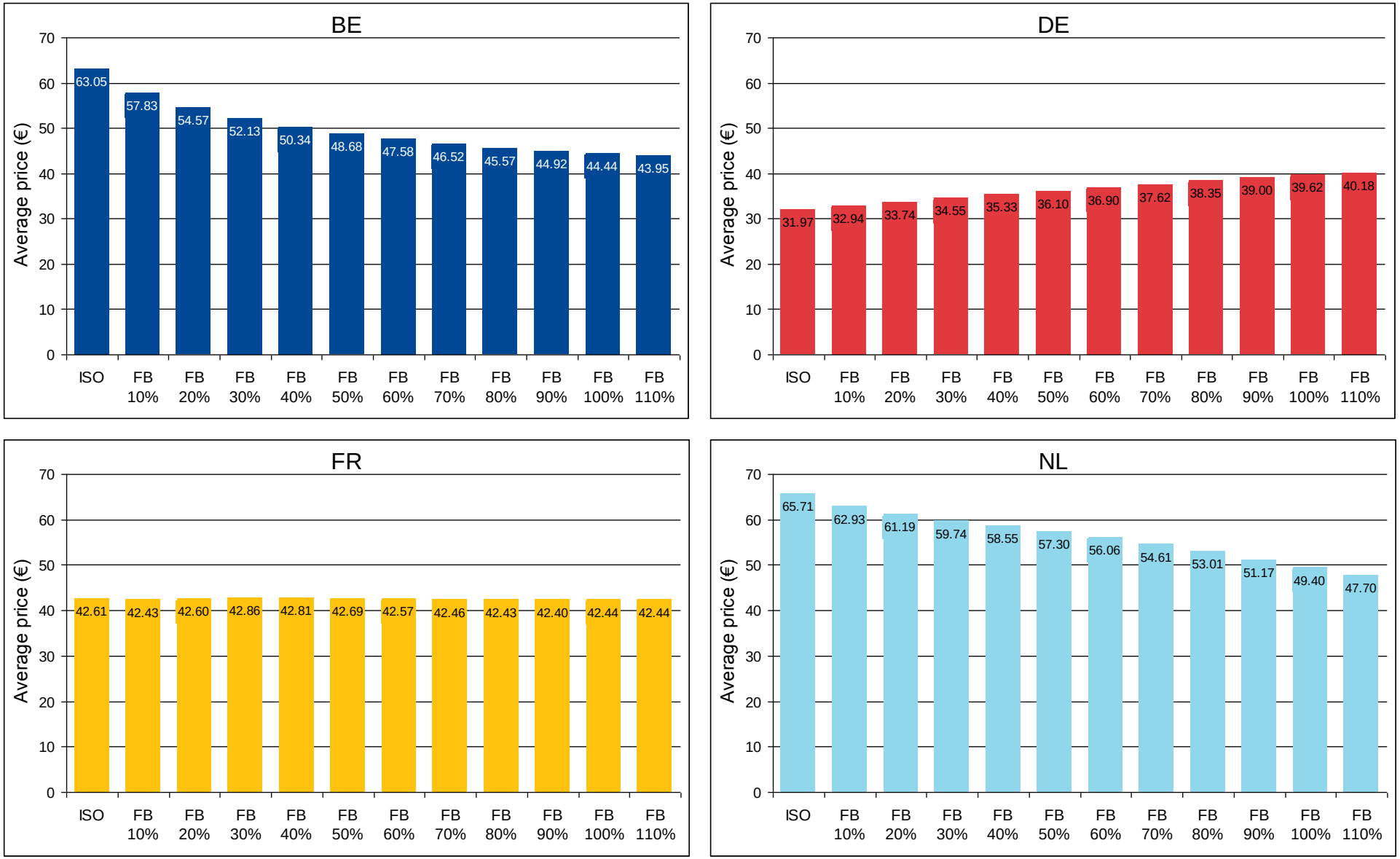

Figure 1 Average price for the full period of FB parallel run results

In Figure 1 the average prices for the parallel run results are shown. It illustrates the (obvious) effect that once margins are more reduced, the prices move closer to the situation that exists in the isolated situation (indicated in the graphs as the ISO scenario).

One can also observe that for high levels of margin, reducing or increasing the RAM has relatively little effect on the price. However once the isolated case is being approached the effects, especially for BE become more noticeable.

Finally notice that the average FR prices appear to be little affected by varying levels of available margin. This is an averaging effect: during winter FR is a net importing market, during summer a net export market. These two effects cancel each other out, resulting in the absence of a price impact. Inspecting the individual quarters we also observe that FR prices decrease with increasing margins for the periods where FR imports (Q1+Q4) and FR prices increase with increasing margins for the periods where FR exports (Q2 + Q3).

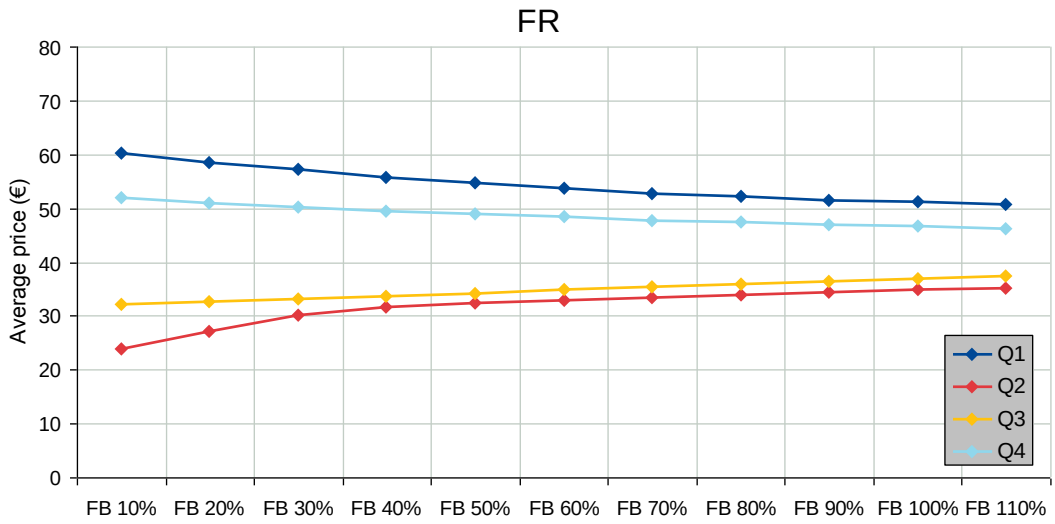

Figure 2 Average FR prices for the different quarters of 2013

Some observations

Figure 3 illustrates that the parallel run has 29.9% convergence for the 100% scenario, and less when margins are reduced.

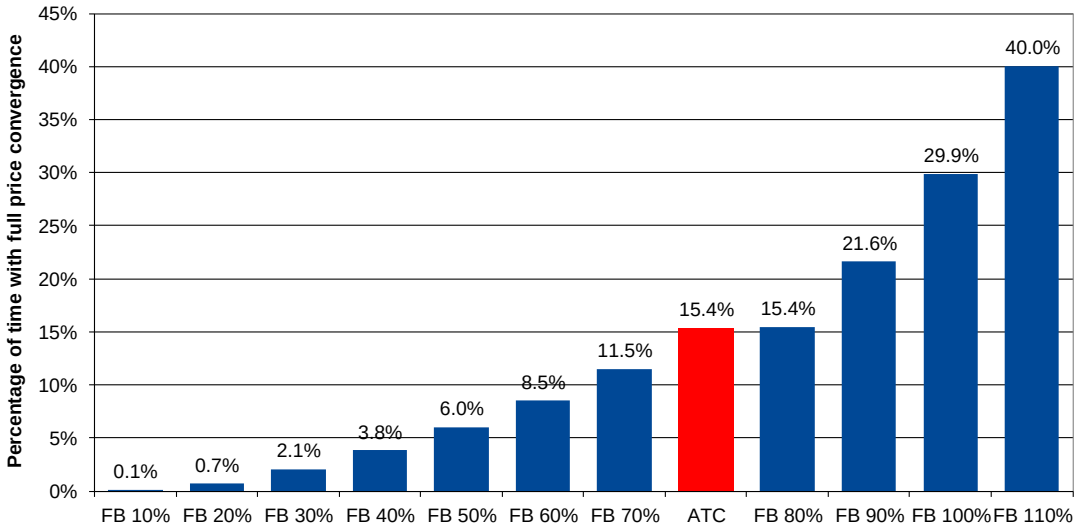

Figure 3 Price convergence in CWE

In the following our focus will not be on the absolute price levels, but rather on the changes in price when moving from one level of margin to the next.

The results presented in Figure 4 contain these price differences, illustrated by looking at different percentiles, namely the 5th, 10th, 50th, 90th and 95th. The nth percentile for a scenario indicates that n% of the hourly price differences were less than the indicated price change.

For the DE market we see that when we reduce the margin by 10%, **irrespective of what level we are**, the prices change by more or less the same amount: for 90% of the hours (between the 5th and 95th percentile) prices change for DE between -1€ and +3€.

For BE at the very strong margin reductions: reducing the margin from 30% to 20% changes 90% of prices (between 95th and 5th percentile) by:

- at most € 30 (≈ €8.09 - €-21.79)).

For FR this figure is:

- € 7 (≈€3.16 - €-3.96);

For NL this figure is:

- € 9.80 (≈€2.50 - €-7.30);

Perhaps the most important observation is that for all markets even at the 110% margin mark the 5th and 95th percentiles are different from zero. I.e. although for increasingly smaller amounts of hours, there are congested hours left, where prices do change when margins are increased.

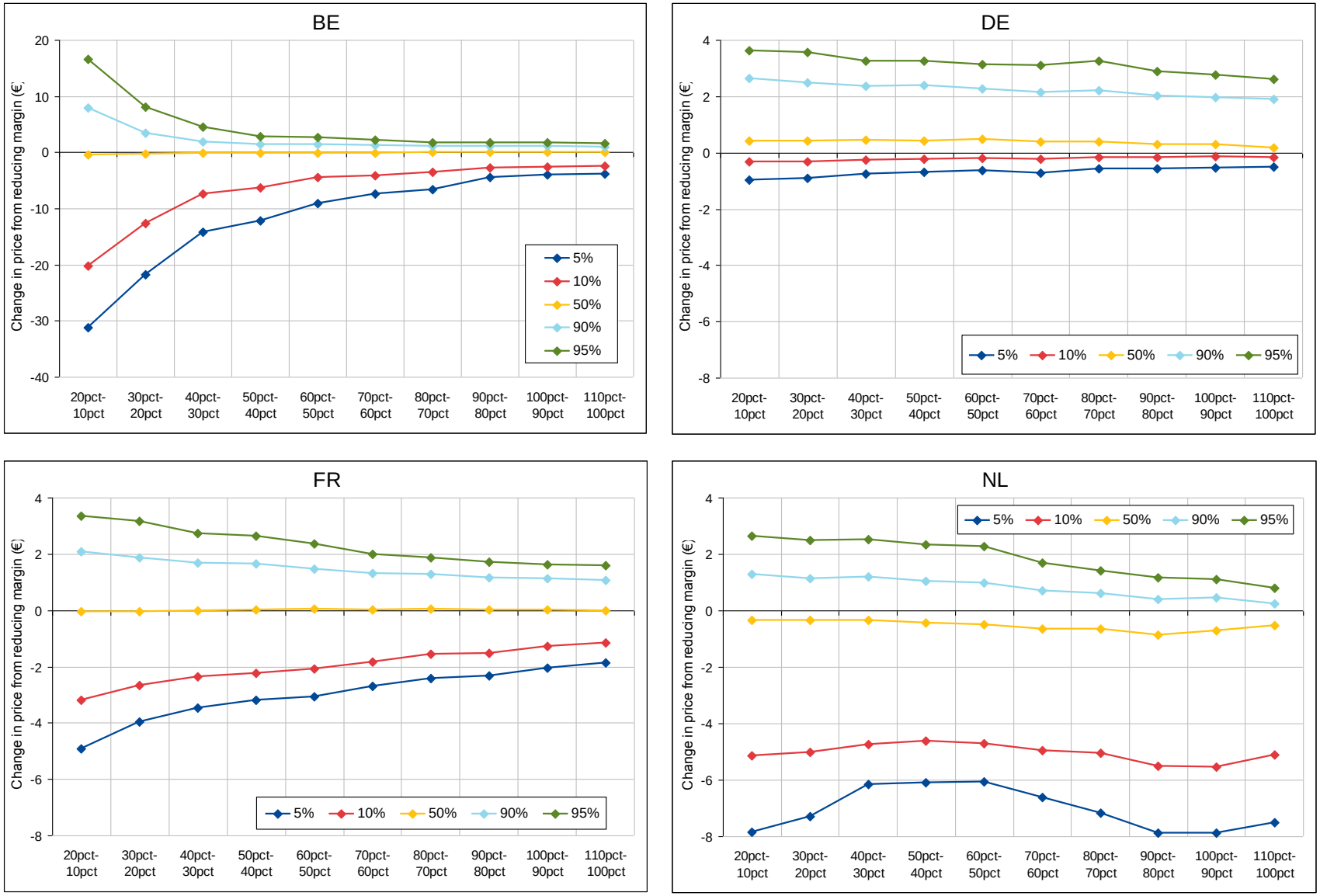

Figure 4 illustrates the effect on prices for the different markets in case of moving from one level of margin reduction to another. The different lines correspond to different percentile values for these price changes. Note the different scale on the vertical axis for BE.

2.4.2. Impact on day-ahead market welfare

Apart from the impact on prices we also consider the impact on welfare. We can anticipate that welfare will decrease when margins are reduced.

The impact of domain reduction on (daily average) welfare is illustrated in Figure 5: increasing the domain results in more welfare being realized. On the far right is the welfare that could be realized in case no network constraints would apply (INF = infinite capacity). Looking closely we notice the difference between the infinite capacity and 100% scenario is 383k€ / day. Compared to the 110% scenario an improvement of 93k€ / day can be observed, i.e. even with an artificial enlargement of the FB domain a significant gap remains with the infinite capacity scenario.

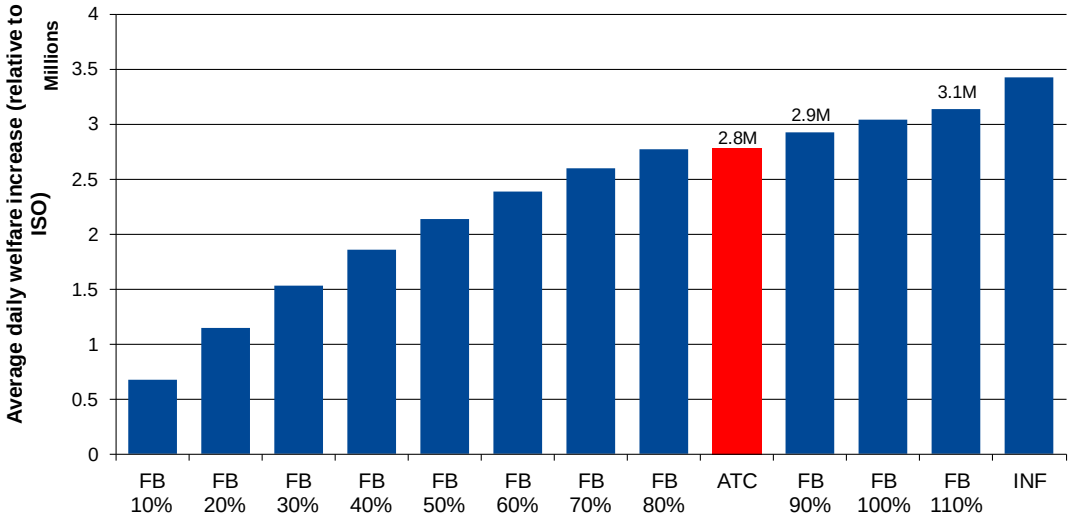

Figure 5 Changes in daily average absolute welfare (€) relative to the isolated case following from applying different domain reductions

We consider the relative welfare increase:

$$\frac{realized\ \ welfare - WF_{ISO}}{WF_{INF} - WF_{ISO}}$$

And express for each day the welfare as a percentage of what could be obtained.

This relative welfare is illustrated in Figure 6. For the different levels of domain reduction the welfare obtained is expressed as a percentage of what could be obtained under infinite capacity. For each day such a percentage is calculated. The graph illustrates the average percentage obtained. By construction, with the infinite capacity results corresponding to 100% we observe diminishing returns.

The 100% parallel run result realizes 90.3% of the welfare potential. Increasing margins to 110% would result in 92.8%.

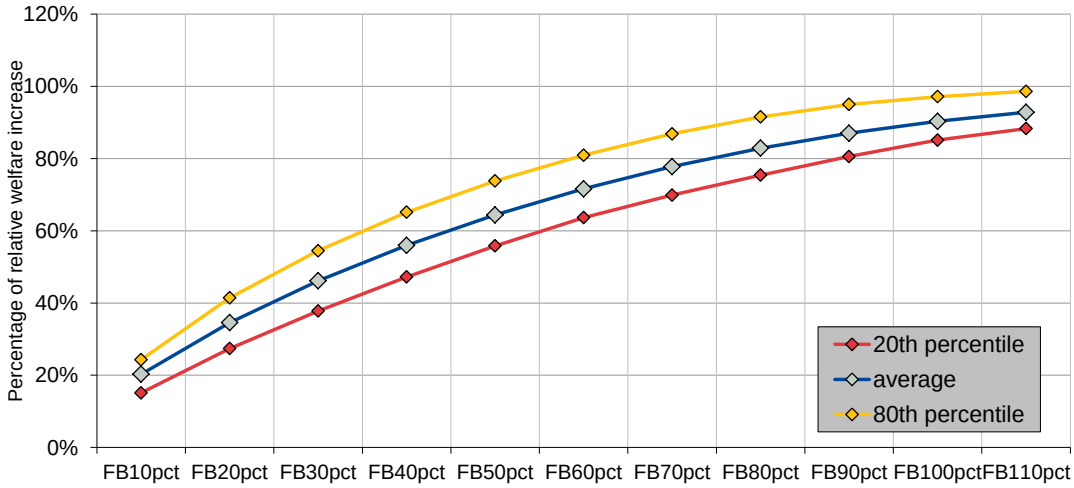

Figure 6 illustration of average relative welfare increase

Finally Figure 6 illustrates apart from the average relative welfare increases, also the 20th and 80th percentiles of the welfare increases.

the range between the 20th and 80th percentiles is more or less stable across the reductions: between 10% and 20% of potential welfare.

2.5. Conclusion

The domain reduction study aims at providing some insights into the sensitivity of the market results to different FB parameters. The margin reduction is a simple tool to model impact, although it lacks a link with physical reality.

- The objective of this study was to answer what impact changes to the FB domain have on market results. A series of trivial qualitative results could be obtained by simple reasoning and was confirmed in our study:The level of price convergence increases with additional margin;
- The day-ahead market welfare increases with additional margin;

We tried to quantify the impact.

Impact on price

The annual average prices are little affected by the margin reductions. However once the isolated case is being approached the effects, especially for BE become more noticeable (e.g. for BE the average price under FB is € 44.44, but this would increase to € 57.83 when margins are reduced to only 10% of the current level. When margin is reduced to 90% of the current level the BE would increase to € 44.92).

Impact on welfare

The difference in welfare between the 100% scenario and the infinite scenario is 383k€ average per day. This suggests that under the current market conditions welfare could be further increased with additional margin.

When we consider the relative increase in welfare (distance from isolated scenario over distance between infinite scenario and isolated scenario) we observe that 90.3% of the welfare potential is realized. This would increase to 92.8% when margin is increased to 110%, or drop to 87.03% when margin is decreased to 90%.

There are limitations too: diminishing return to scales: each subsequent increase in margin will increase welfare by less than it increased by earlier margin increases. This means that increasing margin from 10% to 20% raises average daily welfare by 470k€, whereas increasing margin from 20% to 30% only raises welfare an additional 380k€. The increase from 90% to 100% only added 119k€ and from 100% to 110% 93k€. Realizing the full remaining welfare potential with the infinite scenario would likely require vast increases in margin.

Overall

Comparing the results from this study with the results from ATC, it appears that as long as margins are at least 90% of their current values the FB methodology still outperforms the ATC approach, both in terms of welfare and price convergence.