Liquidity analysis – Bidding zone reconfiguration study
Update for Consultative Group

11 July 2024

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Agenda

1. Introduction and Overview

2. Literature Review

3. Analysis of the State of Liquidity

4. Expected Liquidity Metric Development from Bidding Zone Reconfigurations
Preliminary results subject to potential updates (based on comments by ACER, the NRAs, the TSOs)

1. Scope of the study
Scope of the study
The liquidity and transaction cost study includes several products across several power markets in Europe, in compliance with the requirements stated in the ACER methodology.

ACER methodology

- "The analysis shall, at least, consider the following elements:
  - "A descriptive analysis of liquidity aiming to describe the starting point of market liquidity in the concerned BZs"
  - A correlation analysis, aiming to describe the correlation of average day-ahead prices of the concerned BZ with average day-ahead prices of other BZs or BZ combinations.
  - To describe possible liquidity impacts because of expected changes in competition"
- changes of liquidity should not “impact the existence of sufficient hedging opportunities for market participants”

Liquidity and transaction cost definition

- Liquidity is an elusive concept but loosely speaking: “the speed and easiness by which assets can be bought or sold without drastically impacting the underlying market price”
- Transaction costs are “intrinsically related” to liquidity and included in the analysis through consideration of bid-ask spreads

Markets

- Bidding zones of France, Germany-Luxembourg, Italy, the Netherlands, and Sweden are subject to a potential bidding zone reconfiguration in this bidding zone review
- They show different specifications with regard to:
  - Several bidding zones per country (Sweden, Nordics, Denmark, Italy) vs single bidding zone (Germany + Luxembourg, France, Netherlands, …)
  - Exchange-trading “obligation” (Nordics, Italy, Spain) vs bilateral trades (Germany, France, Netherlands, etc.)
  - Other design/regulatory specifications (French ARENH, Nordic system price, Italian PUN)

Products

- Short term products comprise the exchange traded Intraday (ID) and Day-Ahead (DA) market but, due to data unavailability, not over-the-counter trades. For ID, only traded volumes are considered
- Long term products comprise selected exchange-traded futures and cleared and non-cleared forwards. Data is sourced from EEX, NASDAQ, ICE, and LEBA. For the futures, bid-ask spreads are calculated

Source: [1] ACER Methodology
Limitations of the scope and the assessment of future liquidity metrics

Limitations regarding the exhaustiveness of products and markets considered

- We focus on each BZ that is subject to a potential reconfiguration individually and do not account for potential cross border effects
- We were not able to obtain data on intraday-OTC markets
- A newly-developing market for OTC-long-term products – PPAs – could not be analysed further, because it was out of scope and there were not data available
- Same limitation with regards to combined bidding zone changes as the dispatch model used by TSOs (not implemented yet)

Limitations due to restriction in scope, data and chosen methodology

- No modelling of behavioural trading dynamics – like interplay between short-term and long-term markets or exchange traded vs. OTC
- Conclusions on LT vs. ST markets are indirectly inferred from results of the econometric analysis
- No consideration of mitigation measures (out of scope)
- We have identified some non-linear relationships between liquidity metrics and drivers, which we cannot capture here
Preliminary results subject to potential updates (based on comments by ACER, the NRAs, the TSOs)

2. Literature review
Literature review – Approximation of market liquidity

Metrics to assess transaction and liquidity costs are based on a review of academic sources and reports from market participants.

**Market characteristics**

- **Bidding zone size:**
  - It has been asserted that the *size of bidding zones* positively correlates with liquidity due to the increased number of market participants.
  - This has been questioned, i.e. as “the experience from different markets [...] does not show a clear link”.³

- **Market concentration**
  - The European Commission stated in its decision on Brittany’s capacity tender that *market power* “contributes to a loss of liquidity”.⁴
  - Others have again noted from splitting a congested bidding zone, competition may in fact increase because more cross-border parties may participate.⁵

- **Other market characteristics**
  - Literature on *other market characteristics* is considered as well.

**Metrics to assess liquidity**

- The *traded volume* is a principal metric to assess liquidity, as established by the ACER methodology.¹

- The *churn rate*, the ratio between total traded volume and the volume of the product, is a meaningful indicator for continuous* markets, because of the possibility of secondary trading of products.²

- *Bid-ask spreads* and the *time to maturity* are relevant indicators for continuous markets as well.

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¹Over-the-counter markets are included within continuous trading markets.

Literature review – Analysis of BZ reconfiguration effects on liquidity

Past bidding zone reconfigurations have been discussed in a restricted number of publications. In most cases, liquidity was assessed ca. 1 year after the split by considering traded volumes, churn rates and BAS.

Past reconfiguration: Germany-Luxembourg-Austria

- The review of literature on past reconfigurations suggests that the split had positive effects for the short- and negative for long-term products.
- DNV GL noted an increase of 13% and 20% of DA volumes between the 12 months before and after the split for EpeX Spot and EXAA respectively. ACER attributed the increase partially to the case that companies trading in both areas cannot net their positions and have to close their position on both markets after the split.
- For long-term products, it was highlighted that traded volume in Austria was very limited directly after the split. Bid-ask spreads for the Austrian market decreased between the baseload products for 2019 to 2021 but remained significantly higher than in the BZ before the split. German futures remained on a high liquidity level and saw slightly decreasing BAS between 2019 and 2021 products.

Past reconfiguration: Sweden

- Results Sweden’s bidding zone split have been largely similar: The DA volumes have arguably increased by 10% between 2011 and 2012 but traded volumes for long-term products have decreased.
- Researchers and market participants are not clear about the role of the reconfiguration on the decrease of turnover. Other causes such as decreasing demand and increasing exchange fees may have also contributed to the decrease of traded volumes.

Past reconfiguration: Italy

- Liquidity effects on Italian reconfigurations have seen little discussion in the literature so far.
Excursion: DE/AT Bidding zone split – traded volume of key products

Market participants in Austria were confronted with significantly decreased turnover after the reconfiguration while liquidity in Germany seems to not have been compromised in general.

Note: “DE” denotes the German-Luxembourg bidding zone; “DE/AT” the German-Luxembourg-Austrian zone. Further note that the observable trends until 2021 and thereafter are not necessarily originating in the bidding zone reconfiguration. Others have reduced the time frame for analysis of the reconfiguration to one year before and one year after the split.

Source: Compass Lexecon analysis of EEX data
Excursion: DE/AT Bidding zone split – Bid-ask spreads of key products

Transaction costs (i.e. bid-ask spreads) have not changed significantly for German market participants but increased substantially for Austrian participants.

**Liquidity and transaction cost**

- Bid-ask spreads (BAS) remained largely unchanged in Germany: while BAS decreased for Q+1 base load products slightly also after the split, year-ahead products showed a slightly higher avg. spread.
- In contrast, Austria (not shown) saw significantly less turnover after the split. In association, BAS – when bids were actually made – were substantially higher than before the split.

Note: * Data is missing for 01/01/2018-31/03/2018

Source: Compass Lexecon analysis of EEX data provided by ICE
3. Historic analysis

Preliminary results subject to potential updates (based on comments by ACER, the NRAs, the TSOs)
Market liquidity “starting point” – Exchange-traded short-term products

Traded volumes in Day-Ahead have been relatively stable over the past few years. Traded volumes in intraday have increased in most markets, but remain a fraction of amounts traded in Day-Ahead.

- **Traded volumes on the DA market** tend to be relatively stable between 2016 and 2022. In DE_LU and FR, a significant share is traded OTC such that their exchange turnover is lower compared to SE (for FR) or IT (for DE_LU).

- **ID traded volumes** in all countries except for IT exhibit a significant and positive trend, which is the most pronounced for DE_LU.

- **Seasonal variation** is generally higher in the DA-market with SE and IT showing significantly more variation than i.e. FR.

Abbreviations: DE_LU … Germany-Luxembourg, FR … France, IT … Italy, NL … Netherlands, SE … Sweden, ID … Intraday, DA … day-ahead

Sources: Compass Lexecon analysis of NEMO and ACER data
Market liquidity “starting point” – Long-term products
Long-term products for the German BZ are the most traded in Europe. The bid-ask-spread metric points towards a high level of liquidity for Nordic system price futures as well.

- Germany is the largest futures market, with turnover about 8 times higher than the next largest market area.
- In line with turnover, Germany shows the lowest bid-ask spreads, closely followed by the Nordic Y+1 future, then France and Italy.
- Liquidity for long-term products has been fairly constant apart from monthly fluctuations and the effect from the recent price increase.
- Liquidity of the French market has been qualified as “low” by ESMA.¹

Sources: Compass Lexecon analysis of EEX, NASDAQ, ICE, and LEBA data. [1] ESMA 2019
Note: [¹] German products are considered as of available DE-LU products on EEX (as of then, all OTC volumes are considered DE-LU only); [**] Nordics Y+1 corresponds to the minimum BAS of the EEX or NASDAQ traded Nordic system future. All others correspond to minimum BAS of EEX base load year ahead (Y+1) futures
The relationship between liquidity and other market metrics shall be substantiated through regression analysis that identifies the presence of structural relationships in historic data.

### Dependent Variable
- Which variables are used to indicate liquidity?
  - Traded volume (for all)
    - (Demand + supply) / 2 (coupled markets); and across products
  - Churn Ratios (for all)
    - Traded volume / total load
  - Bid-Ask Spreads (for futures)
    - (ask price – bid price) for all new events on a given day
    - Min., unweighted avg., max. across a day of all BAS
    - Product-specific → min., avg., max across products for selected products

### Explanatory Variables
- Which variables are assumed to impact the dependent variable?
  - Market Size
    - Total Load (hourly or aligned with the respective long-term product)
  - Share of Variable Generation
    - Generation or capacity from RES / total gen.
  - Market Concentration
    - HHI values
  - Seasonality
    - Avg. Temperature
  - Cross-border participation
    - Avg. price correlation to connected BZ weighted by XB-trade

### Controlling for Noise
- What should be expected as how the missing information is distributed?
  - Time
    - Time trends
    - auto-correlation
  - Location
    - Country fixed effects
    - Separate regressions for different markets

### Functional Form
- What is the expected relationship between explanatory variable and dependent variable?
  - Linear, log-linear, non-linear relationships?
Liquidity relationships in the short-term markets
The relationship between traded volume and market size is most pronounced for smaller DA-markets.

Figure 3.11 Market size (daily load) and DA daily traded volume by country (in MWh)

Figure 3.12 Market size (daily load) and ID daily traded volume by country (in MWh)
**Liquidity relationships in the long-term markets**

Bid-ask spreads tend to have a log-linear relationship to volumetric indicators

<table>
<thead>
<tr>
<th></th>
<th>Exchange traded volume</th>
<th>Exchange churn</th>
<th>Market size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum bid-ask spread (EUR / MWh)</td>
<td><img src="image1" alt="Graph" /></td>
<td><img src="image2" alt="Graph" /></td>
<td><img src="image3" alt="Graph" /></td>
</tr>
<tr>
<td>Mean bid-ask spread (EUR / MWh)</td>
<td><img src="image4" alt="Graph" /></td>
<td><img src="image5" alt="Graph" /></td>
<td><img src="image6" alt="Graph" /></td>
</tr>
</tbody>
</table>

country: France, Germany, Italy, Netherlands, Nordics

Preliminary results subject to potential updates (based on comments by ACER, the NRAs, the TSOs)

compasslexecon.com
## Relationship of liquidity metrics with market characteristics: Short-term

The regression model analysis of liquidity metrics on market characteristics of the Day-Ahead and the Intraday market, shows that total load displays the highest level of correlation among the assessed characteristics.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Relationship</th>
<th>Explanation and interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanatory and confounding variables in focus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total load</td>
<td>⬆</td>
<td>• Liquidity (in terms of traded volume) and market size (in terms of total load) go hand in hand. This relationship is more pronounced for DA than for ID.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The relationship is also less pronounced for Germany and France on the DA market and for France on the ID market. This may be explained by the various design differences between the European countries, particularly considering the relevance of OTC trades of short term products.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No clear relationship was identified between churn ratios and total load.</td>
</tr>
<tr>
<td>RES share</td>
<td>⬆</td>
<td>• The share of RES and liquidity is positively correlated but the impact is limited.</td>
</tr>
<tr>
<td>Average weighted correlation</td>
<td>⬆</td>
<td>• Products for countries that are highly correlated to its neighbours tend to have a higher liquidity (not across all metrics/products).</td>
</tr>
<tr>
<td>HHI</td>
<td>⬇</td>
<td>• Market concentration shows a negative correlation with liquidity but the strength of the model result (due to annual data) is not high.</td>
</tr>
<tr>
<td>Temperature</td>
<td>⬇️</td>
<td>• The relationship is inconclusive. It may be that this is because much of the variation of traded volumes is due to total load changes that also follow temperature.</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time trend</td>
<td>⬆</td>
<td>• The data shows that over time liquidity generally increases in Europe.</td>
</tr>
</tbody>
</table>

Legend for relationships: Direction of the arrow: direction of coefficient, if in both directions: Inconclusive direction among models. Size of arrow: Relative size of coefficient. Colour of coefficient: Significance (black = significant) of coefficient. Note: The underlying regression models are based on monthly data (but for HHI) and use data from the NEMOs, ACER, ENTSO-E and EUROSTAT, ECAD.
# Relationship of liquidity metrics with market characteristics: Long-term

The analysis of the model results for traded volumes and bid-ask spreads shows that load and prices are the characteristics displaying the highest correlation.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Relationship</th>
<th>Explanation and interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanatory and confounding variables in focus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total load</td>
<td></td>
<td>• Larger countries (in terms of market size) show higher traded volumes for their long-term products and lower bid-ask spreads.</td>
</tr>
<tr>
<td>RES share</td>
<td></td>
<td>• The share of RES and liquidity is positively correlated.</td>
</tr>
<tr>
<td>Price spread and correlation to lead market</td>
<td></td>
<td>• The relevance of proxy-hedging for liquidity is inconclusive. The relationship to correlation is only significant in one case – the price spread variable sometimes shows a positive or a negative relationship to liquidity metrics, depending on the model specification.</td>
</tr>
<tr>
<td>HHI</td>
<td></td>
<td>• Market concentration is negatively correlated with liquidity in terms of traded volumes but not bid-ask spreads. The strength of the model result (due to annual data) is not high.</td>
</tr>
<tr>
<td>Price</td>
<td></td>
<td>• The price of the traded products and the traded volumes generally show a negative correlation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• This relationship does not hold in all model specifications. This may require further analysis.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• For Bid-ask-spreads, the relationship of increasing prices and decreasing liquidity (increasing BAS) is significant across different models.</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time trend</td>
<td></td>
<td>• Traded volume for exchanged traded and cleared product increased over time while the volume for bilateral contracts without clearing decreased.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bid-ask spreads did not show a time trend over the past 7 years.</td>
</tr>
</tbody>
</table>

Legend for relationships: Direction of the arrow: direction of coefficient, if in both directions: Inconclusive direction among models. If multiple relationships: different directions for different underlying parameters. Size of arrow: Relative size of coefficient. Colour of coefficient: Significance (black = significant) of coefficient.

Note: The underlying regression models are based on monthly data (but for HHI) and use data from EEX, NASDAQ, ICE, LEBA, ENTSO-E and EUROSTAT.
Preliminary results subject to potential updates (based on comments by ACER, the NRAs, the TSOs)

4.

Analysis of simulated reconfigurations
Methodological approach

The analysis of the state of liquidity in the proposed alternative BZ configurations is based on simulated market parameters that have shown a correlation to liquidity metrics in historical data.

1. First, we **analyse the simulated data** provided to us by the TSOs and identify specifications of the market characteristics.

2. Then, we assess the **implications for the alternative configurations** in light of the likely relationship between liquidity metrics and the parameters as provided by the TSOs.

3. We derive, where possible, **expectations on changes to liquidity metrics** from the proposed alternative configurations.

### Market size
- Approximated by the parameters generation and load volume as provided by the TSOs
- Based on the results of the historical analysis, we consider **increases in market size as, ceteris paribus, increases of liquidity metrics** both for the short- and long-term markets

### Market concentration
- Portrayed by HHI values for the Nordics and RSI and PSI\(^1\) values for Central Europe
- An **increase in the HHI** and a **decrease in RSI or PSI** indicates an **increase in market concentration**, which tends to imply a **decreased level of liquidity metrics** both for short- and long-term markets

### Price correlation
- Calculated as the market size-weighted average of price correlation across directly connected BZ to the BZ in question\(^2\) and can take values between -1 and 1.
- Based on the results of the historical analysis, we consider **increases in price correlation** are, ceteris paribus, **liquidity enhancements** for short-term markets.

**Note:** [1] The RSI and PSI values are provided in three instances to account for uncertainty of available import capacity. These instances each assume different correction factors (i25, i50, i75) for the assumed available import capacity. The higher the correction factor, the higher the assumed available import capacity. [2] We have assessed the robustness of the correlations by computing the parameter twice: First, only including neighbouring BZ that are also part of the CORE region. Then including all neighbouring BZ, i.e. also those that assume a NTC border in the model. We conclude that the model simplification used for NTC borders does not impact the robustness of the parameter.
Overall results and observations
We have assessed the likely effect on liquidity metrics for the alternative configurations based on identified historic relationship between market characteristics and liquidity metrics.

<table>
<thead>
<tr>
<th>Countries</th>
<th>ACER identifier</th>
<th>Market concentration</th>
<th>Price correlation</th>
<th>Market size</th>
<th>Overall assessment on liquidity metrics w/o mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td>8</td>
<td>Mostly decreasing</td>
<td>Decreasing, but only to a small extent</td>
<td>Mostly increasing</td>
<td>Tendency to improvement for short- and long-term markets</td>
</tr>
<tr>
<td>Sweden</td>
<td>9</td>
<td>Mostly decreasing</td>
<td>Decreasing, but only to a small extent</td>
<td>Mostly increasing</td>
<td>Tendency to improvement for short- and long-term markets</td>
</tr>
<tr>
<td>Sweden</td>
<td>10</td>
<td>Mostly decreasing</td>
<td>Mostly decreasing, but only to small extent</td>
<td>Decreasing</td>
<td>Tendency to impairment for short- and long-term markets</td>
</tr>
<tr>
<td>Sweden</td>
<td>11</td>
<td>Limited change</td>
<td>Decreasing, but only to small extent</td>
<td>Two-sided</td>
<td>Inconclusive due to limited changes in market characteristics for both short- and long-term markets</td>
</tr>
<tr>
<td>Germany; Luxembourg</td>
<td>2</td>
<td>Mostly decreasing</td>
<td>Mostly increasing, but only to a small extent</td>
<td>Decreasing</td>
<td>Tendency to impairment for short- and long-term markets</td>
</tr>
<tr>
<td>Germany; Luxembourg</td>
<td>12</td>
<td>Mostly decreasing</td>
<td>Mostly increasing, but partially to a small extent</td>
<td>Decreasing</td>
<td>Tendency to impairment with potential exceptions at least for short-term markets</td>
</tr>
<tr>
<td>Germany; Luxembourg</td>
<td>13</td>
<td>Mostly decreasing</td>
<td>Mostly increasing</td>
<td>Decreasing</td>
<td>Tendency to impairment with potential exceptions at least for short-term markets</td>
</tr>
<tr>
<td>Germany; Luxembourg</td>
<td>14</td>
<td>Mostly decreasing</td>
<td>Mostly increasing</td>
<td>Decreasing</td>
<td>Tendency to impairment with potential exceptions at least for short-term markets</td>
</tr>
<tr>
<td>France</td>
<td>5</td>
<td>Mostly decreasing</td>
<td>Increasing</td>
<td>Decreasing</td>
<td>Inconclusive due to potentially offsetting changes for the short-term markets, and tendency to impairment for long-term markets in line with market size changes</td>
</tr>
<tr>
<td>Northern Italy</td>
<td>6</td>
<td>Mostly decreasing</td>
<td>Two-sided</td>
<td>Decreasing</td>
<td>Tendency to impairment for short- and long-term markets</td>
</tr>
<tr>
<td>Netherlands</td>
<td>7</td>
<td>Decreasing</td>
<td>Increasing, but only to a small extent</td>
<td>Decreasing</td>
<td>Tendency to impairment for short- and long-term markets</td>
</tr>
</tbody>
</table>

- Market size **decreases** for most BZs reconfigurations.
- Market concentration as measured by the simulated HHI and RSI is **decreasing** in most cases or at least remains below critical levels such as RSI values below 1.
- Price correlation tends to **increase** for the reconfigured BZs.

Note: The BZ liquidity and its metrics materialising after a BZ reconfigurations may significantly differ from the expectations formed in a “ceteris paribus” analysis such as this one.
Key observations: Nordics

Our analysis suggests potential slight liquidity metric improvements for reconfigurations 8 and 9, and an impairment for alternative configuration 10. The analysis of configuration 11 has been inconclusive.

- **Reconfigurations 8 and 9**: tend to show overall increased liquidity metrics
- **Reconfiguration 10**: impairment of liquidity metrics, primarily driven by decreases in market size (in particular for O3) without strong offsets by other market characteristics such as price correlation
- **Reconfiguration 11**: inconclusive picture as some market characteristics change in opposite directions or only to a limited extent
### Key observations: Germany-Luxembourg

Our analysis shows a differentiated picture with improvements in the parameters market concentration and price correlation, but substantial decreases in market size. Ceteris paribus we would expect a decrease in liquidity metrics.

- Particularly impacted by decreases in BZ market size.
- Due to the positive relationship between market size and liquidity metrics, this suggests an impairment of liquidity metrics.
- However, the effect may be (partially) offset by increases in price correlation and decreases in market concentration at least for short-term markets.

<table>
<thead>
<tr>
<th>Case</th>
<th>Descriptive statistics</th>
<th>Market concentration</th>
<th>Price correlation</th>
<th>Market size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rs25</td>
<td>Rs50</td>
<td>Rs75</td>
</tr>
<tr>
<td>Base case</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Con. 2</td>
<td>Max</td>
<td>DEJ2: 2.42</td>
<td>DEJ2: 2.62</td>
<td>DEJ2: 2.77</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>1.89</td>
<td>2.04</td>
<td>2.18</td>
</tr>
<tr>
<td></td>
<td>Min</td>
<td>DEJ2: 1.32</td>
<td>DEJ2: 1.45</td>
<td>DEJ2: 1.58</td>
</tr>
<tr>
<td>Con. 12</td>
<td>Max</td>
<td>DEJ2: 2.14</td>
<td>DEJ2: 3.14</td>
<td>DEJ2: 3.41</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>2.14</td>
<td>2.35</td>
<td>2.50</td>
</tr>
<tr>
<td></td>
<td>Min</td>
<td>DEJ2: 1.32</td>
<td>DEJ2: 1.45</td>
<td>DEJ2: 1.59</td>
</tr>
<tr>
<td>Con. 13</td>
<td>Max</td>
<td>DEJ3: 2.91</td>
<td>DEJ3: 3.18</td>
<td>DEJ3: 3.39</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>1.80</td>
<td>2.12</td>
<td>2.37</td>
</tr>
<tr>
<td></td>
<td>Min</td>
<td>DEJ2: 1.19</td>
<td>DEJ2: 1.39</td>
<td>DEJ2: 1.58</td>
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<tr>
<td>Con. 14</td>
<td>Max</td>
<td>DEJ5: 4.62</td>
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<tr>
<td></td>
<td>Average</td>
<td>2.41</td>
<td>2.71</td>
<td>3.02</td>
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<td>DEJ2: 1.4</td>
<td>DEJ2: 1.6</td>
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</table>

**Market size – generation (in MWh)**

- Conf. 2
- Conf. 12
- Conf. 13
- Conf. 14
Key observations: France
As for Germany-Luxembourg, our analysis suggests two opposing effects: a substantial decrease of market size per BZ, but a decrease of market concentration and increase in price correlation.

- Market size is decreasing but price correlation parameter increases significantly for all the BZ.
- Hence no clear indication regarding changes in liquidity metrics for the short-term market and a tendency towards impairments of liquidity metrics for long-term markets.
- Unique case in the analysis of historical data, because the relationship between market size and traded volume in the short-term markets has been relatively inelastic.
Key observations: Italy
Our analysis suggests a limited impairment in market liquidity metrics in both BZs in Northern Italy for both the short- and long-term markets.

- Alternative configuration suggests an impairment of liquidity metrics for short- and long-term markets at least in the north-western BZ.
- This may be derived from the observation of a significant decrease in market size without substantial changes in other parameters that may counter this effect.
**Key observations: Netherlands**

Our analysis suggests a decrease in liquidity metrics for both short- and long-term markets at least in the northern zone of the alternative configuration.

- **Market size – generation (in MWh)**
- **Price correlation**
- **Market concentration – RSI**

<table>
<thead>
<tr>
<th>Case</th>
<th>Descriptive statistics</th>
<th>Market concentration</th>
<th>Price correlation</th>
<th>Market size</th>
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<tr>
<td></td>
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<td>Ra25</td>
<td>Ra50</td>
<td>Ra75</td>
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<tr>
<td>Base case</td>
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<td>NL00: 1.75</td>
<td>NL00: 1.88</td>
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<td>Con. 7</td>
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<td>2.22</td>
<td>2.51</td>
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<tr>
<td></td>
<td>Min</td>
<td>NLN1: 1.77</td>
<td>NLN1: 1.95</td>
<td>NLN1: 2.13</td>
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</tbody>
</table>

- Alternative configuration sees similar changes as the Northern Italian reconfiguration and equally suggests an impairment of liquidity metrics for short- and long-term markets at least in one BZ. However, correlation is notably higher than in Northern Italy.
- This follows particularly from the market size decreases and the limited increase in price correlation from an already high level.
## Locations

<table>
<thead>
<tr>
<th>Europe</th>
<th>North America</th>
<th>Latin America</th>
<th>Asia Pacific</th>
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