Understanding the dynamics of the French intraday market: insights on the roles of balancing needs and flexibility

Mathieu RICHARD[1,2]

[1]I-tésé CEA

[2]Paris Dauphine University

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Abstract

Intraday markets are gaining importance in Europe, particularly in the context of renewable energy deployment and the harmonization of balancing models. France is no stranger to this dynamic, having experienced a surge in intraday market size, with total trading volumes nearly doubling between 2021 and 2024. This paper aims to study the intraday dynamics in the unique context of the French balancing phase. Through econometric modelling, we assess how traded volume, price level, and price volatility are influenced by balancing adjustment needs and short-term flexibility availability. In particular, the role of forecast error from renewables production located in France or abroad is assessed. Building on the methodology of Soysal et al. (2017) in combination with panel econometric methods, we can disentangle the effect on market dynamics of positive and negative forecast error. Preliminary results, focusing on hourly products from the continuous market, illustrate the balancing role of the French intraday market for both the French and other neighbouring countries' power systems.

1 Introduction

The liberalization of electricity markets has transformed the organization of the sector, shifting from regulated monopolies to competitive markets. This evolution impacts the balancing phase, as short-term supply–demand equilibrium is now realized through market mechanisms. The intraday period provides the final opportunity for market participants (producers represented by aggregators, consumers represented by suppliers and traders) to balance their production and consumption portfolios before the transmission system operator (TSO) takes control in real-time and charges financial any imbalance at through the imbalance settlement mechanism. Traditionally, the intraday market has been associated with three main functions: managing forecast errors and unplanned outages, as well as optimizing short-term flexible assets (Kazempour, 2025). This makes it a particularly well-suited market to address the uncertainty inherent to renewable generation that affects the balancing phase of power systems (Borggrefe and Neuhoff, 2011). Such uncertainty arises from updated weather forecasts issued close to real time, causing renewable output to deviate from its day-ahead commitments. Thus, it creates a need for balancing energy that is filled either via intraday adjustment or via reserve energy activation (Figure 4).

As in other European countries, the French intraday market experienced a surge in activity over the last decade, in parallel with renewables deployment. The total volumes traded on the EPEX plateform[1] almost reached 20 TWh in 2024, with most trades taking place on the continuous market (Figure:1).

[1]the main Nominated Electricity Market Operator (NEMO) for intraday trading in France, as total intraday volumes reached 23.9 TWh in 2024 according to ACER, with nearly 20 TWh traded through EPEX.

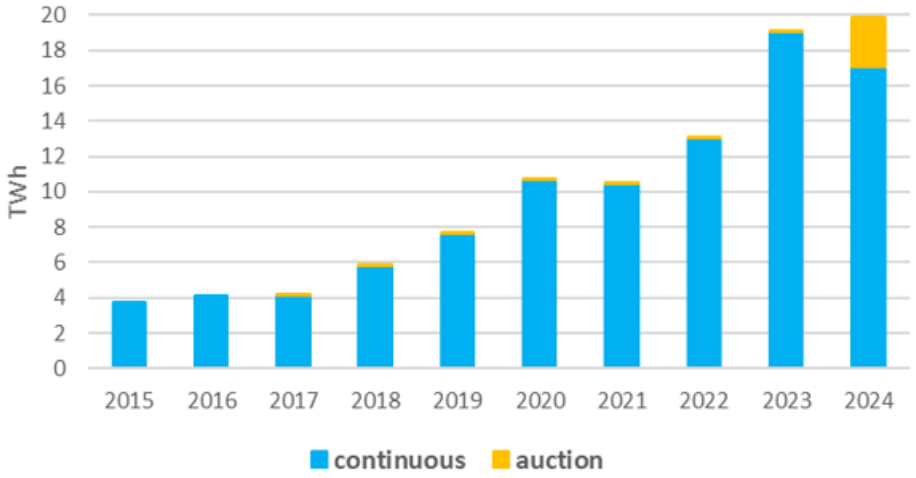


Figure 1: Yearly traded volume in Intraday market via Epex platform

Our analysis focuses on hourly products traded on the French continuous market in 2024, which accounts for more than 85% of total traded volumes in intraday. Using a panel econometric approach, it aims at contributing to the literature in three ways. First it proposes to extend the traditional empirical studies on intraday market to others dimensions than the sole price level perspective. In this respect we also look at how supply demand drivers tend to influence price volatility and traded volumes at session (hourly) level. Secondly we broader the set of traditional drivers, by including alongside renewable forecast errors, flexibility levies in the form of demand and supply elascities, interconnector availability or TSO messages relative to system imbalance margins. Third, the study of the French market based on recent data provides an interesting case study in comparison to previous analysis conducted on other countries. It allows critical examination of the functioning of the intraday market in a country with a unique imbalance pricing scheme, which may affect the

incentives for market participants with respect to their balancing responsibilities. Our findings underline the robustess of intraday market to a different balancing context. In fact market prices manage to translate system balanicng needs relative to renewables with price bearish price trend in moment energy surplus in intraday compared to day-ahead forecast and vice-versa. Additionally the focus on volume traded relative to renewables hilight an asymetrical effect already observed in subsequent markets (Deman and Boucher, 2023). A surplus of renewables generation in intraday tends to be balance to a lesser extent than a deficit. Finally our results highlight the smoothing effect of flexibility on intraday price.

Beyond the academic contribution, our results are also useful for several stakeholders of the electricity industry. For public authorities (regulator, TSO/DSO) our observations provide useful information about the behavior of renewables producers in intraday relative to their balancing responsabilities. For market players, our findings demonstrate the important role played by flexible assets in reducing the intraday price risk.

The remainder of this paper is structured as follows. Section 2 reviews the related literature. Section 3 presents the organization of the balancing phase in France followed by the data and the empirical strategy presentation in Section 4. Results are then presented in Section 5, with their implications discussed in Section 6.

2 Literature review

Literature on intraday markets has focused mainly on the price level perspective. Few studies have centered on volumes or volatility, which are other key dimensions of a well-functioning market.

Determinants of intraday price level have been thoroughly assessed in the literature, in particular regarding the German case. Pape et al. (2016) highlights the ability of models based on fundamental information (representing the supply stack model) to explain intraday price variations. He mentions that the addition of other market peculiarities, which capture the flexibility level (ramping or scarcity level), can significantly impact price. Bâra et al. (2025) use a quantile regression to show the importance of supply and demand fundamentals in intraday price formation. In particular, they highlight the greater (positive) marginal impact of demand on intraday price across the price distribution, thereby underlying a non-linear effect.
Pape (2018) incorporates the role of uncertainty by considering the impact of forecast errors in addition to supply-demand fundamentals. In fact, with the rise in renewable energy generation, attention has been given to the role of those forecast errors on intraday prices. In the German context, Kiesel and Paraschiv (2017) demonstrate that the forecast error of renewables influences intraday prices, with a positive error decreasing prices and a negative error increasing prices. Splitting the effect of positive and negative forecast errors, Soysal et al. (2017) shows that the adjustment price premium on intraday is higher when overestimating production than when underestimating. This study underlines the asymmetry of intraday price variation depending on the direction of adjustment needs. Kulakov and Ziel (2019)

use an econometrical model based on Day-Ahead auction curves to assess German intraday price variation. Based on a transformed day-ahead supply curve, they find a differential effect of positive and negative forecast errors on intraday price. They also point out a nonlinear impact of forecast error on price. Also focusing on the German context, Paulsen identifies a similar relationship between intraday prices and renewable forecast errors through a panel regression. In the French context, Ekoue et al. (2025) analyse the impact of renewables on intraday prices. Based on the decomposition of the renewable effect proposed by Weber and Woerman (2024) in the Texan context, they find a significant effect of renewable intermittency and uncertainty. Interestingly, they attribute the lower magnitude of those effects compared to the one for Texas, because of the existence of additional flexible levies in France: interconnectors and dispatchable nuclear fleet. Building on VAR framework and analysis of Impulse Response, Karanfil and Li (2017) demonstrate the role played by load and conventional power plants in handling wind forecast errors in Denmark. In the same vein, Spodniak et al. (2021) measure the effect of wind error on Nordics price spreads between Day-ahead, Intraday and Imbalance prices. Based on a VAR with exogenous variables, they disentangle the effect of a shock on wind forecast error among the three spreads. They show that when forecast error shock increases Day-Ahead versus Intraday prices from 5 to 9%, depending on the studied bidding zone.

Regarding the dynamics of traded volumes, the literature emphasizes the central roles played by renewables forecast error and international trades. While intraday

markets have only seen significant development since the 2010s, early focus has been on finding an efficient market design. In this respect, studies on intraday market development addressed the volume aspect under the lens of liquidity development (Hagemann and Weber, 2013; Balardy, 2019). Hagemann (2013) highlights the positive relationship between renewables forecast errors and traded volumes on the German intraday market. He finds that for a 1MWh forecast error of solar (resp. wind), traded volume increases by 0.3MWh (resp. 0.54). However, it is important that at the time of his study, balancing responsibility was borne by TSO and not producers themselves. In another study focusing, Hagemann and Weber (2015) examine the annual volume of trades in different European countries and compares those volumes with expected theoretical volumes set according to the competition level in each country. They find that Germany was the only country where actual traded volumes were consistent with the participation of the competitive fringe (small market players). Actual traded volumes suggest oligopolistic competition in the case of the French intraday market. Renewables' effects have also been studied on other balancing markets. It has been shown that a larger renewable generation level is associated with a system that tends to be long, which in turn tends to increase downward reserve energy activations by the TSO. (Deman and Boucher, 2023). However, this asymmetrical effect has not been observed on the intraday market to the best of our knowledge.

Studying the Elbas intraday market[2], Scharff and Amelin (2016) point out that between 2012 and 2013 only 37% of trades were realized between a buyer and a seller

[2]Elbas is the intraday market place run by Noordpool, encompassing the Nordic and Baltic region, and Germany, Belgium and the Netherlands

located in the same country. This result emphasizes the importance of considering the role of neighbouring countries in terms of both balancing needs and short-term flexibility levies when assessing a particular intraday market that is interconnected.

The volatility of intraday prices has attracted limited attention in the literature. A study focusing on the Dutch intraday continuous market assesses the determinants of the realized volatility aggregated at the daily level (Birkeland et al., 2024). Interestingly, the article points out that forecast errors from load and renewables do not tend to increase volatility, whereas increasing export volumes to Belgium has a positive impact on volatility. Other works use volatility as an explanatory variable when studying the intraday market. In this respect, we can cite the work of Balardy (2022) analysing the liquidity determinants in the German context. She finds a positive effect of intraday price volatility (measured by the price standard deviation of hourly product over a session) on the bid-ask spread level.

Research on the intraday market has predominantly been conducted through the lens of price-level analysis. The main attention has been given to the role of renewable energy, whereas the German market constitutes the prevailing case study. Our contribution widens the analytical framework of intraday markets by incorporating additional dimensions and an expanded set of determinants, including not only the conventional drivers such as renewable forecast errors but also the role of available flexibility levers. The French market further provides an opportunity to evaluate the resilience of intraday trading under a balancing context that is unique in Europe.

3 The French balancing phase

In France, balancing responsibility lies with market players. They must ensure a perfect balance at their portfolio level between consumption and production. They can balance their portfolio by taking physical actions at their site level (adjustment of grid withdrawal and injection) or via the market (purchases and sales). Any remaining imbalance in real-time is settled at the imbalance price.

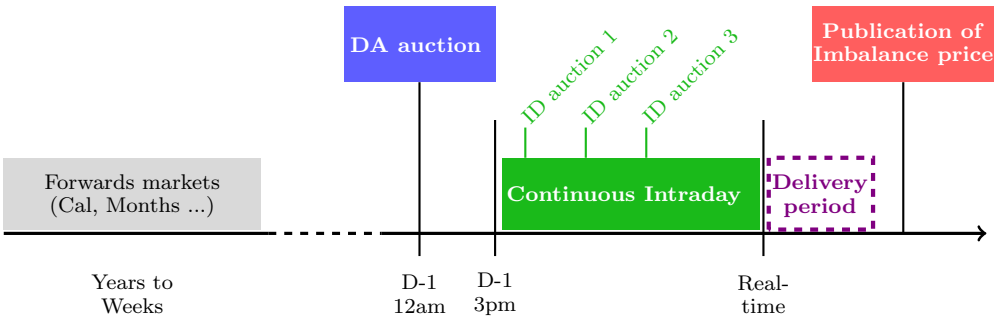


Figure 2: Sequence of electricty markets

3.1 Day ahead market

The Day-Ahead market is the first stage of the balancing phase. It gives a first approximation of the real-time equilibrium between supply and demand. It offers a suitable market for renewable producers, as the day-ahead auction enables electricity to be traded at an hourly (or even finer) resolution, aligning well with the variable output of weather-dependent renewable generation. In Europe, this market is organized through a single cross-zonal auction cleared at 12 am on the day-ahead.

The most recent renewable support scheme implemented in France creates additional incentives for renewable producers to participate in the day-ahead auction. The "Complément de Rémunération" is a pay-as-produced two-way contract for difference (CfD), with the reference market price indexed to the day-ahead price. As a result, plants benefiting from this scheme are encouraged to participate in the day-ahead market in order to hedge the price risk associated with the CfD settlement. In 2024, 28% of onshore wind generation and 17% of solar generation originated from plants operating under this support scheme.

3.2 Intraday market

Early literature on intraday markets has focused on finding the most adequate design between auctions and continuous trading (Weber, 2010). Nowadays, most European countries rely on a hybrid model with efforts centered on coordinating continuous stage and auctions (Alberizzi and Zani, 2024; Bindu et al., 2023), but also dealing with the co-existence of pan-european and national auctions (Ocker and Jaenisch, 2020). The French intraday market design is no stranger to those current integration challenges. It combines a continuous market with auctions. However, the design of the auction stage evolved in 2024. Prior to June 14th 2024, there was a single intraday local auction. This auction took place on the day-ahead at 5 pm, and trading was limited to half-hourly products. This auction system has now shifted to three pan-european auctions. They are respectively set at 3 pm and 10 pm in the day ahead and at 10 am on the delivery day[3]. In addition, interconnection capacities

[3]in this third auction, only products for delivery between 12 am and 12 pm are therefore available

are now made available, allowing international buyers and sellers to participate in the auction. In 2024, only half-hourly products were traded in the pan-European auctions.

Regarding continuous design, it is stable throughout 2024. Products available are hourly and half-hourly products, with international trades possible upon availability of interconnection capacities. For products delivered on day D, the continuous intraday gate opening is set at 3 pm on the day before. The gate closure timing is set 5 minutes prior to the start of the delivery period of the corresponding product. However, cross-border trades are no longer possible one hour before the start of the delivery period.

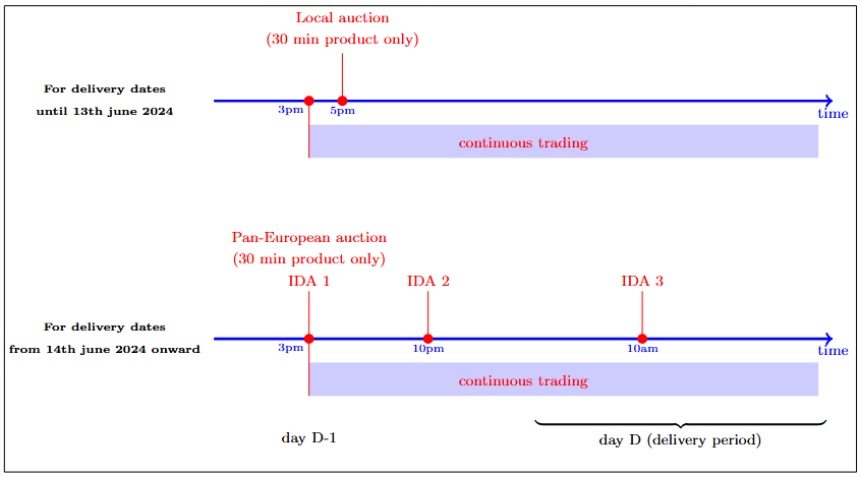


Figure 3: Evolution of French intraday market design

Both the day-ahead market and intraday market are run by NEMOs. Each market player must go through a NEMO in order to submit bids on the market. Then, bids from all NEMOs are shared through a common order book and market

coupling, and clearing is ensured by NEMOs themselves.

3.3 Imbalance market

The two objectives of the imbalance settlement mechanism are to allow the TSO to recover the cost of energy activation and to incentivize market players to avoid creating an imbalance at the system level. When a market player has a surplus of energy, the TSO buys back this energy at the imbalance price. Conversely, a market player has a deficit of energy, the TSO sells the missing energy at the imbalance price. In France, the imbalance price reflects the weighted average cost of reserve energy activated. This imbalance pricing design (based on volume weighted average price of activated reserve energy), coupled with other specific balancing choices, such as the prominent use of tertiary reserves, makes France a special case (Richard and Solier, 2025). From a theoretical perspective, this design transmits weaker incentives for market participants to balance their positions compared to other European imbalance market designs Håberg and Doorman (2016).

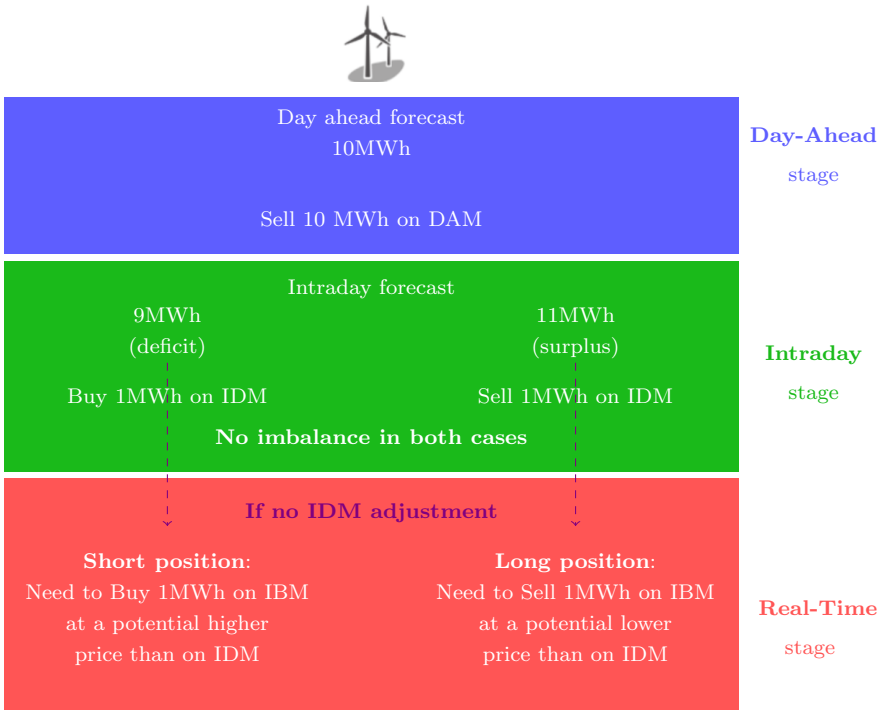


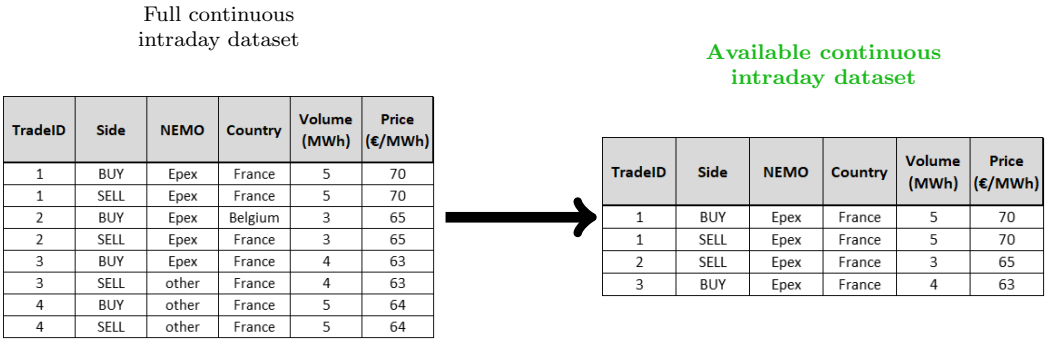
Figure 4: Balancing phase

4 Data & Methodology

Our analysis focuses on the trading of hourly products on the French continuous intraday market for the entire 2024 year.

We retrieved continuous intraday market data from Epex platform, for which we were given access via the Chaire Electricity market from the University of Paris-Dauphine. This dataset contains trades for which at least one counterparty (buy or sell) is located in France and affiliated with EPEX. When a trade occurs between two counterparties, both located in France and affiliated with EPEX, the dataset includes two observations for that trade (one for the buy side and one for the sell side). When only one counterparty is located in France and affiliated with EPEX

(e.g., the buyer), the dataset includes only that side of the trade. In such cases, the other counterparty is either located abroad (and may or may not be affiliated with EPEX) or located in France but affiliated with another NEMO. Consequently, the dataset is not exhaustive, as some trades in the French intraday market (for example, between two counterparties not affiliated with Epex) are not included (Figure 5). Nevertheless, this dataset provides a sample capturing the dynamic of the French intraday market because in 2024, the EPEX platform recorded approximately 20 TWh of traded volume, compared with a total of 24 TWh traded on the French intraday market. Data related to power mix, forecasts come from the Entso-e Transparency platform, whereas outage information has been retrieved from the RTE's Inside Information public platform.



TradeID	Side	NEMO	Country	Volume (MWh)	Price (€/MWh)
1	BUY	Epex	France	5	70
1	SELL	Epex	France	5	70
2	BUY	Epex	Belgium	3	65
2	SELL	Epex	France	3	65
3	BUY	Epex	France	4	63
3	SELL	other	France	4	63
4	BUY	other	France	5	64
4	SELL	other	France	5	64

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1	BUY	Epex	France	5	70
1	SELL	Epex	France	5	70
2	SELL	Epex	France	3	65
3	BUY	Epex	France	4	63

Figure 5: Illustration of intraday data availability depending on trade counterparties' affiliation and location

4.1 Variable of interest

For each trading session and product (hourly contract only), we retrieve data about volume exchanged, price level and volatility (Table 1). Each trade potentially gives rise to a new price. Price levels are captured by the mean and the median price over a session, whereas price volatility is represented by price standard deviation and median absolute deviation. Volume exchanged corresponds to the sum of individual trade volume, calculated according to the industry standard formula (Appendix A). As a result, a trade of 1MWh between a French market player and an international counterparty will be recorded as 0.5MWh in the French intraday market. However, a 1MWh trade between two French counterparties will be recorded as 1MWh in the French intraday market. We are also able to look at Buy and Sell volumes separately, which can be indicative of the market participant position (long or short) at the aggregate level. In those cases, we preserve the same volume calculation rule (total volume considered divided by 2), so a 1MWh of energy sold (or bought) by a French market player to any counterparty (local or international will be recorded as 0.5MWh in the French intraday market. This Buy and Sell split may be informative in capturing the cross-zonal trading dynamic regarding balancing needs in France and abroad. For example, a positive solar forecast error in France may increase the total traded volumes, but this information is of little help in analysing who has helped in balancing this solar error. However, if in this situation only sell volume increases, it may suggest that most of this solar surplus has been absorbed by foreign market players [4].

[4]because our initial dataset provides information to both parties (Buy and Sell) for a trade only if they are located in France and affiliated to Epex (but as already mentionned the vast majority of intraday trading in France is realised via Epex platform)

As a continuous market, the timing of information disclosure may also influence the intraday dynamics (Figure: 9). Not all trades benefit from the same level of information. Some information is known across the entire trading session, but its relevancy may decrease with time. For example, the Day-Ahead price is known at the beginning of the trading session. It may strongly influence the price of initial trades. However, as the session progresses, other information arises, such as updated renewables forecasts, and impacts the price level, making the Day-Ahead price less relevant. To account for heterogeneity in information availability throughout the trading session and its differentiated impact on trades executed at different times, we conduct our analysis through sub-samples encompassing different moments of the trading session. It allows us to capture the effect of information disclosure through time. Splitting our sample depending on the trading moment should help in understanding market player behavior regarding the processing of new information. We split our dataset into the following sub-samples according to their lead time relative to the start aof the delivery period: everithing except the last eight hours of trading (st480 sample), last four hours of the trading session (lt240 sample), last three hours (lt180 sample), last two hours (lt120 sample), last 90 minutes (lt90 sample), last 75 minutes (l75 sample), last 65 minutes (lt65 sample), and last 60 minutes (lt60 sample). Multiple sub-samples examine trades executed shortly before the final hour, aiming to capture the surge in trading activity driven by the withdrawal of cross-zonal capacities during the last 60 minutes. Additionally, we also analysed intraday dynamics over the full sample (FULL sample). No sub-sample is used for

the very first hour of trading (e.g., first six or eight, for example) because with such a division, most trading sessions exhibited no trade at all [5]. In addition, most of the trading activity for a product arises close to real-time. The sample st480 allows us to capture the market dynamic when being far from real-time, while preserving for the last product of the day a large timing window to avoid missing observations due to a lack of trades.

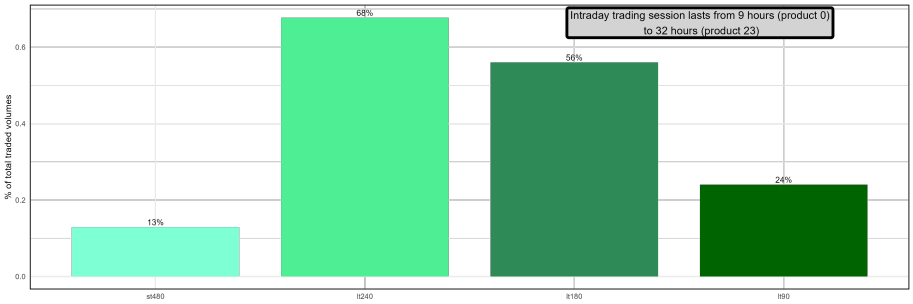


Figure 6: Average percentage of total traded for some sub-samples

4.2 Explanatory variable

4.2.1 Balancing needs

Balancing needs encompass forecast errors from renewables technologies (solar, wind onshore and offshore) and load. Outages and messages published by RTE regarding reserve capacity outlook are also identified as potential drivers of the intraday balancing needs.

[5] for example, in a sub-sample considering only trades on the first six hours of the trading session, 50% of sessions exhibited less than two trades

Forecast errors are built as the difference between the last available forecast and the day-ahead forecast. We do not compare the day-ahead forecast with actual observation since we want to capture forecast error related to weather only and not errors driven by economical optimization strategies arising from the market sequence (Equation 1). We further distinguish between positive and negative errors, as suggested in the literature to capture asymmetrical effect (Kulakov and Ziel, 2019; Soysal et al., 2017; Balardy, 2022). This split allows us to assess the respective effect of a surplus or a deficit of energy to balance on the intraday market dynamics (Figure 7).

$$FE_t = LastForecast_t - DayAheadForecast_t \tag{1}$$

$$FE_t^+ = \max\{FE_t, 0\} \tag{2}$$

$$FE_t^- = \max\{-FE_t, 0\} \tag{3}$$

We compute forecast errors for solar, wind onshore and load[6] in France. We also retrieved forecast errors from Germany, Belgium and Spain. For Germany and Belgium we have forecast errors for solar, wind onshore and offshore technologies, whereas Spain only relied on solar and wind onshore technologies in 2024. Correlation matrix between forecast error by direction and countries shows a strong correlation between onshore and offshore wind errors in Belgium, as well as between solar errors in Belgium and Germany. For Belgian wind, it can be explained by the reliance on a similar wind regime due to the proximity of onshore and offshore wind farms. For solar, the relatively similar latitude (which affects solar irradiance level) between

[6]for load we reverse the forecast error value to interpret a positive load forecast as a surplus of energy, like for generation technologies

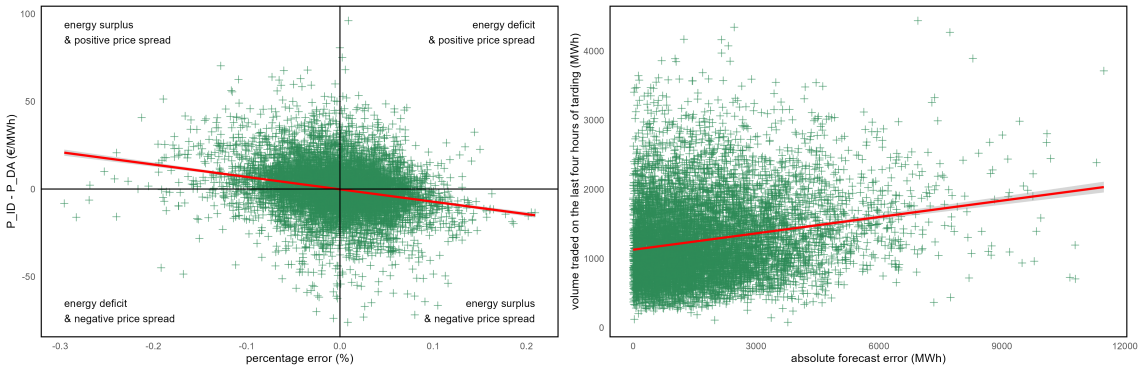


Figure 7: Links between total forecast error with spot prices spread and with intraday traded volumes

both countries can explain the high correlation level. Multicollinearity can affect the coefficients and standard error estimations. Therefore, we merge Belgian wind offshore and onshore forecast errors (first, we sum forecast errors and then split between positive and negative errors). Similarly, we sum solar forecast errors from Belgium and Germany.

$$
\begin{aligned}
Z_t = (&\text{SolarFR}_t^+,\ \text{SolarFR}_t^-,\ \text{WindOnshoreFR}_t^+,\ \text{WindOnshoreFR}_t^-,\\
&\text{LoadFR}_t^+,\ \text{LoadFR}_t^-,\ \text{SolarBE\_GE}_t^+,\ \text{SolarBE\_GE}_t^-,\\
&\text{WindOnshoreGE}_t^+,\ \text{WindOnshoreGE}_t^-,\ \text{WindOffshoreGE}_t^+,\ \text{WindOffshoreGE}_t^-,\\
&\text{WindBE}_t^+,\ \text{WindBE}_t^-,\text{WindOnshoreES}_t^+,\text{WindOnshoreES}_t^-,\\
&\text{SolarES}_t^+,\ \text{SolarES}_t^-)'
\end{aligned}
\tag{4}
$$

In addition to forecast errors, balancing needs are also influenced by unplanned outages. The unexpected nature of the outage is likely to influence the intraday market dynamics. If an outage lasts several days, we do not consider that it will

affect the intraday market during the entire period, since for the period where the day-ahead auction has not been done yet, we consider that the outage information will already be integrated in the day-ahead price formation and will not lead to additional adjustment on the intraday. Conversely, the outage will affect the intraday market for periods where the day-auction has already been done. Moreover, we split the total capacity unavailable according to the direction of the flexibility that is unavailable (upward or downward). When an outage at the plant level is reported, we analyze whether this plant was planned to produce according to the day-head price. For plants using fossil fuel, we approximate their marginal cost and compare it with the Day-Ahead price. For dams and pumped-storage plants, we approximate marginal costs by their opportunity cost, set just below the marginal cost of gas-fired generation.

Therefore, we distinguish two types of outages. The first type, called downward outage, is when an unplanned outage affects a plant that was planned to produce according to the Day-Ahead price. This kind of outage has a direct and an indirect effect on the intraday market. The direct effect corresponds to the need to buy extra energy during the intraday to cover the missing energy. The indirect effect corresponds to the fact that the unavailable plant would have been able to provide downward flexibility (reduce its output) during intraday to accommodate a potential surplus of energy at the system level. The second type of outage, called upward outage, is about plants that were not planned to produce according to the Day-Ahead price. This type of outage has an indirect effect on the intraday market. Those

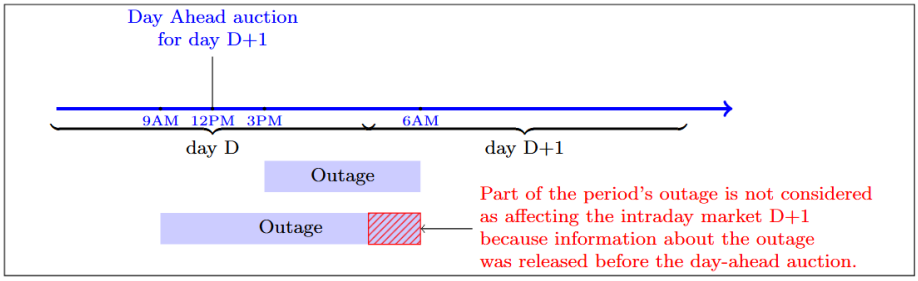


Figure 8: Period of outage influencing the intraday market

plants are no longer available to switch on during the intraday to provide upward flexibility in the case where the system has an energy deficit. Outage variables are expressed in MWh

Finally, we introduce a third set of variables that may influence balancing needs. This set represents messages published by RTE, signalling a lack of balancing capacity for some period. Two types of messages exist: alert and downgraded. Alert messages are commonly published the day preceding the period covered by the message, generally around 5 to 7 pm, thus after the day-ahead auction and several hours after the opening of the intraday market. Downgraded messages are published near real-time, meaning that the beginning of the period concerned by the downgraded message takes place at the same time as the publication of the information. Both types of message inform about the direction where reserve capacity may be lacking. Those messages aim to inform market players about a potential impact on imbalance settlement price and, therefore, may incentivize them to take additional balancing actions. The missing reserve capacity is not mentioned. We use four dummies to

differentiate the type of message and direction of missing capacity[7].

4.2.2 Flexible levies

In parallel with balancing needs, the level of short-term flexibility available can influence the dynamics of the intraday market.

As a proxy for flexibility in intraday markets, we estimate the elasticity of demand and supply on the day-ahead curve as proposed in Balardy (2022). These elasticities are estimated around the equilibrium point through the calculation of the slope at ±5% of the equilibrium quantity (Equations 5 & 6). On average, supply is more elastic than demand, though both are generally inelastic, with levels below 100%.

$$\frac{\Delta Q}{\Delta P} = \frac{(Q^* - 0.1 * Q^*) - (Q^* + 0.1 * Q^*)}{(P^*(Q^* - 0.1 * Q^*)) - (P^*(Q^* + 0.1 * Q^*))} \tag{5}$$

$$|\varepsilon| = \left| \frac{dQ}{dP} * \frac{P^*}{Q^*} \right| * 100 \tag{6}$$

In order to capture the available flexibility offered by interconnected countries, we retrieved data about the availability of interconnectors. At the hourly level, we retrieved the available import and export capacity for France. Import capacity (resp. export) represents the sum of import (resp. export) capacities between France and Belgium, Germany and Spain. When import capacities are available, a deficit of

[7]When an hour has been subject to both alert and downgraded messages, we code the downgraded message dummy to 0 to only capture through downgraded dummies messages without prior public information available for market players

energy in France can be filled by upward flexibility located abroad. Additionally, import capacity also gives the opportunity for the French downward flexibilities to absorb a surplus of energy occurring in neighbouring countries. On the other hand, export capacity allows for the exportation of a surplus of energy occurring in France, as well as activation of upward flexibility in France to absorb a deficit located abroad. Throughout a trading session, the level of interconnection capacities available may vary according to the evolution of transmission constraints faced by TSOs and also by the capacity used by intraday trades themselves. Therefore, the level of available import/export capacities may drastically vary between the start and the end of the session. The interconnected capacities in this work reflect the remaining capcaity available at the end of each session (further discussion on appendix B.1).

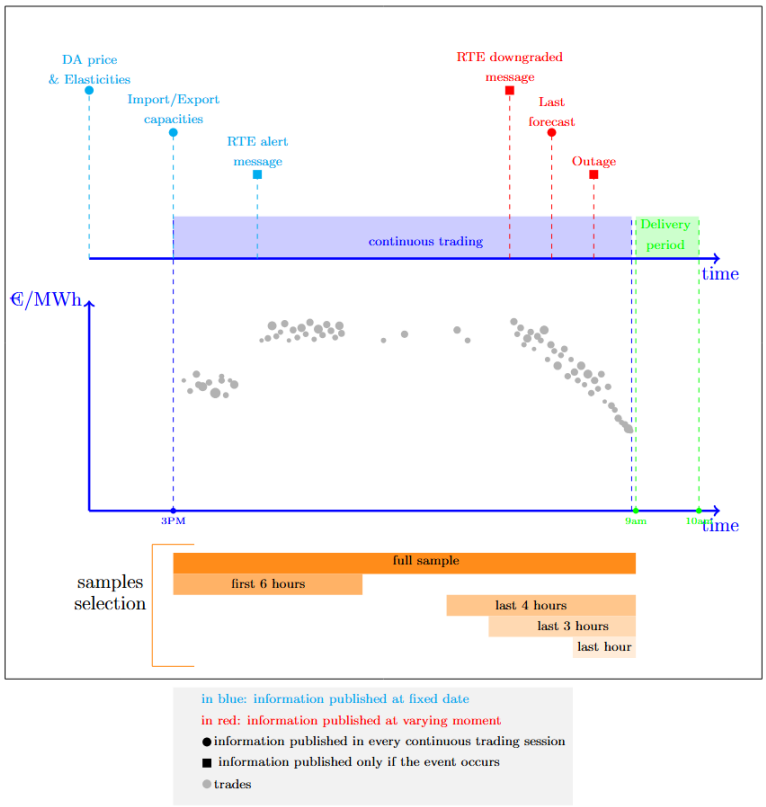


Figure 9: Information disclosure and market dynamics heterogeneity

4.3 Econometric approach

Panel data methods can address the nature of our hourly dataset. In this regard, hourly products[8] can be seen as individuals i and the day of delivery as a time index t. Panel data methods help control for the unobserved time-invariant effect. Such individual time-invariant heterogeneity is suggested by the graphical observation of median and 1st and 3rd quantiles distribution by product (Figure 10). To assess the presence of a fixed or random effect in our panel dataset, we first assess the presence

[8]product 0 corresponds to intraday electricity trading for the 0 am - 1 am delivery period, with subsequent products referring to the following hourly delivery intervals

of a fixed effect on the pooled OLS specification using the Honda Lagrange Multiplier test. Then, to choose between fixed or random specification, we rely on the Mundlak test.

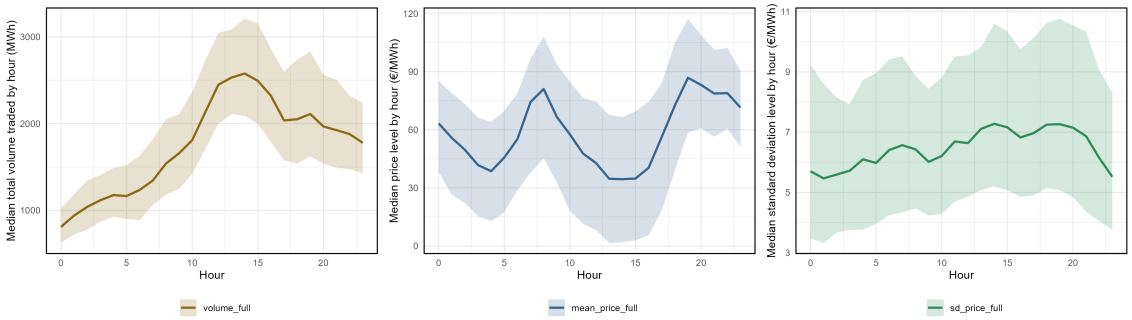


Figure 10: Hourly median, 1st and 3rd quantiles of intraday quantity, price level and volatility considering full trades sample

We further test for the presence of correlation and heteroskedasticity in our regressions. Breusch–Godfrey tests are used to control the potential presence of within-group correlation, whereas potential cross-sectional correlation is detected through Breusch-Pagan LM tests. Finally, the presence of heteroskedasticity is tested via the Breusch-Pagan test. The presence of correlation and/or heteroskedasticity creates a bias in the estimation of standard errors. To overcome this issue, we use Driscoll and Kraay standard errors that are robust to correlation and heteroskedasticity. Additionally, to assess the intraday market dynamic accross different moments of the trading session, our econometric analysis is split between daily and night products. In the daily specification, we only include products corresponding to solar hours (products 9 to 17 included). Night sample corresponds to all other hours. Such a split allows us to study the solar effect only when it actually affects the intraday mar-

ket and avoid any time invariant variable in our regression [9]. Therefore, we estimate the role of fundamentals on seven variables of interest (total volumes traded, Buy volumes, Sell volumes, median price, mean price, standard error, median absolute deviation). For every variable of interest, the relationship is estimated on the nine differents sub samples capturing different moments of the trading session. For each sub-sample, there are two regressions, one focusing on daily products and the others on night products. Therefore, a total of $7 * 9 * 2 = 126$ models are reported. In each case, the specification (random effects or fixed effects) is selected based on the corresponding test results.

Finally, prior to running our regression, we have to control the stationarity of our series. We run Levin-Li-Chu and Hadri tests for all our variables in level. Results suggest that all series are stationary.

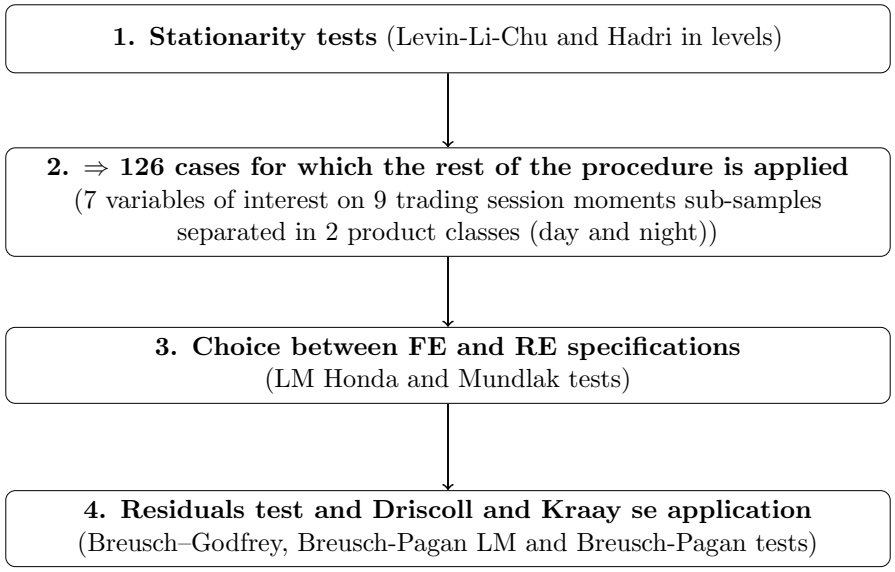


Figure 11: Modeling procedure

[9] which would have been the case by using solar variables to explain the night products dynamic

4.4 Specifications

$$\begin{aligned}\text{Volume}_{i,t} = \beta_0 + \beta_{1:23} Z'_t + \beta_{24}\,\text{outage}_t^- + \beta_{25}\,\text{Import}_t + \beta_{26}\,\text{Export}_t \\ \beta_{27}\,\text{alert}_t^+ + \beta_{28}\,\text{alert}_t^- + \beta_{29}\,\text{downgraded}_t^+ + \beta_{30}\,\text{downgraded}_t^- \\ \beta_{31}\,\text{load}_t + \beta_{32}\,\text{ida\_intro}_t + \varepsilon_{i,t},\end{aligned} \tag{7}$$

$$\begin{aligned}\text{Price level}_{i,t} = \beta_0 + \beta_{1:23} Z'_t + \beta_{24}\,\text{outage}_t^- + \beta_{25}\,\text{Import}_t + \beta_{26}\,\text{Export}_t \\ \beta_{27}\,\text{alert}_t^+ + \beta_{28}\,\text{alert}_t^- + \beta_{29}\,\text{downgraded}_t^+ + \beta_{30}\,\text{downgraded}_t^- \\ +\beta_{31}\,\text{DA\_price}_t + \varepsilon_{i,t},\end{aligned} \tag{8}$$

$$\begin{aligned}\text{Price volatility}_{i,t} = \beta_0 + \beta_{1:23} Z'_t + \beta_{24}\,\text{outage}_t^{total} + \beta_{25}\,\text{Import}_t + \beta_{26}\,\text{Export}_t \\ \beta_{27}\,\text{alert}_t^+ + \beta_{28}\,\text{alert}_t^- + \beta_{29}\,\text{downgraded}_t^+ + \beta_{30}\,\text{downgraded}_t^- \\ \beta_{31}\,\varepsilon\text{\_demand}_t^+ + \beta_{32}\,\varepsilon\text{\_supply}_t^+ \qquad (9) \\ \beta_{33}\,\text{DA\_price}_t + \beta_{34}\,\text{ida\_intro}_t + \varepsilon_{i,t}, \qquad (10)\end{aligned}$$

5 Preliminary results

Regression results are displayed in Appendix C.

5.1 Volumes

All specifications retained for the volume regressions are fixed-effects models. The fixed-effects specification controls for time-invariant factors affecting traded volumes, such as higher trading activity for products corresponding to solar hours due to balancing needs by solar forecast errors, or for products far from the day-ahead auction,

which tend to exhibit greater trading needs because of lower forecast accuracy.

5.1.1 Total traded volumes

Positive and negative forecast errors from French solar plants have different effects on total volume traded. Surpluses are less intensively traded than negative errors. The negative effect on total volumes is persistent throughout most of the trading session, with only sub-samples for the last 65 minutes or less having no significant effect. Regarding errors from French onshore wind plants, we observe in most sub-samples no significant effects on daily products. Focusing on the night products, we observe that both positive and negative wind onshore errors in France tend to increase total traded volumes in most cases. Overall, we do not observe a clear difference in the effect of positive and negative French wind onshore errors at the level of trading activity. Those results on French renewables technologies highlight an asymmetrical effect only for solar errors, with solar short positions (energy deficit) leading to more traded volumes than long ones (Figure 12).

French positive load forecast errors tend to raise traded volumes in both daily and night samples, whereas negative errors have a significant effect on total volume, mainly in night hours. The asymmetric effect, although present for daily products, is less pronounced than for French solar power (and operates in the opposite direction). A 100 MWh positive error from French load leads to an increase in traded volumes on the last fours hours of the trading session for daily products by 5MWh.

The direction of forecast errors from renewables generators located abroad has no significant effect on total traded volume during the day for most sub-samples. During the night, negative forecast errors from onshore wind in Germany and Spain, as well as negative forecast errors from Belgian wind plants, tend to increase total traded volumes in France.

As expected, unplanned outages on plants scheduled to produce tend to increase total traded volume on intraday.
Availability of export capacity is associated with greater traded volumes for daily products, with the effect only present at night for some sub-samples. Increasing import capacities has no effect during the day but a slightly negative effect in most sub-samples during the night.

Alert messages in both directions do not affect the total volume traded in all hours. For downgraded messages (in both directions), they have a significant effect on the trading activity of daily products, but affect the total traded volume of night products only when the message is for a lack of upward capacity. Interestingly, when significant, the effect on total volume is larger when considering the full sample than sub-samples closer to real-time, despite the fact that such messages are published close to real-time. Our results may illustrate some anticipation from players regarding the publication of downgraded messages by the TSO. In addition, hours associated with negative day-ahead prices show a greater volume traded, mainly at the beginning of the session. The introduction of pan-European auctions tends to

slightly decrease the trading activity close to real-time for night products.

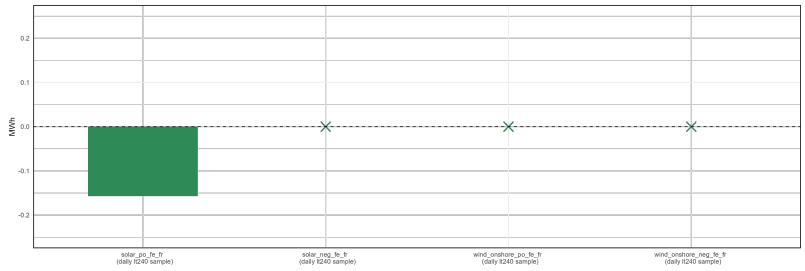


Figure 12: French renewables errors effects on total traded volumes

5.1.2 Buy & Sell volumes

Analysis of volume through the decomposition of total traded volume between Buy and Sell volumes illustrates even more the balancing purpose of the intraday market. Regarding solar forecast errors, total volume results are not particularly steered by Buy or Sell volumes, with the negative effect on volumes relative to positive solar error present for both Buy and Sell sub-samples. For the French wind onshore forecast error, the results reflect the expected market position. Negative wind onshore errors in France create an energy need. In turn, it increases Buy volumes for all products. It reflects the need for additional energy, leading wind plants to adopt a buy position intraday to absorb their energy deficit. Conversely, a surplus of onshore wind in France is associated with greater Sell volumes (during the night hours), showing how the intraday market can help wind market players in selling their energy surplus (Figure 13). Since Buy volumes are not affected by French onshore positive errors and Sell volumes by French onshore negative errors, it illustrates the fact that these errors are absorbed via international trading with counterparties located abroad (or

from another NEMO). The same logic is also at work for international wind negative errors. Those errors increase Sell volumes in France, showing that French (upward) flexibility is mobilized via intraday trading to absorb the international energy deficit from wind plants. Outages on plants scheduled to produce drive Buy and Sell volumes up for all hours. The magnitude of the effect is slightly higher for Buy volumes, which may illustrate that part of the energy deficit relative to outages is balanced using foreign flexibility.

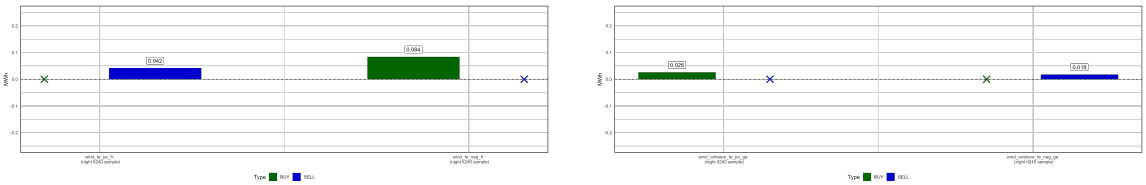
Results on the effect of foreign forecast errors on the volumes traded (total, Buy and Sell) on the French market can be linked to results on the effect on import / export capacities. It seems that the French market is used to cope with the deficit of wind generation in Belgium, Germany and Spain. In turn, this upward energy increase Sell volumes in France and requires export capacities to be effectively offered to foreign counterparties. Therefore, it is consistent that an increase in export capacities is associated with greater total volumes traded (the latter being driven in particular by higher Sell volumes). In fact, we observe that a higher level of available export capacity is linked with greater Sell volumes but has no effect on Buy volumes. Import capacities have a significant effect on Buy volumes and no effect on Sell volumes, which is coherent since French imports in intraday can only be realized when a French buyer receives energy from an international seller. The negative effect of import capacity on Buy volumes (with the effect also present on total traded volumes) could be the result of two effects. First, as we have seen, when international renewables plants experience a surplus of energy in intraday, they do not tend to rely on French downward flexibility. Second, higher interconnectors' capacities may

be associated with moments where France did rely too much on imports, so it was able to deal internally with downward need in intraday.

As for the total traded volumes, alert messages have no significant effect on either Buy or Sell volumes in most cases, except for a negative effect in most sub-samples for Buy volumes at night for downward alert messages. It may illustrate the fact that, due to expected low imbalance price, some market players with a short position prefer to keep this position on real-time instead of buying energy on intraday in order to benefit from an even lower price (and by doing so, helping the TSO to balance the system by implicitly providing downward energy). Concerning upward downgraded messages, they affect Buy and Sell volumes in most cases. An upward downgraded message leads to an increase in the same proportion of Buy and Sell volumes (in all hours). It illustrates the fact that buyers seeking to avoid high imbalance prices find an upward flexibility provider located in France (in turn increasing Sell volumes as well). For downgraded messages for a lack of downward capacity, it mainly drives up Sell volumes during the day, showing that market players with an energy surplus try to avoid a low imbalance price. There is no clear effect at night of a downward downgraded message on Buy volumes, suggesting that the energy surplus is absorbed via international downward capacities.

Negative day-ahead hours lead to increases in both Buy and Sell volumes, although the impact is more pronounced for Buy volumes. This result shows that due to the curtailment of some renewable plants (those under the "Complément de Rémunération" scheme), some market players have to buy extra energy on the market to balance their portfolio. As the increase in Sell volume is not equivalent, some of the upward

energy is covered by international market players. The introduction of pan-European auctions reduces near real-time trading activity for Buy and Sell volumes at night, with a slightly stronger impact on Buy volumes.



(a) French wind onshore error (b) German wind onshore error

Figure 13: Effects of French and German wind onshore errors on Buy and Sell volumes

5.2 Price level

Results on median and mean price are very close. For the daily product samples random effect model is preferred for the full session sample and the following sub-samples: st480, lt240, lt180, and lt120. Otherwise, the fixed effect model is chosen. For night products, the random model is used for the median or mean price model only on the full sample and st480 sub-sample, with fixed effect models preferred for all subsamples. We focus our comments on the median price outputs since the results on the mean price regressions are very similar.

Positive forecast errors from French solar and wind onshore production lead to lower intraday prices, with a greater magnitude of the effect for solar (Figure 14). Negative errors from these sources have no significant effect on the price level except for wind onshore negative errors that tend to increase the price level for night products. Only the negative French load error has a positive effect on price level, with a magnitude

similar to the one from wind onshore error (around 0.2-0.3€/MWh for every 100 MWh of error). Foreign forecast errors are either insignificant or have the expected effect on price level (positive errors lowering price and negative errors increasing price level). We can, in particular, underline the large effect of positive forecast error from the Belgian wind plants at night. A 100MWh positive error from these plants reduces the price level by approximately 0.9 to 2.9€/MWh, with the effect exacerbated close to real-time.

Prices increase by 0.2 to 05€/MWh every 100 MWh of outages on plants scheduled for all hours.

Increased export capacities do not affect the price level, while more import capacities slightly lower the price level for all products (<0.1€/MWh for 100MW of capacity). This negative effect is consistent with the theoretical effect of imports on the local price level. In fact, import capacity gives the opportunity for France to benefit from foreign upward flexibility in case of intraday energy deficit. If used, this foreign upward flexibility is expected to be at a lower price than local upward flexibility, increasing intraday price but less or at the same magnitude as if local upward flexibility had been used. The second option offered by import capacity is for French downward flexibility, which can be offered to cover the foreign surplus of energy. In the case of downward flexibility activation in France to cover foreign intraday surplus, intraday prices are likely to drop, compared to a situation where the foreign surplus is absorbed abroad and no additional activation occurs in France. These two effects are likely to decrease the intraday price (at least not increase it) and are the explanation of the observed negative effect of additional import capacities on the

French intraday price. A similar reasoning for export capacities justifies theoretically the bullish (at least not bearish) effect of additional export capacities on the local intraday price.

Only alert messages for a lack of upward reserve capacity affect prices. Session with upward alert messages experienced a surge in price of around 7€/MWh for daily products and 6€/MWh for night products. Only downward downgraded messages affect the price level. On average, sessions featuring such messages have a price level around 10-11€/MWh lower for both day and night products.

Finally, the day-ahead price tends to be higher than the intraday price for all products, confirming a trend already observed in previous case studies.

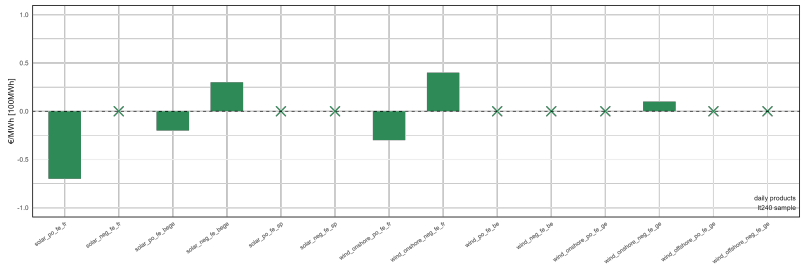


Figure 14: Effects of errors by technology, direction and country on median price of daily products

5.3 Price volatility

Fixed effect specification is always chosen when studying the standard deviation or the median absolute deviation. Directions of effects are very similar between regressions on standard deviation and median absolute deviation. However, since standard error is more sensitive to extreme values, the magnitude of effects is exacerbated in those regressions.

The effects of forecast errors on intraday price volatility are mixed. Most of the forecast errors have no significant effect, some have a positive impact, whereas others have a negative impact. Those mixed effects can be explained by the fact that forecast errors bring additional uncertainty on intraday, thus increasing the price volatility. However, on the other hand, forecast errors create new trading needs, therefore feeding the market depth and lowering bid-ask spread (Balardy, 2022). The same logic applies to outages, which can be considered as a forecast error as well. For volatility models, we bulk all outage types in a single variable named *outage_total*. No significant effect appears on price volatility from outages.

Increasing export capacities slightly lowers price volatility for night products, but the effect is not significant for daily products. No effect of import capacities is found for all products.

Upward alert and downward downgraded messages feed the price volatility of daily products; otherwise, there are no consistent effects of RTE messages.

The more the offer is elastic, the less the prices are volatile at night, with the trend also observed for daily products when considering median absolute deviation for sub-

samples close to real-time. Finally, the introduction of the Pan-European auction seems to have increased price volatility for all products, but only during the last minutes of the trading session.

6 Discussion

Our analysis illustrates the central role played by supply/demand fundamentals in the intraday market dynamics. They highlight the adjustment role played by the French intraday market in the balancing phase of the French power system and more broadly at the European level. Despite a unique imbalance pricing scheme, the French intraday market is able to clearly indicate balancing requirements in real time. In addition, our findings clearly illustrate the upward balancing role at the European level played by the French power system. Finally, recent changes in intraday market design have impacted the dynamic of the intraday market in real-time, notably relative to inflated volatility. However, we show that other levies can also smooth the volatility level on the intraday continuous market.

6.1 A market reflecting balancing needs

Incentives for French market players to actively participate in the balancing phase are, in theory, lower than in other countries due to the proactive approach in place (Håberg and Doorman, 2016). However, physical balancing needs are surprisingly accurately translated in the intraday market. Volumes traded, and the position adopted by French market players (Buy or Sell), reflect the system balancing need

arising from forecast errors.

Additionally, the sensitivity of prices to forecast errors and to RTE messages (in particular to downgraded messages) is in line with the expectation of a well-functioning market. Market information efficiency can be defined as the ability of the price to immediately reflect all information available (Fama, 1970). In this regard, our findings show that the French intraday price manages to convey the information relative to a change in the demand / supply equilibrium.

However, our results also illustrate some market distortions relative to the renewables support scheme. We find that in terms of traded volumes, negative errors from French solar and wind onshore production are balanced with more intensity than positive errors. These results are in line with studies on subsequent markets that also find this asymmetrical effect Deman and Boucher (2023); Richard and Solier (2025). A central explanation of such asymetry arise from the fact that most renewable plants are backed by pay-as-produced support schemes that are lowering their incentives to curtail their output even when there is an overproduction situation at the system level (Kitzing et al., 2024).

6.2 A well-integrated market at the European level

Our case study on the continuous intraday market for 2024 is informative about the interdependence of European power systems and the influence of market design changes on market dynamics. We show that French wind onshore errors are partially balanced through upward and downward flexibility activated abroad, thanks to the connection of European continuous markets. On the other hand, our results demon-

strate the balancing role of the French power system in particular, relatively to the supply of upward energy in moments of wind deficit abroad. This export position on the intraday stage can be linked to the fact that France has a large installed capacity of dams and pumped storage units that are able to quickly provide upward energy and that benefit from a level of water storage. Interestingly, this upward energy provider position on the intraday market of the French market player coincides with a record-breaking year in terms of power exportation from the French system at an aggregated level. Moreover, our findings highlight the fact that in moments of energy abundance (negative day-ahead prices), France is prone to importing energy to cover its upward energy needs.

Finally, the study of different market dimensions allows for capturing the effect of the change of auction market design on the continuous stage. With the deployment of pan-European auctions, with the second and third auctions now close to the start of some delivery periods, market players are realizing less trade close to real time on the continuous stage. Another consequence is a rise in price volatility close to real-time. This rise is driven by a reduced need for exchange, which results in fewer active participants on the continuous market. It is also reinforced by the use of interconnections during auctions, which limits access to international resources on the continuous market when capacities have already been allocated via auctions. However, our results underline other levels to smooth the volatility level on the continuous market. Notably, we show that a greater elasticity on the supply side is an important driver of intraday price volatility. Therefore, deployment of flexible assets, in particular battery storage, appears as a relevant option for market players to deal

with short-term balancing risk management.

7 Conclusion

In this paper, we analyze the role of supply and demand fundamentals in shaping the French continuous intraday market dynamics, which is embedded in a unique balancing philosophy in Europe. Using a panel data econometrics approach, we look at the evolution of traded volume, price level and volatility for different moments of the trading period. Early results highlight the central role played by renewables forecast error regarding price formation. Intraday adjustment from French solar and wind onshore producers tends to be larger for negative forecast error, confirming an asymmetric effect already observed in subsequent markets. Additionally, we underline the key role played by the French power system that provides short-term upward energy to ensure equilibrium in the balancing phase. Finally, this work offers relatively new findings into volatility drivers in the continuous intraday market, providing market players with useful ways to manage the risk in the balancing phase.

APPENDICES

A Variable of interest calculation

We access the trade dataset from Epex. This dataset regroups every trade realized by a seller or a buyer located in France and affiliated with Epex. Therefore, when a buyer and a seller are both located in France and affiliated with Epex, the same trade is entered twice. In order to calculate volume traded on the French intraday market, Epex applies the industry standard formula, consisting of aggregating buy and sell volumes and dividing by two. With this approach, a trade is not double-counted. Additional, only half of the volume trade with an international counterparty (or another NEMO) is accounted for in the total traded volume in France. We apply this standard approach for volume to our different lead time filters (full session, h-4, h-1). Additionnaly we also analyse the sum of BUY and SELL volumes separatly. This approach cannot be followed for price level and volatility calculation since the weight of a trade with two counterparty in France would count twice. Therefore, before calculating the weighted average price and standard error, we remove duplicates when two rows have the same trade ID (indicating that both buyer and seller were located in France). Once duplicates are removed, weighted averages and standard errors are calculated only by applying lead time filters.

Figure 15: Dataset selection before variable of interest calculations

Table 1: Descriptive statistics of variables of interest

Variable	mean	sd	min	max	skew	kurtosis	n
volume_full	1868.710	910.648	243.650	5892.300	0.935	0.981	8784
volume_st480	241.899	344.634	0.000	5616.100	4.456	37.868	8784
volume_lt240	1265.931	579.008	77.350	4436.900	1.096	1.580	8784
volume_lt180	1046.559	477.004	0.000	3628.150	1.079	1.599	8784
volume_lt120	688.151	322.075	0.000	2567.050	1.108	1.868	8784
volume_lt90	449.255	221.692	0.000	1788.900	1.217	2.405	8784
volume_lt75	250.721	137.658	0.000	1233.300	1.269	2.790	8784
volume_lt65	117.344	84.863	0.000	828.350	1.613	4.510	8784
volume_lt60	46.507	58.991	0.000	649.500	2.592	10.642	8784
BUY_full	952.609	492.680	97.400	4468.900	1.265	2.955	8784
BUY_st480	115.628	160.786	0.000	1907.250	2.989	14.543	8784
BUY_lt240	651.693	315.062	36.450	3241.500	1.165	2.063	8784
BUY_lt180	542.695	263.858	0.000	2089.050	1.105	1.691	8784
BUY_lt120	361.477	184.592	0.000	1641.950	1.138	1.989	8784
BUY_lt90	238.362	130.845	0.000	1060.000	1.280	2.581	8784
BUY_lt75	133.772	82.154	0.000	779.350	1.291	2.634	8784
BUY_lt65	61.986	47.440	0.000	418.850	1.513	3.653	8784
BUY_lt60	23.259	29.514	0.000	327.250	2.599	10.734	8784
SELL_full	927.177	525.370	83.250	5621.300	2.103	11.097	8784
SELL_st480	126.270	219.013	0.000	4116.950	7.371	93.564	8784
SELL_lt240	614.687	315.600	18.400	3460.600	1.343	3.125	8784
SELL_lt180	503.864	259.881	0.000	2447.300	1.301	2.691	8784
SELL_lt120	326.675	178.195	0.000	1940.800	1.405	3.497	8784
SELL_lt90	210.893	122.361	0.000	1380.650	1.447	3.790	8784
SELL_lt75	116.948	74.652	0.000	736.550	1.515	4.000	8784
SELL_lt65	55.358	44.090	0.000	412.650	1.647	4.721	8784
SELL_lt60	23.248	29.488	0.000	322.250	2.586	10.567	8784
median_price_full	58.007	41.801	-50.000	296.160	0.273	0.047	8784
median_price_st480	58.832	41.114	-50.000	306.720	0.354	0.498	8784
median_price_lt240	57.856	42.125	-49.760	337.890	0.250	-0.003	8784
median_price_lt180	57.906	42.303	-50.000	336.780	0.257	0.012	8784
median_price_lt120	58.170	42.614	-49.000	321.870	0.234	-0.064	8784
median_price_lt90	58.309	43.009	-50.000	284.990	0.218	-0.104	8784
median_price_lt75	58.256	43.613	-50.000	285.000	0.222	-0.054	8784
median_price_lt65	58.433	43.936	-50.000	308.740	0.261	0.109	8784
median_price_lt60	60.214	51.612	-50.000	1900.000	5.690	184.850	8784
mean_price_full	58.070	41.753	-49.406	306.774	0.278	0.096	8784
mean_price_st480	58.961	41.019	-48.591	315.109	0.369	0.596	8784
mean_price_lt240	57.822	42.136	-48.243	327.701	0.259	0.003	8784
mean_price_lt180	57.855	42.339	-49.510	325.783	0.257	-0.003	8784
mean_price_lt120	58.102	42.659	-49.857	313.865	0.240	-0.053	8784
mean_price_lt90	58.252	43.103	-49.987	296.299	0.225	-0.063	8784
mean_price_lt75	58.427	43.536	-48.379	278.132	0.237	-0.023	8784
mean_price_lt65	58.729	44.233	-49.937	317.698	0.295	0.275	8784
mean_price_lt60	60.585	52.296	-50.000	1900.000	5.878	180.815	8784
sd_price_full	7.786	5.958	0.795	99.639	5.010	48.137	8784
sd_price_st480	4.408	4.226	0.000	89.293	4.037	40.609	8784
sd_price_lt240	6.899	5.811	0.788	97.985	5.565	54.587	8784
sd_price_lt180	6.683	5.825	0.705	96.678	5.763	56.878	8784
sd_price_lt120	6.386	5.865	0.594	98.074	6.103	63.587	8784
sd_price_lt90	6.340	6.019	0.512	97.197	5.826	57.932	8784
sd_price_lt75	6.742	6.448	0.257	87.682	4.757	37.910	8784
sd_price_lt65	7.903	7.808	0.000	98.039	3.972	25.751	8784
sd_price_lt60	8.073	9.408	0.000	99.988	3.276	16.814	8784
mad_price_full	6.585	5.274	0.326	83.604	3.762	28.088	8784
mad_price_st480	3.180	3.640	0.000	65.783	3.338	23.814	8784
mad_price_lt240	5.774	5.069	0.089	92.425	5.019	51.575	8784
mad_price_lt180	5.459	4.938	0.104	96.354	5.454	61.227	8784
mad_price_lt120	4.750	4.348	0.000	96.354	5.497	66.502	8784
mad_price_lt90	4.238	3.918	0.000	66.539	4.032	34.089	8784
mad_price_lt75	4.089	4.237	0.000	92.092	5.172	59.931	8784
mad_price_lt65	4.115	5.378	0.000	90.439	5.110	49.898	8784
mad_price_lt60	4.198	8.400	0.000	95.435	4.274	25.999	8784

B Independant variables

Table 2: Descriptive statistics including skewness and kurtosis

Variable	mean	sd	min	max	skew	kurtosis	n
solar_fe_fr_clean	38.626	287.509	-1148.00	1313.000	0.608	4.748	8784
wind_onshore_fe_fr_clean	137.816	607.791	-2061.00	2315.000	0.333	1.353	8784
load_fe_fr_clean	-15.823	1029.344	-4005.50	4000.000	0.001	1.329	8784
wind_onshore_fe_ge_clean	-84.363	1202.654	-4306.75	4129.750	-0.190	1.172	8784
wind_offshore_fe_ge_clean	-79.727	602.547	-2188.50	2106.000	-0.488	1.349	8784
solar_fe_bege_clean	-67.178	816.963	-4337.25	3925.400	-0.452	5.494	8784
wind_fe_be_clean	1.627	178.383	-657.00	676.000	-0.006	1.078	8784
solar_fe_sp_clean	-46.885	498.635	-2437.65	2330.275	-0.698	5.483	8784
wind_onshore_fe_sp_clean	27.425	791.381	-2850.00	2923.500	-0.372	1.654	8784
outage_down	379.653	598.312	0.00	4232.000	1.866	3.369	8784
outage_up	198.589	432.606	0.00	4695.000	3.727	18.434	8784
message_alert_up	0.013	0.113	0.00	1.000	8.644	72.730	8784
message_alert_down	0.044	0.205	0.00	1.000	4.443	17.739	8784
message_downgraded_up_no_alert	0.047	0.211	0.00	1.000	4.297	16.469	8784
message_downgraded_down_no_alert	0.037	0.188	0.00	1.000	4.939	22.397	8784
export_to_all_clean	3399.932	2902.874	0.00	13400.500	0.609	-0.172	8784
import_from_all_clean	5471.887	2770.777	0.00	12787.800	0.239	-0.294	8784
e_offre_p5_clean	25.329	24.312	0.00	121.446	1.591	2.689	8784
e_demande_p5_clean	7.906	8.800	0.00	44.083	1.915	4.079	8784
DA_price	58.013	40.660	-87.29	284.210	0.338	0.445	8784

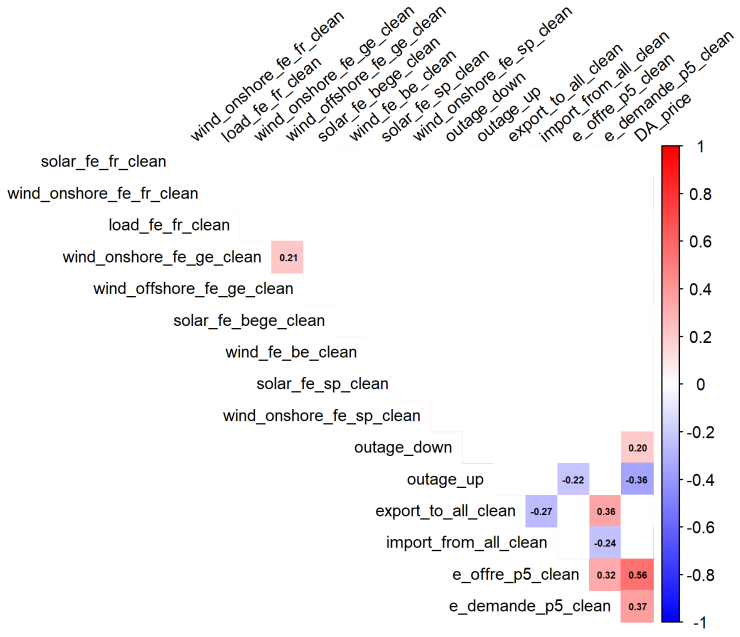


Figure 16: Correlation heatmap

B.1 Interconnection availability calculation

The available interconnection capacity is a variable that evolves throughout the trading session. The more international trades are realized, the less available interconnection capacity remains. Additionally, evolving constraints on the national grid level are likely to influence the available interconnection capacity. Unfortunately, we were unable to retrieve all updates of available interconnection capacities. Instead, we accessed a single value or at the very first updates. Our analysis is based on this single value[10]. This information is displayed at the half-hourly level. We manually compared this single value with the time series of the first updates[11]. As illustrated in Figure 17, we observe that our single value is systematically lower than the first updated values. It tends to underline the fact that our single observation represents the available capacity at the end of the continuous trading session.

Additionally, as we have capacity at the half-hourly level but our focus is on hourly products, we aggregate the capacity for the two half-hours of the same hour by keeping the minimum of both capacities, since this is the one that sets the constraint for international trade for hourly products.

By construction, the level of interconnection capacities available in intraday may vary according to the evolution of transmission constraints faced by TSOs and also by the capacity used by intraday trades themselves. Therefore, the level of available import/export capacities may drastically vary between the start and the end of the

[10] available at: https://newtransparency.entsoe.eu/market/allocation/continuous/offeredCapacity
[11] available at: https://newtransparency.entsoe.eu/market/allocation/continuous/ocEvolution

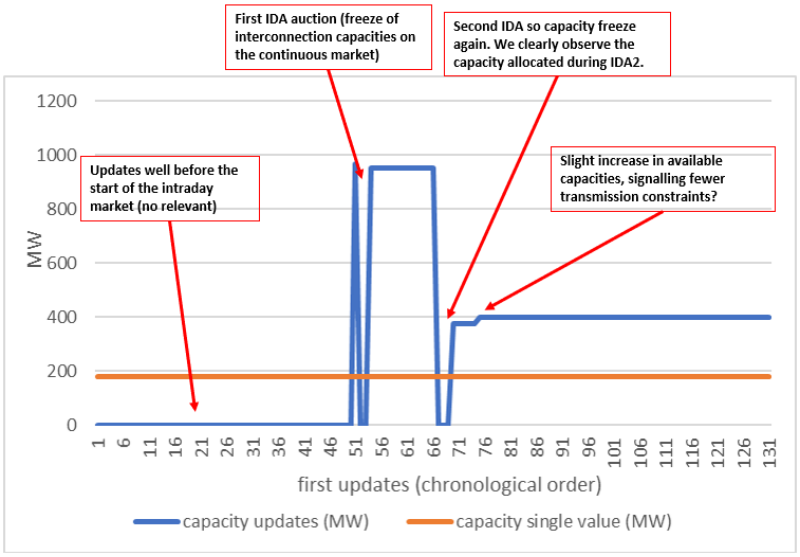


Figure 17: Available capacity updates and single value for the half-hour starting at 11:30 pm on October the 3th 2024

session. When uploading interconnector capacities data for the same border, several versions of the time series can be available, but this is not always the case. We didn't manage to retrieve the full historical updates of the capacity, and we are unable to access the latest capacity updates. We compare our own capacity value with the first update manually, we observe that our data is systematically lower than the one from the first capacity update, suggesting our data reflects the remaining interconnector capacities at the end of the intraday trading session. However, we must also point out that available capacity can increase throughout updates.

We retrieved a single observation of available capacity per border and direction at the half-hourly level. The hourly capacity corresponds to the minimum capacity of the two half-hours of the corresponding hour, since it represents the interconnector constraint for the trading of hourly product.

C Model results

	FE volume_full	FE volume_st480	FE volume_lt240	FE volume_lt180	FE volume_lt120	FE volume_lt90	FE volume_lt75	FE volume_lt65	FE volume_lt60
solar_fe_po_fr_clean	**-0.203***	**-0.007**	**-0.157****	**-0.135****	**-0.088****	**-0.048***	**-0.028***	**-0.005**	**-0.002**
	(0.090)	(0.034)	(0.059)	(0.048)	(0.033)	(0.022)	(0.013)	(0.007)	(0.006)
solar_fe_neg_fr_clean	**-0.061**	**-0.001**	**-0.024**	**-0.014**	**0.000**	**-0.004**	**-0.004**	**-0.004**	**-0.001**
	(0.111)	(0.033)	(0.075)	(0.065)	(0.043)	(0.026)	(0.016)	(0.010)	(0.007)
wind_onshore_fe_po_fr_clean	**0.004**	**-0.025**	**0.021**	**0.006**	**-0.008**	**0.004**	**0.002**	**-0.001**	**-0.001**
	(0.063)	(0.022)	(0.041)	(0.030)	(0.020)	(0.013)	(0.008)	(0.005)	(0.004)
wind_onshore_fe_neg_fr_clean	**0.075**	**-0.023**	**0.086**	**0.075**	**0.053**	**0.043***	**0.024+**	**0.007**	**0.001**
	(0.080)	(0.023)	(0.060)	(0.049)	(0.034)	(0.022)	(0.013)	(0.007)	(0.004)
solar_fe_po_bege_clean	**-0.020**	**-0.007**	**-0.006**	**-0.002**	**-0.006**	**-0.002**	**-0.002**	**-0.002**	**0.001**
	(0.041)	(0.010)	(0.031)	(0.024)	(0.014)	(0.009)	(0.006)	(0.004)	(0.003)
solar_fe_neg_bege_clean	**0.012**	**0.001**	**0.010**	**0.010**	**0.006**	**0.003**	**-0.000**	**-0.002**	**-0.000**
	(0.039)	(0.011)	(0.027)	(0.022)	(0.014)	(0.009)	(0.005)	(0.003)	(0.002)
wind_onshore_fe_po_ge_clean	**0.035**	**0.004**	**0.000**	**0.006**	**0.005**	**0.006**	**0.000**	**-0.001**	**-0.001**
	(0.039)	(0.010)	(0.024)	(0.021)	(0.014)	(0.010)	(0.006)	(0.003)	(0.002)
wind_onshore_fe_neg_ge_clean	**0.081+**	**0.029***	**0.036**	**0.026**	**0.017**	**0.014**	**0.007**	**0.006**	**0.004**
	(0.043)	(0.013)	(0.027)	(0.021)	(0.013)	(0.009)	(0.006)	(0.004)	(0.003)
wind_offshore_fe_po_ge_clean	**0.111**	**0.011**	**0.057**	**0.035**	**0.016**	**-0.001**	**-0.001**	**0.003**	**0.003**
	(0.084)	(0.030)	(0.051)	(0.041)	(0.028)	(0.020)	(0.012)	(0.007)	(0.005)
wind_offshore_fe_neg_ge_clean	**0.001**	**-0.059****	**0.057**	**0.039**	**0.018**	**0.002**	**0.003**	**0.005**	**0.003**
	(0.065)	(0.020)	(0.046)	(0.036)	(0.023)	(0.015)	(0.010)	(0.006)	(0.004)
wind_fe_po_be_clean	**0.128**	**-0.087**	**0.201**	**0.171**	**0.127**	**0.096+**	**0.063+**	**0.029**	**0.010**
	(0.227)	(0.065)	(0.155)	(0.128)	(0.087)	(0.057)	(0.034)	(0.019)	(0.013)
wind_fe_neg_be_clean	**0.076**	**0.050**	**0.129**	**0.105**	**0.066**	**0.015**	**0.025**	**0.024**	**0.013**
	(0.242)	(0.097)	(0.173)	(0.140)	(0.094)	(0.063)	(0.037)	(0.021)	(0.014)
solar_fe_po_sp_clean	**-0.052**	**-0.003**	**-0.042**	**-0.027**	**-0.009**	**-0.006**	**0.002**	**-0.006**	**-0.002**
	(0.060)	(0.018)	(0.046)	(0.040)	(0.031)	(0.023)	(0.013)	(0.006)	(0.005)
solar_fe_neg_sp_clean	**-0.112***	**-0.041***	**-0.041**	**-0.034**	**-0.017**	**-0.017**	**-0.008**	**-0.005**	**-0.002**
	(0.046)	(0.016)	(0.028)	(0.021)	(0.015)	(0.011)	(0.007)	(0.004)	(0.003)
wind_onshore_fe_po_sp_clean	**0.040**	**0.004**	**0.019**	**0.020**	**0.017**	**0.015**	**0.011**	**0.010**	**0.005**
	(0.067)	(0.017)	(0.049)	(0.036)	(0.023)	(0.018)	(0.010)	(0.007)	(0.005)
wind_onshore_fe_neg_sp_clean	**0.010**	**-0.005**	**0.037**	**0.036**	**0.023**	**0.020+**	**0.013+**	**0.010***	**0.005**
	(0.061)	(0.019)	(0.039)	(0.031)	(0.019)	(0.012)	(0.007)	(0.004)	(0.003)
load_fe_po_fr	**0.062**	**-0.010**	**0.053+**	**0.047+**	**0.034***	**0.025***	**0.015***	**0.007***	**0.003**
	(0.045)	(0.012)	(0.030)	(0.024)	(0.016)	(0.011)	(0.006)	(0.004)	(0.003)
load_fe_neg_fr	**0.016**	**-0.003**	**0.034**	**0.032**	**0.022**	**0.018**	**0.015***	**0.006**	**0.002**
	(0.044)	(0.012)	(0.031)	(0.025)	(0.017)	(0.011)	(0.007)	(0.003)	(0.002)
outage_down	**0.110***	**-0.007**	**0.110****	**0.096*****	**0.069*****	**0.044*****	**0.024****	**0.008***	**0.002**
	(0.053)	(0.012)	(0.035)	(0.029)	(0.019)	(0.013)	(0.008)	(0.004)	(0.003)
export_to_all_clean	**0.025***	**0.006**	**0.021****	**0.017****	**0.011****	**0.006***	**0.004****	**0.002+**	**0.002+**
	(0.012)	(0.005)	(0.008)	(0.006)	(0.004)	(0.003)	(0.002)	(0.001)	(0.001)
import_from_all_clean	**-0.015**	**0.003**	**-0.011**	**-0.010**	**-0.006**	**-0.004**	**-0.001**	**-0.001**	**0.000**
	(0.012)	(0.004)	(0.008)	(0.006)	(0.004)	(0.003)	(0.002)	(0.001)	(0.001)
message_alert_up	**26.504**	**-62.012+**	**93.565**	**68.290**	**46.883**	**27.517**	**15.096**	**5.924**	**0.273**
	(165.103)	(37.350)	(112.103)	(80.352)	(48.204)	(32.077)	(18.554)	(12.200)	(10.736)
message_alert_down	**146.959**	**95.335****	**-45.156**	**-49.077**	**-38.079**	**-12.762**	**-3.846**	**0.714**	**5.014**
	(98.910)	(35.934)	(66.756)	(53.970)	(35.716)	(24.640)	(14.146)	(7.862)	(5.582)
message_downgraded_up_no_alert	**520.697*****	**10.011**	**417.296*****	**358.022*****	**248.568*****	**158.887*****	**78.327*****	**31.814****	**20.645***
	(102.651)	(33.031)	(60.474)	(51.447)	(38.850)	(28.243)	(17.539)	(9.804)	(8.858)
message_downgraded_down_no_alert	**313.426*****	**110.944***	**152.962***	**107.129***	**62.599+**	**50.808***	**32.871***	**30.205****	**22.477****
	(87.639)	(47.639)	(63.654)	(51.214)	(34.202)	(24.770)	(15.933)	(10.836)	(7.706)
DA_neg	**666.267*****	**204.056*****	**314.726*****	**244.654*****	**148.919*****	**69.370*****	**20.745+**	**8.230**	**-3.022**
	(132.392)	(49.467)	(66.785)	(50.475)	(27.939)	(17.597)	(10.978)	(7.334)	(5.822)
IDA_PETRUE	**-32.267**	**-20.127**	**49.795**	**42.807**	**19.551**	**11.475**	**-6.453**	**1.758**	**1.715**
	(85.349)	(29.320)	(55.170)	(45.055)	(30.229)	(19.084)	(10.899)	(6.516)	(5.600)
Num.Obs.	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**
R2	**0.153**	**0.096**	**0.145**	**0.145**	**0.138**	**0.130**	**0.112**	**0.072**	**0.037**
R2 Adj.	**0.144**	**0.086**	**0.136**	**0.136**	**0.128**	**0.120**	**0.103**	**0.062**	**0.026**
AIC	**52941.9**	**46293.7**	**50597.0**	**49380.8**	**47001.0**	**44703.2**	**41682.7**	**38990.2**	**37292.3**
BIC	**53118.8**	**46470.6**	**50773.9**	**49557.7**	**47177.9**	**44880.1**	**41859.6**	**39167.1**	**37469.2**
RMSE	**741.27**	**270.22**	**519.28**	**431.74**	**300.84**	**212.26**	**134.20**	**89.18**	**68.92**
Std.Errors	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 18: Results for total volume on day sample

	FE volume_full	FE volume_st480	FE volume_lt240	FE volume_lt180	FE volume_lt120	FE volume_lt90	FE volume_lt75	FE volume_lt65	FE volume_lt60
wind_onshore_fe_po_fr_clean	**0.076***	**-0.012**	**0.064****	**0.048***	**0.021**	**0.014+**	**0.008+**	**0.008*****	**0.006****
	(0.039)	(0.016)	(0.024)	(0.019)	(0.013)	(0.008)	(0.004)	(0.003)	(0.002)
wind_onshore_fe_neg_fr_clean	**0.089**	**-0.017**	**0.101***	**0.091****	**0.057***	**0.028+**	**0.015+**	**0.008**	**0.004**
	(0.069)	(0.023)	(0.042)	(0.034)	(0.022)	(0.015)	(0.009)	(0.005)	(0.003)
wind_onshore_fe_po_ge_clean	**0.037**	**0.009**	**0.029**	**0.026+**	**0.016+**	**0.007**	**0.002**	**-0.001**	**-0.001**
	(0.031)	(0.010)	(0.018)	(0.014)	(0.008)	(0.005)	(0.003)	(0.002)	(0.001)
wind_onshore_fe_neg_ge_clean	**0.047+**	**0.013**	**0.025+**	**0.021+**	**0.012**	**0.003**	**0.002**	**0.001**	**0.001**
	(0.025)	(0.011)	(0.015)	(0.012)	(0.007)	(0.005)	(0.003)	(0.002)	(0.001)
wind_offshore_fe_po_ge_clean	**0.023**	**-0.016**	**0.037**	**0.031**	**0.015**	**0.003**	**0.005**	**0.001**	**-0.001**
	(0.060)	(0.027)	(0.034)	(0.027)	(0.017)	(0.011)	(0.007)	(0.004)	(0.003)
wind_offshore_fe_neg_ge_clean	**0.072**	**0.032**	**0.046**	**0.042+**	**0.017**	**0.006**	**-0.000**	**-0.001**	**-0.003**
	(0.059)	(0.027)	(0.032)	(0.025)	(0.015)	(0.010)	(0.006)	(0.004)	(0.002)
wind_fe_po_be_clean	**0.150**	**-0.085**	**0.105**	**0.058**	**-0.016**	**-0.034**	**-0.008**	**-0.001**	**-0.005**
	(0.166)	(0.070)	(0.097)	(0.077)	(0.049)	(0.029)	(0.018)	(0.011)	(0.008)
wind_fe_neg_be_clean	**0.286+**	**-0.043**	**0.219***	**0.169***	**0.079**	**0.032**	**0.016**	**0.001**	**-0.002**
	(0.161)	(0.058)	(0.088)	(0.072)	(0.050)	(0.032)	(0.019)	(0.011)	(0.008)
wind_onshore_fe_po_sp_clean	**0.080***	**0.050****	**0.008**	**0.006**	**0.004**	**0.002**	**0.004**	**0.003**	**0.003**
	(0.038)	(0.018)	(0.021)	(0.018)	(0.012)	(0.008)	(0.005)	(0.003)	(0.002)
wind_onshore_fe_neg_sp_clean	**0.093***	**0.030***	**0.043+**	**0.034+**	**0.025+**	**0.020****	**0.012***	**0.005+**	**0.002**
	(0.042)	(0.014)	(0.026)	(0.020)	(0.013)	(0.007)	(0.005)	(0.003)	(0.002)
load_fe_po_fr	**0.081***	**0.009**	**0.044***	**0.031+**	**0.016**	**0.015***	**0.010***	**0.004+**	**0.001**
	(0.034)	(0.016)	(0.020)	(0.016)	(0.011)	(0.007)	(0.004)	(0.002)	(0.001)
load_fe_neg_fr	**0.037**	**-0.014**	**0.036+**	**0.031***	**0.025***	**0.026*****	**0.016*****	**0.005***	**0.003+**
	(0.033)	(0.014)	(0.018)	(0.015)	(0.010)	(0.007)	(0.004)	(0.003)	(0.001)
outage_down	**0.097*****	**0.008**	**0.076*****	**0.068*****	**0.048*****	**0.034*****	**0.017*****	**0.007*****	**0.004****
	(0.029)	(0.013)	(0.016)	(0.014)	(0.010)	(0.007)	(0.004)	(0.002)	(0.001)
export_to_all_clean	**0.009**	**0.001**	**0.010***	**0.008***	**0.006***	**0.002**	**0.001**	**0.000**	**0.001**
	(0.008)	(0.004)	(0.005)	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)
import_from_all_clean	**-0.015**	**0.003**	**-0.009+**	**-0.007+**	**-0.005+**	**-0.003+**	**-0.002**	**-0.001+**	**-0.000**
	(0.009)	(0.006)	(0.005)	(0.004)	(0.003)	(0.002)	(0.001)	(0.001)	(0.000)
message_alert_up	**31.225**	**-18.935**	**49.390**	**49.777**	**33.635**	**29.961**	**37.608+**	**14.831**	**10.254**
	(91.685)	(27.763)	(89.188)	(75.744)	(56.793)	(38.475)	(22.809)	(12.622)	(7.750)
message_alert_down	**-44.735**	**0.269**	**-86.616**	**-78.973**	**-60.847***	**-33.862+**	**-14.120**	**-5.132**	**-8.115***
	(93.979)	(31.557)	(58.381)	(48.292)	(30.121)	(18.253)	(11.603)	(7.122)	(3.472)
message_downgraded_up_no_alert	**351.328*****	**2.597**	**245.679*****	**199.960*****	**125.179*****	**68.954****	**41.979****	**22.631***	**7.499**
	(96.246)	(39.584)	(53.167)	(45.636)	(30.496)	(20.976)	(13.793)	(8.951)	(6.071)
message_downgraded_down_no_alert	**8.427**	**23.560**	**-34.097**	**-11.531**	**10.168**	**13.193**	**18.303**	**3.533**	**-1.567**
	(118.368)	(35.382)	(61.009)	(53.213)	(35.653)	(26.697)	(14.554)	(7.302)	(4.597)
DA_neg	**695.929*****	**35.111**	**396.094*****	**239.945****	**126.680****	**46.101+**	**28.965****	**12.841**	**-5.076**
	(114.944)	(31.223)	(81.454)	(76.567)	(46.557)	(25.772)	(10.871)	(9.344)	(5.400)
IDA_PETRUE	**-65.907**	**-14.803**	**-24.705**	**-31.517**	**-26.632**	**-17.025**	**-32.801*****	**-18.257*****	**-7.146****
	(69.924)	(35.207)	(40.037)	(32.155)	(20.466)	(12.052)	(7.271)	(3.606)	(2.493)
Num.Obs.	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**
R2	**0.099**	**0.022**	**0.110**	**0.106**	**0.093**	**0.077**	**0.080**	**0.058**	**0.035**
R2 Adj.	**0.093**	**0.016**	**0.104**	**0.100**	**0.087**	**0.071**	**0.074**	**0.052**	**0.029**
AIC	**86517.2**	**78569.2**	**81046.2**	**79096.5**	**75264.1**	**71444.3**	**66438.7**	**61284.2**	**57307.9**
BIC	**86669.3**	**78721.2**	**81198.3**	**79248.5**	**75416.2**	**71596.4**	**66590.8**	**61436.2**	**57460.0**
RMSE	**636.77**	**308.75**	**386.89**	**323.94**	**228.50**	**161.36**	**102.28**	**63.96**	**44.53**
Std.Errors	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 19: Results for total volume on night sample

	FE BUY_full	FE BUY_st480	FE BUY_lt240	FE BUY_lt180	FE BUY_lt120	FE BUY_lt90	FE BUY_lt75	FE BUY_lt65	FE BUY_lt60
solar_fe_po_fr_clean	**-0.159****	**-0.031***	**-0.091****	**-0.073***	**-0.038+**	**-0.016**	**-0.008**	**0.001**	**-0.001**
	(0.052)	(0.014)	(0.034)	(0.028)	(0.020)	(0.015)	(0.009)	(0.004)	(0.003)
solar_fe_neg_fr_clean	**-0.023**	**0.002**	**-0.000**	**-0.002**	**0.007**	**-0.002**	**-0.004**	**-0.003**	**-0.001**
	(0.068)	(0.022)	(0.044)	(0.035)	(0.023)	(0.015)	(0.010)	(0.006)	(0.004)
wind_onshore_fe_po_fr_clean	**-0.030**	**-0.011**	**-0.015**	**-0.015**	**-0.013**	**-0.003**	**-0.001**	**-0.001**	**-0.000**
	(0.038)	(0.012)	(0.022)	(0.017)	(0.012)	(0.008)	(0.005)	(0.002)	(0.002)
wind_onshore_fe_neg_fr_clean	**0.076+**	**-0.005**	**0.066***	**0.057***	**0.038***	**0.030***	**0.016***	**0.005**	**0.000**
	(0.044)	(0.013)	(0.032)	(0.026)	(0.018)	(0.013)	(0.008)	(0.004)	(0.002)
solar_fe_po_bege_clean	**0.021**	**-0.001**	**0.023**	**0.023+**	**0.015+**	**0.010+**	**0.005**	**0.000**	**0.000**
	(0.024)	(0.006)	(0.018)	(0.013)	(0.008)	(0.006)	(0.004)	(0.002)	(0.001)
solar_fe_neg_bege_clean	**-0.005**	**0.000**	**0.001**	**0.002**	**0.001**	**0.001**	**0.000**	**-0.001**	**-0.000**
	(0.019)	(0.005)	(0.014)	(0.011)	(0.008)	(0.005)	(0.003)	(0.002)	(0.001)
wind_onshore_fe_po_ge_clean	**0.042***	**0.008**	**0.015**	**0.015**	**0.009**	**0.007**	**0.002**	**-0.001**	**-0.000**
	(0.021)	(0.006)	(0.015)	(0.013)	(0.010)	(0.007)	(0.004)	(0.002)	(0.001)
wind_onshore_fe_neg_ge_clean	**0.034**	**0.017***	**0.007**	**0.005**	**0.004**	**0.005**	**0.003**	**0.002**	**0.002**
	(0.026)	(0.008)	(0.016)	(0.013)	(0.008)	(0.006)	(0.004)	(0.002)	(0.001)
wind_offshore_fe_po_ge_clean	**0.021**	**0.000**	**0.022**	**0.017**	**0.007**	**-0.002**	**-0.002**	**0.001**	**0.002**
	(0.049)	(0.015)	(0.029)	(0.024)	(0.017)	(0.013)	(0.009)	(0.004)	(0.002)
wind_offshore_fe_neg_ge_clean	**-0.031**	**-0.031****	**0.015**	**0.007**	**-0.003**	**-0.006**	**-0.004**	**0.000**	**0.001**
	(0.037)	(0.012)	(0.026)	(0.021)	(0.013)	(0.009)	(0.005)	(0.003)	(0.002)
wind_fe_po_be_clean	**0.179**	**-0.030**	**0.180+**	**0.138+**	**0.083**	**0.051**	**0.026**	**0.010**	**0.005**
	(0.137)	(0.032)	(0.099)	(0.081)	(0.056)	(0.037)	(0.021)	(0.011)	(0.006)
wind_fe_neg_be_clean	**0.025**	**0.005**	**0.036**	**0.038**	**0.029**	**0.007**	**0.011**	**0.013**	**0.007**
	(0.170)	(0.053)	(0.109)	(0.090)	(0.064)	(0.046)	(0.027)	(0.013)	(0.007)
solar_fe_po_sp_clean	**-0.025**	**0.004**	**-0.017**	**-0.007**	**0.001**	**0.004**	**0.004**	**-0.003**	**-0.001**
	(0.033)	(0.010)	(0.026)	(0.023)	(0.018)	(0.014)	(0.008)	(0.003)	(0.002)
solar_fe_neg_sp_clean	**-0.067***	**-0.020***	**-0.025**	**-0.016**	**-0.007**	**-0.006**	**-0.005**	**-0.003**	**-0.001**
	(0.027)	(0.009)	(0.016)	(0.013)	(0.009)	(0.007)	(0.004)	(0.003)	(0.002)
wind_onshore_fe_po_sp_clean	**0.033**	**0.010**	**0.019**	**0.015**	**0.010**	**0.011**	**0.009**	**0.007+**	**0.002**
	(0.040)	(0.009)	(0.029)	(0.021)	(0.013)	(0.010)	(0.006)	(0.004)	(0.002)
wind_onshore_fe_neg_sp_clean	**0.036**	**0.004**	**0.030**	**0.025**	**0.015**	**0.013+**	**0.010***	**0.007****	**0.002**
	(0.047)	(0.015)	(0.026)	(0.020)	(0.012)	(0.007)	(0.004)	(0.002)	(0.002)
load_fe_po_fr	**0.017**	**-0.003**	**0.014**	**0.014**	**0.012**	**0.010+**	**0.007***	**0.004***	**0.002**
	(0.025)	(0.007)	(0.016)	(0.012)	(0.008)	(0.006)	(0.003)	(0.002)	(0.001)
load_fe_neg_fr	**0.013**	**-0.003**	**0.016**	**0.013**	**0.008**	**0.008**	**0.007+**	**0.004+**	**0.001**
	(0.024)	(0.008)	(0.015)	(0.012)	(0.009)	(0.006)	(0.004)	(0.002)	(0.001)
outage_down	**0.062***	**-0.005**	**0.061****	**0.052****	**0.038*****	**0.025****	**0.014****	**0.005***	**0.001**
	(0.027)	(0.006)	(0.019)	(0.016)	(0.011)	(0.008)	(0.005)	(0.002)	(0.001)
export_to_all_clean	**0.010**	**0.005***	**0.003**	**0.001**	**-0.001**	**-0.002**	**-0.001**	**-0.000**	**0.001+**
	(0.006)	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)
import_from_all_clean	**-0.017****	**-0.002**	**-0.011****	**-0.009****	**-0.006****	**-0.004***	**-0.001**	**-0.001**	**0.000**
	(0.006)	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)
message_alert_up	**10.435**	**-20.826**	**52.948**	**36.918**	**27.714**	**19.188**	**10.347**	**4.666**	**0.131**
	(79.028)	(22.009)	(49.352)	(35.189)	(21.160)	(15.034)	(10.274)	(6.946)	(5.364)
message_alert_down	**-17.662**	**14.417**	**-37.353**	**-30.579**	**-19.945**	**-9.949**	**-5.201**	**-0.571**	**2.513**
	(63.084)	(21.558)	(38.308)	(30.656)	(19.428)	(14.083)	(8.407)	(4.277)	(2.790)
message_downgraded_up_no_alert	**254.951*****	**10.665**	**219.321*****	**193.370*****	**130.541*****	**78.189*****	**37.279****	**14.003****	**10.319***
	(64.581)	(18.834)	(38.905)	(32.634)	(25.676)	(20.339)	(11.524)	(5.404)	(4.434)
message_downgraded_down_no_alert	**107.265***	**43.398***	**23.664**	**5.786**	**-4.291**	**1.033**	**4.948**	**11.841***	**11.247****
	(47.678)	(17.730)	(31.880)	(26.289)	(17.379)	(12.749)	(7.693)	(5.278)	(3.853)
DA_neg	**481.777*****	**151.770*****	**181.888*****	**132.452*****	**76.070*****	**33.647****	**12.783**	**6.450**	**-1.446**
	(96.186)	(36.150)	(42.095)	(31.319)	(18.782)	(12.818)	(7.913)	(4.637)	(2.901)
IDA_PETRUE	**-31.613**	**-23.486+**	**12.221**	**10.274**	**2.026**	**1.072**	**-6.370**	**0.999**	**0.863**
	(45.419)	(13.318)	(27.675)	(22.938)	(15.848)	(10.785)	(6.277)	(3.675)	(2.804)
Num.Obs.	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**
R2	**0.160**	**0.135**	**0.128**	**0.122**	**0.104**	**0.092**	**0.079**	**0.060**	**0.037**
R2 Adj.	**0.151**	**0.125**	**0.118**	**0.113**	**0.094**	**0.082**	**0.068**	**0.049**	**0.026**
AIC	**49309.7**	**41958.1**	**46865.9**	**45784.5**	**43672.2**	**41606.1**	**38528.2**	**35216.6**	**32732.8**
BIC	**49486.6**	**42135.0**	**47042.8**	**45961.4**	**43849.1**	**41783.0**	**38705.1**	**35393.5**	**32909.7**
RMSE	**427.11**	**139.93**	**294.74**	**250.12**	**181.51**	**132.65**	**83.14**	**50.29**	**34.49**
Std.Errors	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 20: Results for BUY volume on day sample

	FE BUY_full	FE BUY_st480	FE BUY_lt240	FE BUY_lt180	FE BUY_lt120	FE BUY_lt90	FE BUY_lt75	FE BUY_lt65	FE BUY_lt60
wind_onshore_fe_po_fr_clean	**0.026**	**-0.003**	**0.022+**	**0.014**	**0.001**	**-0.001**	**0.000**	**0.003***	**0.003****
	(0.020)	(0.006)	(0.013)	(0.010)	(0.007)	(0.005)	(0.003)	(0.001)	(0.001)
wind_onshore_fe_neg_fr_clean	**0.102****	**-0.007**	**0.084****	**0.071****	**0.043****	**0.021***	**0.011+**	**0.005+**	**0.002**
	(0.039)	(0.012)	(0.027)	(0.022)	(0.014)	(0.009)	(0.006)	(0.003)	(0.001)
wind_onshore_fe_po_ge_clean	**0.027**	**0.002**	**0.026***	**0.023***	**0.012***	**0.005**	**0.001**	**-0.001**	**-0.001**
	(0.019)	(0.005)	(0.012)	(0.009)	(0.006)	(0.003)	(0.002)	(0.001)	(0.000)
wind_onshore_fe_neg_ge_clean	**0.018**	**0.009+**	**0.007**	**0.006**	**0.003**	**-0.001**	**0.000**	**0.000**	**0.001**
	(0.015)	(0.005)	(0.010)	(0.008)	(0.005)	(0.003)	(0.002)	(0.001)	(0.001)
wind_offshore_fe_po_ge_clean	**0.023**	**0.002**	**0.027**	**0.022**	**0.012**	**0.003**	**0.004**	**0.001**	**-0.000**
	(0.032)	(0.013)	(0.018)	(0.014)	(0.009)	(0.006)	(0.004)	(0.002)	(0.001)
wind_offshore_fe_neg_ge_clean	**0.026**	**0.017**	**0.011**	**0.012**	**0.003**	**-0.001**	**-0.003**	**-0.001**	**-0.001**
	(0.026)	(0.012)	(0.016)	(0.012)	(0.008)	(0.005)	(0.003)	(0.002)	(0.001)
wind_fe_po_be_clean	**0.175+**	**0.016**	**0.111***	**0.074+**	**0.020**	**-0.006**	**0.001**	**0.001**	**-0.002**
	(0.094)	(0.030)	(0.053)	(0.043)	(0.028)	(0.018)	(0.011)	(0.006)	(0.004)
wind_fe_neg_be_clean	**0.101**	**-0.000**	**0.081**	**0.064**	**0.041**	**0.016**	**0.013**	**0.004**	**-0.001**
	(0.083)	(0.029)	(0.054)	(0.045)	(0.030)	(0.019)	(0.012)	(0.006)	(0.004)
wind_onshore_fe_po_sp_clean	**0.035+**	**0.022****	**-0.003**	**-0.003**	**-0.002**	**-0.002**	**0.001**	**0.001**	**0.001**
	(0.020)	(0.008)	(0.012)	(0.010)	(0.007)	(0.005)	(0.003)	(0.001)	(0.001)
wind_onshore_fe_neg_sp_clean	**0.053***	**0.014***	**0.024**	**0.020**	**0.014+**	**0.011***	**0.006+**	**0.003**	**0.001**
	(0.025)	(0.007)	(0.015)	(0.012)	(0.008)	(0.005)	(0.003)	(0.002)	(0.001)
load_fe_po_fr	**0.020**	**0.004**	**0.010**	**0.005**	**-0.000**	**0.002**	**0.002**	**0.002**	**0.001**
	(0.017)	(0.008)	(0.010)	(0.008)	(0.006)	(0.004)	(0.002)	(0.001)	(0.001)
load_fe_neg_fr	**0.037***	**0.002**	**0.028****	**0.023****	**0.017*****	**0.017*****	**0.010*****	**0.003+**	**0.001+**
	(0.018)	(0.007)	(0.009)	(0.008)	(0.005)	(0.004)	(0.003)	(0.002)	(0.001)
outage_down	**0.072*****	**0.008**	**0.054*****	**0.049*****	**0.033*****	**0.024*****	**0.011*****	**0.004*****	**0.002****
	(0.016)	(0.006)	(0.010)	(0.009)	(0.006)	(0.005)	(0.003)	(0.001)	(0.001)
export_to_all_clean	**0.002**	**0.001**	**0.001**	**0.000**	**-0.000**	**-0.001**	**-0.001**	**-0.000**	**0.000**
	(0.005)	(0.001)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
import_from_all_clean	**-0.012***	**-0.002**	**-0.007****	**-0.005***	**-0.003***	**-0.002***	**-0.001**	**-0.001**	**-0.000**
	(0.005)	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
message_alert_up	**49.735**	**-14.836**	**59.341**	**52.946**	**37.120**	**23.310**	**22.964**	**4.829**	**5.101**
	(75.755)	(9.981)	(68.212)	(59.248)	(44.694)	(28.810)	(15.942)	(6.706)	(3.871)
message_alert_down	**-54.931**	**-7.322**	**-60.392+**	**-56.563+**	**-49.343***	**-32.459****	**-14.817***	**-3.916**	**-4.065***
	(52.119)	(13.215)	(32.692)	(29.431)	(19.768)	(11.878)	(6.539)	(3.825)	(1.736)
message_downgraded_up_no_alert	**164.276****	**5.195**	**117.650*****	**94.707*****	**59.762*****	**35.127****	**23.411****	**14.094****	**3.750**
	(52.645)	(16.780)	(30.375)	(25.233)	(16.867)	(12.038)	(7.785)	(4.635)	(3.036)
message_downgraded_down_no_alert	**5.917**	**6.324**	**-8.931**	**-1.801**	**8.689**	**11.579**	**9.141**	**1.237**	**-0.810**
	(65.397)	(14.331)	(35.279)	(30.885)	(21.057)	(17.380)	(8.645)	(3.701)	(2.296)
DA_neg	**459.603*****	**36.441+**	**245.762****	**156.304***	**85.034***	**30.509**	**20.503***	**6.197**	**-2.531**
	(116.280)	(21.840)	(86.129)	(69.626)	(40.947)	(23.261)	(10.407)	(7.221)	(2.699)
IDA_PETRUE	**-38.535**	**-17.733+**	**-21.808**	**-25.260**	**-21.160+**	**-12.793+**	**-19.994*****	**-10.491*****	**-3.573****
	(34.095)	(10.009)	(20.098)	(16.698)	(11.012)	(7.043)	(4.508)	(2.113)	(1.242)
Num.Obs.	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**
R2	**0.094**	**0.033**	**0.094**	**0.087**	**0.073**	**0.059**	**0.058**	**0.047**	**0.035**
R2 Adj.	**0.088**	**0.027**	**0.088**	**0.081**	**0.067**	**0.053**	**0.052**	**0.040**	**0.029**
AIC	**79875.0**	**69068.7**	**75134.1**	**73421.6**	**69977.3**	**66402.3**	**61536.4**	**55360.2**	**49697.8**
BIC	**80027.0**	**69220.8**	**75286.1**	**73573.6**	**70129.4**	**66554.3**	**61688.4**	**55512.2**	**49849.9**
RMSE	**347.74**	**129.97**	**225.81**	**193.20**	**141.18**	**101.95**	**65.45**	**37.29**	**22.27**
Std.Errors	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 21: Results for BUY volume on night sample

	FE SELL_full	FE SELL_st480	FE SELL_lt240	FE SELL_lt180	FE SELL_lt120	FE SELL_lt90	FE SELL_lt75	FE SELL_lt65	FE SELL_lt60
solar_fe_po_fr_clean	**-0.039**	**0.024**	**-0.062+**	**-0.062***	**-0.050****	**-0.032****	**-0.020****	**-0.006**	**-0.001**
	(0.055)	(0.025)	(0.032)	(0.026)	(0.018)	(0.012)	(0.007)	(0.004)	(0.003)
solar_fe_neg_fr_clean	**-0.014**	**-0.003**	**-0.001**	**-0.012**	**-0.007**	**-0.002**	**-0.000**	**-0.001**	**-0.001**
	(0.060)	(0.016)	(0.044)	(0.035)	(0.024)	(0.015)	(0.009)	(0.005)	(0.004)
wind_onshore_fe_po_fr_clean	**0.038**	**-0.014**	**0.035**	**0.020**	**0.004**	**0.007**	**0.003**	**-0.000**	**-0.000**
	(0.038)	(0.011)	(0.024)	(0.017)	(0.012)	(0.009)	(0.005)	(0.003)	(0.002)
wind_onshore_fe_neg_fr_clean	**-0.003**	**-0.017**	**0.019**	**0.018**	**0.014**	**0.014**	**0.008**	**0.002**	**0.000**
	(0.045)	(0.013)	(0.033)	(0.027)	(0.018)	(0.011)	(0.007)	(0.003)	(0.002)
solar_fe_po_bege_clean	**-0.045***	**-0.006**	**-0.032+**	**-0.025+**	**-0.021***	**-0.012***	**-0.007***	**-0.003**	**0.000**
	(0.022)	(0.006)	(0.017)	(0.014)	(0.008)	(0.005)	(0.003)	(0.002)	(0.001)
solar_fe_neg_bege_clean	**0.006**	**0.000**	**0.007**	**0.008**	**0.005**	**0.002**	**-0.001**	**-0.001**	**-0.000**
	(0.026)	(0.009)	(0.016)	(0.013)	(0.008)	(0.005)	(0.003)	(0.001)	(0.001)
wind_onshore_fe_po_ge_clean	**-0.009**	**-0.004**	**-0.016**	**-0.009**	**-0.003**	**-0.001**	**-0.002**	**-0.000**	**-0.000**
	(0.022)	(0.006)	(0.013)	(0.011)	(0.007)	(0.005)	(0.003)	(0.002)	(0.001)
wind_onshore_fe_neg_ge_clean	**0.056***	**0.011**	**0.029+**	**0.021+**	**0.013**	**0.009+**	**0.004**	**0.004***	**0.002**
	(0.024)	(0.007)	(0.015)	(0.012)	(0.008)	(0.005)	(0.003)	(0.002)	(0.001)
wind_offshore_fe_po_ge_clean	**0.063**	**0.010**	**0.035**	**0.018**	**0.009**	**0.001**	**0.000**	**0.002**	**0.002**
	(0.049)	(0.019)	(0.028)	(0.023)	(0.015)	(0.010)	(0.005)	(0.003)	(0.002)
wind_offshore_fe_neg_ge_clean	**0.008**	**-0.028***	**0.040**	**0.031**	**0.021**	**0.008**	**0.007**	**0.005**	**0.001**
	(0.039)	(0.012)	(0.025)	(0.020)	(0.014)	(0.010)	(0.006)	(0.003)	(0.002)
wind_fe_po_be_clean	**-0.054**	**-0.057**	**0.025**	**0.033**	**0.044**	**0.045**	**0.036+**	**0.019+**	**0.005**
	(0.121)	(0.043)	(0.076)	(0.064)	(0.046)	(0.030)	(0.020)	(0.010)	(0.006)
wind_fe_neg_be_clean	**0.126**	**0.045**	**0.089**	**0.067**	**0.036**	**0.009**	**0.014**	**0.011**	**0.007**
	(0.144)	(0.054)	(0.082)	(0.067)	(0.046)	(0.029)	(0.017)	(0.010)	(0.007)
solar_fe_po_sp_clean	**-0.048**	**-0.008**	**-0.030**	**-0.020**	**-0.010**	**-0.010**	**-0.002**	**-0.003**	**-0.001**
	(0.033)	(0.010)	(0.024)	(0.021)	(0.015)	(0.010)	(0.006)	(0.003)	(0.002)
solar_fe_neg_sp_clean	**-0.062***	**-0.021***	**-0.020**	**-0.018**	**-0.009**	**-0.010**	**-0.003**	**-0.002**	**-0.001**
	(0.027)	(0.009)	(0.016)	(0.012)	(0.009)	(0.007)	(0.004)	(0.002)	(0.002)
wind_onshore_fe_po_sp_clean	**-0.005**	**-0.006**	**0.002**	**0.005**	**0.007**	**0.005**	**0.001**	**0.003**	**0.002**
	(0.036)	(0.009)	(0.027)	(0.022)	(0.015)	(0.010)	(0.005)	(0.004)	(0.002)
wind_onshore_fe_neg_sp_clean	**-0.020**	**-0.009**	**0.006**	**0.011**	**0.008**	**0.007**	**0.003**	**0.003**	**0.002**
	(0.023)	(0.006)	(0.017)	(0.013)	(0.008)	(0.006)	(0.003)	(0.002)	(0.002)
load_fe_po_fr	**0.033**	**-0.008**	**0.038***	**0.033***	**0.022***	**0.015***	**0.008***	**0.004+**	**0.002**
	(0.027)	(0.008)	(0.017)	(0.015)	(0.010)	(0.007)	(0.004)	(0.002)	(0.001)
load_fe_neg_fr	**0.009**	**-0.000**	**0.017**	**0.020**	**0.013**	**0.009**	**0.008+**	**0.002**	**0.001**
	(0.028)	(0.006)	(0.020)	(0.016)	(0.011)	(0.007)	(0.004)	(0.002)	(0.001)
outage_down	**0.054+**	**-0.002**	**0.050****	**0.044****	**0.031****	**0.018****	**0.010****	**0.003**	**0.001**
	(0.029)	(0.007)	(0.019)	(0.015)	(0.011)	(0.007)	(0.004)	(0.002)	(0.001)
export_to_all_clean	**0.021****	**0.002**	**0.019*****	**0.016*****	**0.012*****	**0.008*****	**0.005*****	**0.002*****	**0.001+**
	(0.008)	(0.003)	(0.005)	(0.004)	(0.003)	(0.002)	(0.001)	(0.001)	(0.000)
import_from_all_clean	**0.007**	**0.005**	**-0.000**	**-0.001**	**-0.000**	**-0.001**	**-0.000**	**0.000**	**0.000**
	(0.008)	(0.003)	(0.005)	(0.004)	(0.003)	(0.002)	(0.001)	(0.000)	(0.000)
message_alert_up	**14.900**	**-41.186***	**38.038**	**31.372**	**19.169**	**8.329**	**4.748**	**1.259**	**0.141**
	(99.312)	(17.226)	(73.237)	(56.236)	(39.437)	(26.875)	(15.935)	(9.432)	(5.372)
message_alert_down	**129.086***	**80.918*****	**-9.849**	**-18.498**	**-18.134**	**-2.813**	**1.355**	**1.285**	**2.501**
	(59.848)	(19.660)	(36.251)	(30.022)	(22.315)	(16.161)	(9.087)	(4.276)	(2.792)
message_downgraded_up_no_alert	**236.740*****	**-0.654**	**195.457*****	**164.652*****	**118.027*****	**80.699*****	**41.048*****	**17.811*****	**10.325***
	(54.081)	(18.955)	(35.698)	(30.899)	(22.057)	(14.459)	(9.474)	(5.125)	(4.425)
message_downgraded_down_no_alert	**261.882*****	**67.546+**	**128.962****	**101.343****	**66.889****	**49.775****	**27.923****	**18.364****	**11.230****
	(67.360)	(35.202)	(39.168)	(32.280)	(22.712)	(16.417)	(10.251)	(6.067)	(3.853)
DA_neg	**250.692*****	**52.286****	**133.161*****	**112.202*****	**72.849*****	**35.722****	**7.962**	**1.781**	**-1.576**
	(67.467)	(19.725)	(37.697)	(30.364)	(19.160)	(11.925)	(6.696)	(3.570)	(2.921)
IDA_PETRUE	**29.423**	**3.359**	**38.680**	**32.533**	**17.526**	**10.402**	**-0.083**	**0.760**	**0.853**
	(53.526)	(20.395)	(31.939)	(26.240)	(17.665)	(10.881)	(6.193)	(3.242)	(2.797)
Num.Obs.	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**
R2	**0.118**	**0.058**	**0.133**	**0.133**	**0.127**	**0.121**	**0.109**	**0.071**	**0.037**
R2 Adj.	**0.109**	**0.047**	**0.124**	**0.124**	**0.117**	**0.111**	**0.099**	**0.061**	**0.026**
AIC	**49754.8**	**43358.6**	**47003.1**	**45763.4**	**43529.1**	**41209.5**	**38072.8**	**34815.3**	**32722.3**
BIC	**49931.7**	**43535.5**	**47180.0**	**45940.3**	**43706.0**	**41386.4**	**38249.7**	**34992.2**	**32899.2**
RMSE	**456.96**	**173.07**	**300.94**	**249.32**	**177.61**	**124.90**	**77.59**	**47.32**	**34.44**
Std.Errors	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 22: Results for SELL volume on day sample

	FE SELL_full	FE SELL_st480	FE SELL_lt240	FE SELL_lt180	FE SELL_lt120	FE SELL_lt90	FE SELL_lt75	FE SELL_lt65	FE SELL_lt60
wind_onshore_fe_po_fr_clean	**0.040**	**-0.008**	**0.042****	**0.034****	**0.020****	**0.015*****	**0.008****	**0.006*****	**0.003****
	(0.026)	(0.012)	(0.014)	(0.011)	(0.007)	(0.004)	(0.003)	(0.001)	(0.001)
wind_onshore_fe_neg_fr_clean	**-0.005**	**-0.010**	**0.017**	**0.019**	**0.014**	**0.007**	**0.004**	**0.003**	**0.002**
	(0.035)	(0.013)	(0.020)	(0.017)	(0.011)	(0.007)	(0.004)	(0.002)	(0.001)
wind_onshore_fe_po_ge_clean	**0.009**	**0.007**	**0.003**	**0.004**	**0.004**	**0.002**	**0.001**	**-0.000**	**-0.001**
	(0.015)	(0.006)	(0.008)	(0.006)	(0.004)	(0.003)	(0.002)	(0.001)	(0.000)
wind_onshore_fe_neg_ge_clean	**0.028***	**0.004**	**0.018***	**0.014***	**0.009***	**0.004**	**0.001**	**0.000**	**0.001**
	(0.014)	(0.007)	(0.007)	(0.006)	(0.004)	(0.003)	(0.002)	(0.001)	(0.001)
wind_offshore_fe_po_ge_clean	**-0.012**	**-0.018**	**0.011**	**0.008**	**0.003**	**0.001**	**0.001**	**-0.000**	**-0.000**
	(0.039)	(0.017)	(0.019)	(0.016)	(0.011)	(0.007)	(0.004)	(0.002)	(0.001)
wind_offshore_fe_neg_ge_clean	**0.053**	**0.015**	**0.035+**	**0.030***	**0.014**	**0.007**	**0.002**	**0.000**	**-0.001**
	(0.038)	(0.016)	(0.019)	(0.015)	(0.009)	(0.006)	(0.003)	(0.002)	(0.001)
wind_fe_po_be_clean	**-0.085**	**-0.101***	**-0.005**	**-0.017**	**-0.036**	**-0.029+**	**-0.009**	**-0.001**	**-0.002**
	(0.097)	(0.048)	(0.053)	(0.042)	(0.028)	(0.016)	(0.010)	(0.006)	(0.004)
wind_fe_neg_be_clean	**0.144**	**-0.043**	**0.137***	**0.106***	**0.038**	**0.016**	**0.003**	**-0.003**	**-0.001**
	(0.089)	(0.036)	(0.054)	(0.044)	(0.030)	(0.019)	(0.011)	(0.006)	(0.004)
wind_onshore_fe_po_sp_clean	**0.050***	**0.027***	**0.011**	**0.009**	**0.005**	**0.004**	**0.003**	**0.002**	**0.001**
	(0.025)	(0.013)	(0.012)	(0.010)	(0.007)	(0.004)	(0.002)	(0.001)	(0.001)
wind_onshore_fe_neg_sp_clean	**0.041***	**0.016***	**0.019**	**0.015**	**0.011+**	**0.010****	**0.006****	**0.003***	**0.001**
	(0.020)	(0.008)	(0.013)	(0.010)	(0.006)	(0.004)	(0.002)	(0.001)	(0.001)
load_fe_po_fr	**0.051***	**0.005**	**0.033****	**0.026***	**0.016***	**0.013****	**0.008****	**0.003***	**0.001**
	(0.022)	(0.011)	(0.012)	(0.010)	(0.007)	(0.004)	(0.003)	(0.001)	(0.001)
load_fe_neg_fr	**-0.010**	**-0.015+**	**0.008**	**0.008**	**0.008**	**0.010***	**0.006***	**0.002**	**0.001+**
	(0.021)	(0.009)	(0.012)	(0.010)	(0.007)	(0.004)	(0.002)	(0.001)	(0.001)
outage_down	**0.023**	**0.000**	**0.022***	**0.020****	**0.015****	**0.010****	**0.006****	**0.003****	**0.002****
	(0.018)	(0.009)	(0.009)	(0.007)	(0.005)	(0.003)	(0.002)	(0.001)	(0.001)
export_to_all_clean	**0.010+**	**0.000**	**0.009*****	**0.008*****	**0.006*****	**0.003*****	**0.002****	**0.001+**	**0.000**
	(0.005)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
import_from_all_clean	**0.002**	**0.005**	**-0.002**	**-0.002**	**-0.001**	**-0.001**	**-0.001**	**-0.000**	**-0.000**
	(0.009)	(0.005)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
message_alert_up	**-9.835**	**-4.099**	**-9.951**	**-3.169**	**-3.484**	**6.651**	**14.644+**	**10.003+**	**5.154**
	(43.699)	(20.302)	(29.805)	(23.659)	(16.720)	(12.005)	(8.566)	(6.063)	(3.879)
message_alert_down	**8.227**	**7.592**	**-26.224**	**-22.410**	**-11.505**	**-1.404**	**0.697**	**-1.216**	**-4.050***
	(50.924)	(19.939)	(30.300)	(23.773)	(14.799)	(10.521)	(7.093)	(3.947)	(1.736)
message_downgraded_up_no_alert	**168.825****	**-2.599**	**128.029*****	**105.252*****	**65.416*****	**33.827****	**18.568***	**8.536+**	**3.748**
	(53.856)	(25.594)	(26.464)	(23.502)	(16.280)	(11.167)	(7.497)	(4.719)	(3.035)
message_downgraded_down_no_alert	**-5.152**	**17.236**	**-25.165**	**-9.730**	**1.479**	**1.614**	**9.162**	**2.296**	**-0.758**
	(61.137)	(25.386)	(30.170)	(26.886)	(18.563)	(11.899)	(7.510)	(4.143)	(2.301)
DA_neg	**230.789*****	**-1.330**	**150.332*****	**83.641***	**41.647+**	**15.592**	**8.462**	**6.643+**	**-2.545**
	(38.909)	(14.451)	(30.877)	(37.828)	(24.525)	(13.668)	(8.110)	(4.005)	(2.701)
IDA_PETRUE	**0.208**	**2.930**	**-2.897**	**-6.257**	**-5.472**	**-4.232**	**-12.807*****	**-7.766*****	**-3.573****
	(54.367)	(28.541)	(22.515)	(18.013)	(11.670)	(6.858)	(3.850)	(1.834)	(1.251)
Num.Obs.	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**
R2	**0.072**	**0.020**	**0.108**	**0.104**	**0.089**	**0.074**	**0.074**	**0.053**	**0.035**
R2 Adj.	**0.065**	**0.014**	**0.102**	**0.098**	**0.083**	**0.068**	**0.068**	**0.047**	**0.029**
AIC	**81425.0**	**74442.3**	**74301.6**	**72393.4**	**68669.1**	**64739.5**	**59526.6**	**54101.6**	**49699.3**
BIC	**81577.0**	**74594.4**	**74453.6**	**72545.4**	**68821.1**	**64891.5**	**59678.6**	**54253.7**	**49851.3**
RMSE	**400.46**	**212.02**	**209.32**	**175.93**	**125.32**	**87.62**	**54.50**	**33.25**	**22.27**
Std.Errors	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**	**Custom**

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 23: Results for SELL volume on night sample

	mean_price_full	mean_price_st480	mean_price_lt240	mean_price_lt180	mean_price_lt120	mean_price_lt90	mean_price_lt75	mean_price_lt65	mean_price_lt60
(Intercept)	2.849	2.009+	2.677	3.115	3.910				
	(2.041)	(1.125)	(2.185)	(2.251)	(2.376)				
solar_fe_po_fr_clean	-0.007***	-0.002**	-0.007***	-0.007***	-0.007***	-0.008***	-0.008***	-0.008***	-0.010***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
solar_fe_neg_fr_clean	-0.002	-0.002+	-0.002	-0.002	-0.002	-0.003	-0.004	-0.003	-0.003
	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
wind_onshore_fe_po_fr_clean	-0.003*	-0.000	-0.003*	-0.003*	-0.003*	-0.004*	-0.004*	-0.003	-0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
wind_onshore_fe_neg_fr_clean	0.003*	-0.000	0.003*	0.003*	0.004*	0.004*	0.004*	0.004+	0.004
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
solar_fe_po_bege_clean	-0.002**	-0.000	-0.002**	-0.002*	-0.002*	-0.002*	-0.002*	-0.003**	-0.002*
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
solar_fe_neg_bege_clean	0.002***	0.001**	0.003***	0.003***	0.003***	0.002***	0.002**	0.002**	0.003***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_onshore_fe_po_ge_clean	-0.000	-0.001**	-0.000	-0.000	-0.000	-0.000	-0.000	0.000	0.001
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_onshore_fe_neg_ge_clean	0.001+	0.001+	0.001+	0.001+	0.001+	0.001	0.001	0.001+	0.002*
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_offshore_fe_po_ge_clean	0.000	-0.000	0.000	0.000	-0.000	0.000	-0.000	0.001	0.000
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
wind_offshore_fe_neg_ge_clean	0.003	0.001	0.003+	0.004+	0.004+	0.004*	0.004+	0.004+	0.003
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
wind_fe_po_be_clean	-0.008+	-0.003	-0.009+	-0.010+	-0.005	-0.005	-0.004	-0.011	-0.006
	(0.005)	(0.002)	(0.005)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
wind_fe_neg_be_clean	0.008*	0.003	0.009+	0.008+	0.009+	0.008+	0.009+	0.008+	0.009
	(0.004)	(0.002)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
solar_fe_po_sp_clean	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
solar_fe_neg_sp_clean	-0.000	-0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
wind_onshore_fe_po_sp_clean	-0.000	-0.001	-0.000	-0.000	-0.001	-0.001	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
wind_onshore_fe_neg_sp_clean	0.001	-0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
load_fe_po_fr	0.000	0.001	0.000	0.000	0.000	0.000	-0.000	-0.001	-0.002+
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
load_fe_neg_fr	0.002***	0.000	0.003***	0.003***	0.004***	0.004***	0.004***	0.005***	0.005***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
outage_down	0.002*	0.001*	0.003*	0.003*	0.003**	0.003**	0.004**	0.003*	0.004**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
export_to_all	0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000+
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
import_from_all	-0.000**	-0.000	-0.000**	-0.000**	-0.001**	-0.001**	-0.001**	-0.001**	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
message_alert_up	7.356***	4.821***	7.314***	7.267***	6.592**	6.067**	5.921*	5.229+	6.456
	(1.789)	(0.952)	(1.879)	(1.959)	(2.061)	(2.091)	(2.407)	(2.946)	(4.327)
message_alert_down	-1.648	-0.554	-1.187	-0.775	0.286	0.416	1.086	-0.247	-1.533
	(2.309)	(1.068)	(2.521)	(2.833)	(3.096)	(3.148)	(3.238)	(3.300)	(3.471)
message_downgraded_up_no_alert	1.830	-0.432	2.257	2.240	2.470	2.974	3.380	4.328	5.336
	(2.888)	(1.011)	(3.284)	(3.381)	(3.508)	(3.527)	(3.679)	(3.898)	(4.711)
message_downgraded_down_no_alert	-11.439***	-4.866***	-11.925***	-11.960***	-11.843***	-11.906***	-10.949***	-11.586***	-12.154***
	(1.713)	(1.026)	(1.879)	(1.954)	(2.008)	(2.137)	(2.055)	(2.250)	(2.941)
DA_price	0.941***	0.974***	0.935***	0.932***	0.925***	0.926***	0.928***	0.931***	0.919***
	(0.016)	(0.011)	(0.018)	(0.019)	(0.019)	(0.021)	(0.021)	(0.022)	(0.026)
Num.Obs.	3294	3294	3294	3294	3294	3294	3294	3294	3294
R2	0.917	0.969	0.894	0.884	0.864	0.847	0.830	0.813	0.722
R2 Adj.	0.916	0.968	0.893	0.883	0.863	0.845	0.828	0.811	0.719
AIC	26308.2	22924.4	27162.8	27465.7	27991.1	28339.6	28738.1	29158.2	30830.2
BIC	26479.0	23095.2	27333.6	27636.5	28161.9	28504.3	28902.8	29322.9	30994.9
RMSE	13.01	7.79	14.81	15.51	16.80	17.72	18.82	20.06	25.86
Std.Errors	mean_price_full	mean_price_st480	mean_price_lt240	mean_price_lt180	mean_price_lt120	mean_price_lt90	mean_price_lt75	mean_price_lt65	mean_price_lt60

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 24: Results for mean price on day sample

	mean_price_full	mean_price_st480	mean_price_lt240	mean_price_lt180	mean_price_lt120	mean_price_lt90	mean_price_lt75	mean_price_lt65	mean_price_lt60
(Intercept)	5.169*								
	(2.027)								
wind_onshore_fe_po_fr_clean	-0.002*	-0.001+	-0.003*	-0.003*	-0.002*	-0.002*	-0.002+	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
wind_onshore_fe_neg_fr_clean	0.002	-0.000	0.002	0.002	0.002	0.002	0.002	0.002	0.001
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
wind_onshore_fe_po_ge_clean	-0.000	-0.001*	-0.000	-0.000	0.000	0.000	0.000	0.000	-0.000
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_onshore_fe_neg_ge_clean	0.003***	0.001**	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.004**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_offshore_fe_po_ge_clean	0.000	-0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
wind_offshore_fe_neg_ge_clean	0.003**	0.001*	0.003**	0.003**	0.003*	0.002*	0.002+	0.002+	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
wind_fe_po_be_clean	-0.019***	-0.010***	-0.022***	-0.022***	-0.023***	-0.023***	-0.023***	-0.025***	-0.029***
	(0.004)	(0.002)	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)
wind_fe_neg_be_clean	0.003	0.002	0.004	0.004	0.004	0.003	0.003	0.005	0.005
	(0.003)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.008)
wind_onshore_fe_po_sp_clean	-0.000	0.000	-0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_onshore_fe_neg_sp_clean	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
load_fe_po_fr	-0.000	0.000	-0.000	-0.000	-0.000	-0.001	-0.001	-0.001	-0.002
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
load_fe_neg_fr	0.002**	0.000	0.002**	0.002***	0.002**	0.003**	0.003**	0.003**	0.002+
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
outage_down	0.002**	-0.000	0.003**	0.003**	0.003***	0.004***	0.004***	0.004***	0.005**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
export_to_all	0.000	0.000	0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
import_from_all	-0.000**	-0.000***	-0.000**	-0.000**	-0.001**	-0.001**	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
message_alert_up	5.271***	3.439***	5.473**	5.644**	5.968**	6.355***	6.736***	6.407***	0.953
	(1.349)	(1.012)	(1.717)	(1.816)	(1.833)	(1.804)	(1.659)	(1.653)	(4.176)
message_alert_down	-3.991	-3.551*	-3.763	-3.521	-3.559	-3.831	-1.861	-1.701	2.326
	(2.538)	(1.523)	(2.976)	(2.993)	(3.129)	(3.195)	(2.157)	(2.118)	(6.297)
message_downgraded_up_no_alert	1.245	0.098	1.449	1.522	1.491	1.450	1.276	0.330	-1.457
	(2.249)	(1.274)	(2.492)	(2.537)	(2.612)	(2.701)	(2.819)	(2.976)	(4.488)
message_downgraded_down_no_alert	-9.745***	-3.656**	-10.960***	-11.086***	-11.280***	-10.856***	-11.147***	-11.571***	-11.506**
	(1.855)	(1.394)	(2.241)	(2.380)	(2.912)	(3.002)	(3.331)	(3.314)	(3.809)
DA_price	0.937***	0.957***	0.927***	0.923***	0.915***	0.913***	0.908***	0.902***	0.891***
	(0.014)	(0.011)	(0.016)	(0.017)	(0.018)	(0.018)	(0.018)	(0.019)	(0.040)
Num.Obs.	5490	5490	5490	5490	5490	5490	5490	5490	5490
R2	0.891	0.926	0.842	0.823	0.794	0.774	0.747	0.711	0.403
R2 Adj.	0.891	0.925	0.841	0.822	0.793	0.773	0.745	0.709	0.400
AIC	43398.3	40233.3	44746.6	45441.9	46398.7	47041.8	47808.6	48741.4	55783.7
BIC	43543.7	40372.1	44885.4	45580.7	46537.5	47180.6	47947.5	48880.2	55922.5
RMSE	12.55	9.41	14.19	15.12	16.49	17.49	18.75	20.42	38.77
Std.Errors	mean_price_full	mean_price_st480	mean_price_lt240	mean_price_lt180	mean_price_lt120	mean_price_lt90	mean_price_lt75	mean_price_lt65	mean_price_lt60

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 25: Results for mean price on night sample

	median_price_full	median_price_st480	median_price_lt240	median_price_lt180	median_price_lt120	median_price_lt90	median_price_lt75	median_price_lt65	median_price_lt60
(Intercept)	2.783	1.719	2.796	3.092	3.986+				
	(2.045)	(1.151)	(2.224)	(2.285)	(2.358)				
solar_fe_po_fr_clean	-0.007***	-0.002**	-0.007***	-0.007***	-0.007***	-0.008***	-0.007***	-0.007***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
solar_fe_neg_fr_clean	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003	-0.003	-0.003	-0.002
	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
wind_onshore_fe_po_fr_clean	-0.003*	-0.000	-0.003*	-0.003*	-0.003*	-0.004*	-0.004*	-0.002	-0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
wind_onshore_fe_neg_fr_clean	0.003*	-0.000	0.004*	0.004*	0.004*	0.004*	0.004*	0.004*	0.004
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
solar_fe_po_bege_clean	-0.002**	-0.000	-0.002**	-0.002**	-0.002*	-0.002*	-0.002*	-0.003**	-0.003*
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
solar_fe_neg_bege_clean	0.003***	0.001**	0.003***	0.003***	0.003***	0.002***	0.002***	0.002**	0.003**
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_onshore_fe_po_ge_clean	-0.000	-0.001*	-0.000	-0.000	-0.000	-0.000	0.000	0.000	0.001
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_onshore_fe_neg_ge_clean	0.001+	0.001+	0.001*	0.001*	0.001	0.001	0.001	0.001	0.002*
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_offshore_fe_po_ge_clean	0.000	-0.000	0.000	0.000	-0.000	0.000	0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
wind_offshore_fe_neg_ge_clean	0.003+	0.001	0.003+	0.003+	0.004+	0.004*	0.004+	0.003+	0.003
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
wind_fe_po_be_clean	-0.008+	-0.003+	-0.010+	-0.010+	-0.006	-0.004	-0.008	-0.009	-0.007
	(0.005)	(0.002)	(0.005)	(0.005)	(0.007)	(0.007)	(0.006)	(0.006)	(0.008)
wind_fe_neg_be_clean	0.008+	0.003	0.008+	0.008+	0.009+	0.008	0.007	0.008	0.006
	(0.004)	(0.002)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
solar_fe_po_sp_clean	0.000	-0.000	0.000	0.000	-0.000	0.000	0.000	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
solar_fe_neg_sp_clean	-0.000	-0.000	0.000	0.000	0.000	0.001	0.001	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
wind_onshore_fe_po_sp_clean	-0.000	-0.001+	-0.000	-0.000	-0.001	-0.001	-0.000	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
wind_onshore_fe_neg_sp_clean	0.001	-0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
load_fe_po_fr	0.001	0.000	0.000	0.000	0.000	0.000	-0.000	-0.000	-0.002+
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
load_fe_neg_fr	0.002***	0.000	0.003***	0.003***	0.003***	0.004***	0.004***	0.004***	0.005***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
outage_down	0.002*	0.001*	0.003*	0.003*	0.003**	0.003**	0.003*	0.003*	0.004**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
export_to_all	-0.000	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
import_from_all	-0.000**	-0.000	-0.000*	-0.000*	-0.001**	-0.001**	-0.001**	-0.001**	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
message_alert_up	7.746***	5.043***	7.660***	7.222***	7.202***	6.312**	6.367**	5.043+	7.401+
	(1.878)	(0.885)	(1.895)	(1.899)	(2.147)	(2.063)	(2.433)	(2.762)	(4.343)
message_alert_down	-1.344	-0.673	-1.143	-0.968	0.515	0.286	0.099	0.027	-1.038
	(2.302)	(1.064)	(2.563)	(2.664)	(3.116)	(3.157)	(3.144)	(2.926)	(3.559)
message_downgraded_up_no_alert	1.759	-0.711	1.959	2.127	2.371	2.584	3.011	3.942	5.348
	(2.933)	(1.019)	(3.238)	(3.343)	(3.511)	(3.501)	(3.661)	(3.768)	(4.532)
message_downgraded_down_no_alert	-11.308***	-4.744***	-12.022***	-11.868***	-11.363***	-10.809***	-10.842***	-10.398***	-12.283***
	(1.746)	(1.027)	(1.819)	(1.870)	(1.934)	(2.001)	(1.948)	(2.278)	(3.102)
DA_price	0.938***	0.975***	0.934***	0.932***	0.925***	0.924***	0.926***	0.929***	0.922***
	(0.017)	(0.010)	(0.019)	(0.019)	(0.019)	(0.020)	(0.021)	(0.023)	(0.026)
Num.Obs.	3294	3294	3294	3294	3294	3294	3294	3294	3294
R2	0.914	0.967	0.893	0.884	0.864	0.846	0.829	0.813	0.715
R2 Adj.	0.913	0.967	0.892	0.884	0.863	0.844	0.827	0.811	0.712
AIC	26407.5	23064.3	27172.0	27449.1	27980.9	28325.2	28761.2	29103.5	30961.9
BIC	26578.3	23235.1	27342.8	27619.9	28151.7	28489.9	28925.9	29268.2	31126.6
RMSE	13.21	7.95	14.84	15.47	16.77	17.68	18.89	19.90	26.38
Std.Errors	median_price_full	median_price_st480	median_price_lt240	median_price_lt180	median_price_lt120	median_price_lt90	median_price_lt75	median_price_lt65	median_price_lt60

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 26: Results for median price on day sample

	median_price_full	median_price_st480	median_price_lt240	median_price_lt180	median_price_lt120	median_price_lt90	median_price_lt75	median_price_lt65	median_price_lt60
(Intercept)	5.165*	5.251***							
	(2.037)	(1.188)							
wind_onshore_fe_po_fr_clean	-0.003*	-0.001*	-0.003*	-0.003*	-0.003*	-0.003*	-0.002+	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_onshore_fe_neg_fr_clean	0.002	0.000	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
wind_onshore_fe_po_ge_clean	-0.000	-0.001+	0.000	0.000	0.000	0.000	0.000	0.000	-0.000
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_onshore_fe_neg_ge_clean	0.003***	0.001**	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_offshore_fe_po_ge_clean	0.000	-0.000	0.000	0.000	-0.000	0.000	-0.000	0.000	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
wind_offshore_fe_neg_ge_clean	0.003**	0.001*	0.003**	0.003*	0.003*	0.002*	0.002*	0.003*	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_fe_po_be_clean	-0.019***	-0.009***	-0.022***	-0.021***	-0.022***	-0.023***	-0.024***	-0.025***	-0.029***
	(0.004)	(0.002)	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)
wind_fe_neg_be_clean	0.004	0.002	0.004	0.004	0.004	0.004	0.003	0.004	0.002
	(0.003)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.007)
wind_onshore_fe_po_sp_clean	-0.000	0.000	-0.000	-0.000	-0.000	-0.001	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_onshore_fe_neg_sp_clean	0.001	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.001
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
load_fe_po_fr	-0.000	0.000	-0.000	-0.000	-0.000	-0.001	-0.001	-0.001	-0.002+
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
load_fe_neg_fr	0.002***	0.000	0.002**	0.002***	0.002***	0.003***	0.003**	0.003**	0.002*
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
outage_down	0.002*	0.000	0.003**	0.003**	0.003***	0.003***	0.004***	0.004***	0.005***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
export_to_all	0.000	0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
import_from_all	-0.000**	-0.000***	-0.000**	-0.000**	-0.001**	-0.001**	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
message_alert_up	5.409***	3.429**	5.434**	5.439**	5.778**	6.069**	6.724***	6.790***	1.429
	(1.502)	(1.059)	(1.697)	(1.841)	(1.908)	(2.005)	(1.701)	(1.502)	(3.717)
message_alert_down	-4.824+	-3.600*	-4.285	-3.995	-4.285	-4.356	-2.740	-2.461	1.707
	(2.796)	(1.404)	(3.061)	(3.055)	(3.215)	(3.544)	(2.635)	(2.426)	(6.183)
message_downgraded_up_no_alert	1.046	0.319	1.261	1.390	1.302	1.251	1.623	0.670	-1.713
	(2.306)	(1.279)	(2.476)	(2.538)	(2.601)	(2.656)	(2.758)	(2.910)	(4.250)
message_downgraded_down_no_alert	-9.629***	-2.722+	-10.725***	-10.998***	-11.348***	-10.553***	-11.607***	-11.727***	-12.018***
	(2.087)	(1.626)	(2.311)	(2.408)	(3.000)	(3.098)	(3.301)	(3.097)	(3.624)
DA_price	0.937***	0.964***	0.927***	0.922***	0.914***	0.914***	0.913***	0.909***	0.896***
	(0.014)	(0.010)	(0.016)	(0.017)	(0.018)	(0.018)	(0.018)	(0.019)	(0.040)
Num.Obs.	5490	5490	5490	5490	5490	5490	5490	5490	5490
R2	0.886	0.932	0.841	0.824	0.795	0.777	0.750	0.731	0.427
R2 Adj.	0.886	0.932	0.840	0.823	0.793	0.775	0.749	0.729	0.423
AIC	43700.7	40517.6	44799.7	45401.7	46379.5	46981.0	47783.7	48272.5	55269.7
BIC	43846.1	40663.1	44938.6	45540.5	46518.3	47119.8	47922.5	48411.3	55408.5
RMSE	12.90	9.65	14.26	15.06	16.46	17.39	18.71	19.56	37.00
Std.Errors	median_price_full	median_price_st480	median_price_lt240	median_price_lt180	median_price_lt120	median_price_lt90	median_price_lt75	median_price_lt65	median_price_lt60

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 27: Results for median price on night sample

	sd_price_full	sd_price_st480	sd_price_lt240	sd_price_lt180	sd_price_lt120	sd_price_lt90	sd_price_lt75	sd_price_lt65	sd_price_lt60
solar_fe_po_fr_clean	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**-0.000**	**-0.000**	**-0.001**	**-0.001***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
solar_fe_neg_fr_clean	**-0.001**	**-0.001+**	**-0.001**	**-0.000**	**0.000**	**0.000**	**0.001**	**0.001**	**-0.000**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_onshore_fe_po_fr_clean	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.001**	**-0.001***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
wind_onshore_fe_neg_fr_clean	**-0.000**	**0.000**	**-0.000**	**-0.000**	**-0.000**	**0.000**	**0.000**	**0.001**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
solar_fe_po_bege_clean	**0.000+**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.001**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
solar_fe_neg_bege_clean	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
wind_onshore_fe_po_ge_clean	**-0.000**	**-0.000**	**-0.000+**	**-0.000+**	**-0.000+**	**-0.000**	**-0.000**	**-0.000**	**-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
wind_onshore_fe_neg_ge_clean	**0.000+**	**0.000***	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
wind_offshore_fe_po_ge_clean	**-0.000**	**0.000**	**0.000**	**-0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.001***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
wind_offshore_fe_neg_ge_clean	**0.002****	**0.000**	**0.002****	**0.002****	**0.002****	**0.002*****	**0.002*****	**0.002****	**0.002****
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
wind_fe_po_be_clean	**0.003**	**0.002**	**0.002**	**0.002**	**0.001**	**0.001**	**0.000**	**-0.001**	**-0.001**
	(0.003)	(0.001)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
wind_fe_neg_be_clean	**-0.000**	**0.001**	**-0.001**	**-0.000**	**-0.000**	**0.000**	**-0.001**	**-0.002**	**-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
solar_fe_po_sp_clean	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**0.000**
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
solar_fe_neg_sp_clean	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**-0.000**	**-0.000**	**-0.000**	**0.000**
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
wind_onshore_fe_po_sp_clean	**-0.000**	**-0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
wind_onshore_fe_neg_sp_clean	**-0.001***	**-0.000****	**-0.001+**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**0.000**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
load_fe_po_fr	**0.000**	**-0.000****	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.001+**	**0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
load_fe_neg_fr	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**0.000**	**-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
outage_total	**-0.000**	**-0.000**	**-0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
export_to_all	**-0.000**	**-0.000***	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
import_from_all	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000+**	**-0.000***	**-0.000***	**-0.000**	**-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
message_alert_up	**-0.516**	**-0.812+**	**-0.349**	**-0.346**	**-0.440**	**-0.696**	**-0.613**	**-0.441**	**-0.699**
	(0.830)	(0.456)	(0.778)	(0.712)	(0.586)	(0.519)	(0.614)	(0.743)	(1.088)
message_alert_down	**3.193***	**1.018***	**2.395***	**2.055***	**1.634+**	**1.578+**	**1.548+**	**2.034***	**2.769***
	(1.558)	(0.507)	(1.180)	(1.045)	(0.889)	(0.885)	(0.816)	(1.033)	(1.104)
message_downgraded_up_no_alert	**0.157**	**-0.734***	**0.016**	**0.072**	**0.088**	**0.194**	**0.583**	**1.478**	**1.881+**
	(0.661)	(0.333)	(0.628)	(0.638)	(0.657)	(0.747)	(0.916)	(1.197)	(1.124)
message_downgraded_down_no_alert	**3.018****	**0.500**	**2.934****	**2.896****	**2.885***	**2.358****	**2.148***	**2.506+**	**2.747***
	(1.013)	(0.416)	(1.084)	(1.111)	(1.154)	(0.902)	(1.005)	(1.310)	(1.241)
e_offre_p5	**-0.014**	**-0.004**	**-0.014**	**-0.013**	**-0.010**	**-0.007**	**-0.003**	**0.003**	**0.011**
	(0.012)	(0.008)	(0.010)	(0.009)	(0.009)	(0.006)	(0.006)	(0.006)	(0.007)
e_demande_p5	**0.001**	**0.003**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**-0.000**	**-0.001**
	(0.014)	(0.009)	(0.021)	(0.021)	(0.029)	(0.012)	(0.020)	(0.031)	(0.016)
IDA_PETRUE	**0.396**	**0.349**	**0.436**	**0.404**	**0.530**	**0.772**	**1.338***	**2.276*****	**2.748*****
	(0.702)	(0.279)	(0.651)	(0.645)	(0.626)	(0.644)	(0.588)	(0.669)	(0.668)
(Intercept)			**7.480*****	**7.298*****	**6.822*****	**6.331*****		**5.975*****	**5.778*****
			(0.919)	(0.901)	(0.836)	(0.820)		(0.874)	(1.055)
Num.Obs.	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**	**3294**
R2	**0.097**	**0.063**	**0.084**	**0.076**	**0.062**	**0.053**	**0.056**	**0.054**	**0.051**
R2 Adj.	**0.087**	**0.052**	**0.076**	**0.068**	**0.054**	**0.045**	**0.045**	**0.046**	**0.043**
AIC	**21294.8**	**16682.9**	**21014.0**	**20935.4**	**21041.0**	**21292.4**	**21745.3**	**23249.8**	**24098.2**
BIC	**21471.7**	**16859.8**	**21197.0**	**21118.4**	**21224.0**	**21475.4**	**21922.2**	**23432.8**	**24281.2**
RMSE	**6.08**	**3.02**	**5.82**	**5.75**	**5.85**	**6.07**	**6.51**	**8.17**	**9.30**
Std.Errors	**sd_price_full**	**sd_price_st480**	**sd_price_lt240**	**sd_price_lt180**	**sd_price_lt120**	**sd_price_lt90**	**sd_price_lt75**	**sd_price_lt65**	**sd_price_lt60**

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 28: Results for sd price on day sample

	sd_price_full	sd_price_st480	sd_price_lt240	sd_price_lt180	sd_price_lt120	sd_price_lt90	sd_price_lt75	sd_price_lt65	sd_price_lt60
wind_onshore_fe_po_fr_clean	**0.001***	**0.001***	**0.001***	**0.001***	**0.001+**	**0.001+**	**0.001***	**0.000**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
wind_onshore_fe_neg_fr_clean	**0.000**	**-0.000**	**0.000**	**0.000**	**-0.000**	**-0.000**	**0.000**	**0.000**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
wind_onshore_fe_po_ge_clean	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
wind_onshore_fe_neg_ge_clean	**0.000***	**0.000**	**0.000+**	**0.000+**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
wind_offshore_fe_po_ge_clean	**-0.001*****	**-0.000**	**-0.001*****	**-0.001*****	**-0.001*****	**-0.001*****	**-0.001****	**-0.001***	**-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
wind_offshore_fe_neg_ge_clean	**0.000**	**0.000**	**-0.000**	**-0.000**	**0.000**	**-0.000**	**0.000**	**-0.000**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
wind_fe_po_be_clean	**0.002**	**0.000**	**0.002+**	**0.002+**	**0.002**	**0.001**	**0.001**	**-0.000**	**0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wind_fe_neg_be_clean	**0.001**	**0.000**	**0.001**	**0.001**	**0.001**	**0.000**	**0.000**	**-0.001**	**0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
wind_onshore_fe_po_sp_clean	**0.001+**	**0.000***	**0.000**	**0.000**	**0.000**	**0.000**	**-0.000**	**-0.000**	**-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
wind_onshore_fe_neg_sp_clean	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
load_fe_po_fr	**-0.000****	**-0.000**	**-0.000***	**-0.000***	**-0.000**	**-0.000**	**-0.000+**	**-0.000**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
load_fe_neg_fr	**-0.000+**	**-0.000+**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000***	**-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
outage_total	**0.000**	**-0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
export_to_all	**-0.000*****	**-0.000****	**-0.000*****	**-0.000*****	**-0.000*****	**-0.000****	**-0.000****	**-0.000**	**0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
import_from_all	**-0.000**	**0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**	**-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
message_alert_up	**-1.230+**	**-1.496*****	**-0.783**	**-0.803**	**-0.821**	**-0.695**	**-0.552**	**-0.349**	**-0.238**
	(0.712)	(0.409)	(0.706)	(0.626)	(0.501)	(0.482)	(0.482)	(0.475)	(0.756)
message_alert_down	**3.566**	**0.920**	**3.399**	**3.196**	**3.192**	**3.283**	**3.255**	**2.183**	**2.456**
	(2.450)	(1.254)	(2.668)	(2.543)	(2.515)	(2.358)	(2.307)	(1.861)	(2.087)
message_downgraded_up_no_alert	**-1.051+**	**-0.551**	**-0.776**	**-0.753**	**-0.400**	**-0.238**	**-0.001**	**0.136**	**0.561**
	(0.548)	(0.362)	(0.494)	(0.482)	(0.433)	(0.431)	(0.483)	(0.580)	(0.843)
message_downgraded_down_no_alert	**0.881**	**0.358**	**0.405**	**0.388**	**0.180**	**-0.427**	**-0.803**	**-1.511+**	**-1.808***
	(1.246)	(0.661)	(1.220)	(1.113)	(0.794)	(0.665)	(0.632)	(0.791)	(0.877)
e_offre_p5	**-0.025****	**-0.014***	**-0.020****	**-0.019****	**-0.019*****	**-0.018*****	**-0.016*****	**-0.018*****	**-0.013***
	(0.008)	(0.006)	(0.007)	(0.006)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)
e_demande_p5	**-0.003**	**-0.002**	**-0.006**	**-0.007**	**-0.008**	**-0.009**	**-0.008**	**-0.000**	**0.012**
	(0.030)	(0.019)	(0.029)	(0.029)	(0.028)	(0.025)	(0.023)	(0.015)	(0.013)
IDA_PETRUE	**0.720**	**0.020**	**0.653**	**0.624**	**0.582**	**0.628**	**1.067****	**1.738*****	**2.068*****
	(0.479)	(0.401)	(0.436)	(0.429)	(0.408)	(0.415)	(0.383)	(0.424)	(0.466)
Num.Obs.	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**	**5490**
R2	**0.107**	**0.054**	**0.090**	**0.082**	**0.067**	**0.056**	**0.054**	**0.039**	**0.023**
R2 Adj.	**0.101**	**0.048**	**0.084**	**0.076**	**0.061**	**0.050**	**0.048**	**0.033**	**0.016**
AIC	**33940.8**	**32080.9**	**34025.2**	**34234.5**	**34400.2**	**34691.1**	**35414.9**	**37266.6**	**39840.2**
BIC	**34092.8**	**32232.9**	**34177.2**	**34386.6**	**34552.2**	**34843.2**	**35567.0**	**37418.7**	**39992.2**
RMSE	**5.30**	**4.48**	**5.34**	**5.45**	**5.53**	**5.68**	**6.06**	**7.18**	**9.07**
Std.Errors	**sd_price_full**	**sd_price_st480**	**sd_price_lt240**	**sd_price_lt180**	**sd_price_lt120**	**sd_price_lt90**	**sd_price_lt75**	**sd_price_lt65**	**sd_price_lt60**

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Figure 29: Results for sd price on night sample

References

Alberizzi, A. and Zani, A. (2024). Analyses of the Outcomes of the Intraday Continuous Trading Market in Europe: The French Case. In *2024 20th International Conference on the European Energy Market (EEM)*, pages 1–5. ISSN: 2165-4093.

Balardy, C. (2019). *Auction and continuous market for power : organization and microstructure*. phdthesis, Université Paris sciences et lettres.

Balardy, C. (2022). An Empirical Analysis of the Bid-ask Spread in the Continuous Intraday Trading of the German Power Market. *Energy Journal*, 43(3):229–255.

Bindu, S., Chaves Ávila, J. P., and Olmos, L. (2023). Factors Affecting Market Participant Decision Making in the Spanish Intraday Electricity Market: Auctions vs. Continuous Trading. *Energies*, 16(13):5106. Publisher: Multidisciplinary Digital Publishing Institute.

Birkeland, D., AlSkaif, T., Duivenvoorden, S., Meeng, M., and Pennings, J. M. E. (2024). Quantifying and modeling price volatility in the Dutch intraday electricity market. *Energy Reports*, 12:3830–3842.

Borggrefe, F. and Neuhoff, K. (2011). Balancing and Intraday Market Design: Options for Wind Integration. *SSRN Electronic Journal*.

Bâra, A., Georgescu, I. A., and Oprea, S.-V. (2025). The role of generation mix, demand fluctuations and sequential markets in shaping intraday electricity prices. Evidence from Romania. *Renewable Energy*, 255:123782.

Deman, L. and Boucher, Q. (2023). Impact of renewable energy generation on power reserve energy demand. *Energy Economics*, 128:107173.

Ekoue, M. K., Woerman, M., and Clastres, C. (2025). Intermittency and uncertainty in wind and solar energy: Impacts on the French electricity market. *Energy Economics*, 142:108176.

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, 25(2):383–417. Publisher: [American Finance Association, Wiley].

Hagemann, S. (2013). Price Determinants in the German Intraday Market for Electricity: An Empirical Analysis.

Hagemann, S. and Weber, C. (2013). An Empirical Analysis of Liquidity and Its Determinants in the German Intraday Market for Electricity.

Hagemann, S. and Weber, C. (2015). Trading volumes in intraday markets: Theoretical reference model and empirical observations in selected European markets.

Håberg, M. and Doorman, G. (2016). Classification of balancing markets based on different activation philosophies: Proactive and reactive designs. In *2016 13th International Conference on the European Energy Market (EEM)*, pages 1–5. ISSN: 2165-4093.

Karanfil, F. and Li, Y. (2017). The Role of Continuous Intraday Electricity Markets: The Integration of Large-Share Wind Power Generation in Denmark. *The Energy Journal*, 38(2):107–130. Publisher: SAGE Publications.

Kazempour, J. (2025). Lecture 5a: Intraday markets.

Kiesel, R. and Paraschiv, F. (2017). Econometric analysis of 15-minute intraday electricity prices. *Energy Economics*, 64:77–90.

Kitzing, L., Held, A., Gephart, M., Wagner, F., Anatolitis, V., and Klessmann, C. (2024). Contracts-for-difference to support renewable energy technologies: considerations for design and implementation.

Kulakov, S. and Ziel, F. (2019). The Impact of Renewable Energy Forecasts on Intraday Electricity Prices. arXiv:1903.09641.

Ocker, F. and Jaenisch, V. (2020). The way towards European electricity intraday auctions – Status quo and future developments. *Energy Policy*, 145:111731.

Pape, C. (2018). The impact of intraday markets on the market value of flexibility — Decomposing effects on profile and the imbalance costs. *Energy Economics*, 76:186–201.

Pape, C., Hagemann, S., and Weber, C. (2016). Are fundamentals enough? Explaining price variations in the German day-ahead and intraday power market. *Energy Economics*, 54:376–387.

Richard, M. and Solier, B. (2025). Dealing with renewables integration: A comparative study of Belgian and French balancing systems. *Energy Economics*, 151:108938.

Scharff, R. and Amelin, M. (2016). Trading behaviour on the continuous intraday market Elbas. *Energy Policy*, 88:544–557.

Soysal, E. R., Olsen, O. J., Skytte, K., and Sekamane, J. K. (2017). Intraday market asymmetries — A Nordic example. In *2017 14th International Conference on the European Energy Market (EEM)*, pages 1–6. ISSN: 2165-4093.

Spodniak, P., Ollikka, K., and Honkapuro, S. (2021). The impact of wind power and electricity demand on the relevance of different short-term electricity markets: The Nordic case. *Applied Energy*, 283:116063.

Weber, C. (2010). Adequate intraday market design to enable the integration of wind energy into the European power systems. *Energy Policy*, 38(7):3155–3163.

Weber, P. and Woerman, M. (2024). Intermittency or Uncertainty? Impacts of Renewable Energy in Electricity Markets. *Journal of the Association of Environmental and Resource Economists*, 11(6):1351–1385. Publisher: The University of Chicago Press.