STUDY CASE
B2W CHALLENGE

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OVERVIEW

- 1. MOTIVATING PROBLEM
- 2. 'SALES.CSV' DATASET
- 3. 'COMP_PRICES.CSV' DATASET
- 4. CONCLUSIONS

MOTIVATING PROBLEM

- Adjust/optimize the relationship between Price and Demand
- Achieve commercial targets

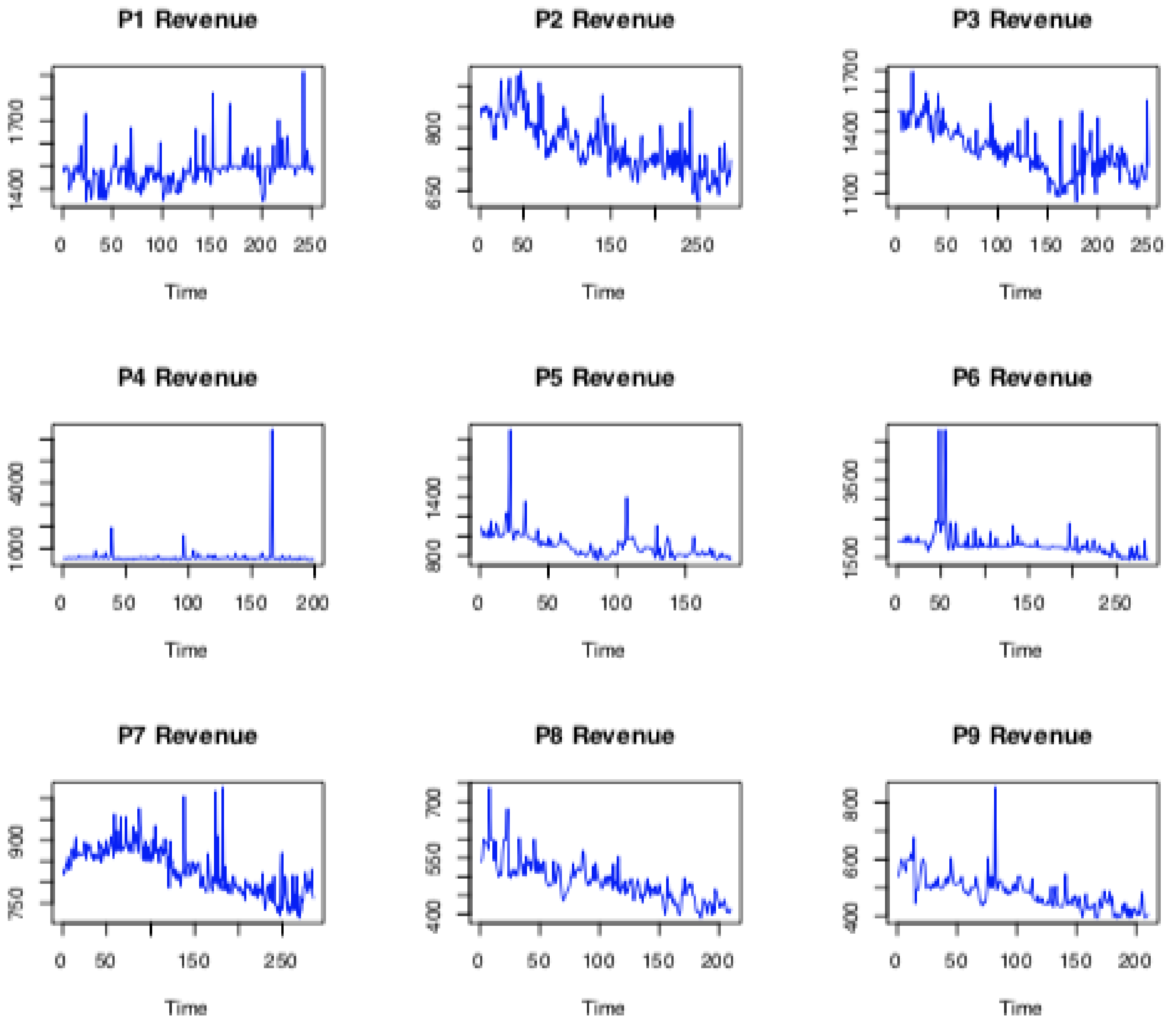
But How?

MOTIVATING PROBLEM

- Analyzing two datasets:
  - 'sales.cvs': contains B2W's **transactional information from 9 different products;**
  - '**comp_prices.csv**': contains 6 competitors' information from the same 9 different product;
  - Data available for the year of 2015.

'SALES.CSV' DATASET

Plot of the products revenue



'SALES.CSV' DATASET

- KPSS Test:
  - Although only three have stationary behavior, the KPSS test suggests that we treat the set as non-stationary in the trend;
- Nonlinear.

Product ID	ARIMA(p, d, q)	ETS	NNETAR(p, k)
P_1	ARIMA$(1,1,1)$, $\widehat{\sigma_e} = 66.87$	ETS(M, N, N), $\widehat{\sigma_e} = 0.04$	NNETAR$(4,2)$, $\widehat{\sigma_e} = 0.04$
P_2	ARIMA$(0,1,2)$, $\widehat{\sigma_e} = 32.21$	ETS(A, N, N), $\widehat{\sigma_e} = 33.56$	NNETAR$(7,4)$, $\widehat{\sigma_e} = 0.04$
P_3	ARIMA$(2,1,3)$, $\widehat{\sigma_e} = 71.28$	ETS(A, N, N), $\widehat{\sigma_e} = 72.13$	NNETAR$(7,4)$, $\widehat{\sigma_e} = 0.05$
P_4	ARIMA$(0,0,0)$, $\widehat{\sigma_e} = 436.59$	ETS(A, N, N), $\widehat{\sigma_e} = 437.72$	NNETAR$(1,1)$, $\widehat{\sigma_e} = 0.22$
P_5	ARIMA$(0,1,1)$, $\widehat{\sigma_e} = 109.04$	ETS(M, N, N), $\widehat{\sigma_e} = 0.11$	NNETAR$(4,2)$, $\widehat{\sigma_e} = 0.08$
P_6	ARIMA$(5,1,0)$, $\widehat{\sigma_e} = 231.71$	ETS(M, A_d, N), $\widehat{\sigma_e} = 0.12$	NNETAR$(6,4)$, $\widehat{\sigma_e} = 0.05$
P_7	ARIMA$(0,1,1)$, $\widehat{\sigma_e} = 34.35$	ETS(A, N, N), $\widehat{\sigma_e} = 34.37$	NNETAR$(8,4)$, $\widehat{\sigma_e} = 0.03$
P_8	ARIMA$(2,1,1)$, $\widehat{\sigma_e} = 29.99$	ETS(M, N, N), $\widehat{\sigma_e} = 0.05$	NNETAR$(2,2)$, $\widehat{\sigma_e} = 0.03$
P_9	ARIMA$(1,1,1)$, $\widehat{\sigma_e} = 39.47$	ETS(M, N, N), $\widehat{\sigma_e} = 0.08$	NNETAR$(6,4)$, $\widehat{\sigma_e} = 0.06$

PREDICTION MODELS

PREDICTION MODELS TUNED

NNETAR(p, k) was chosen due to its ability to:

- model nonlinear dynamics;
- and possible seasonality.

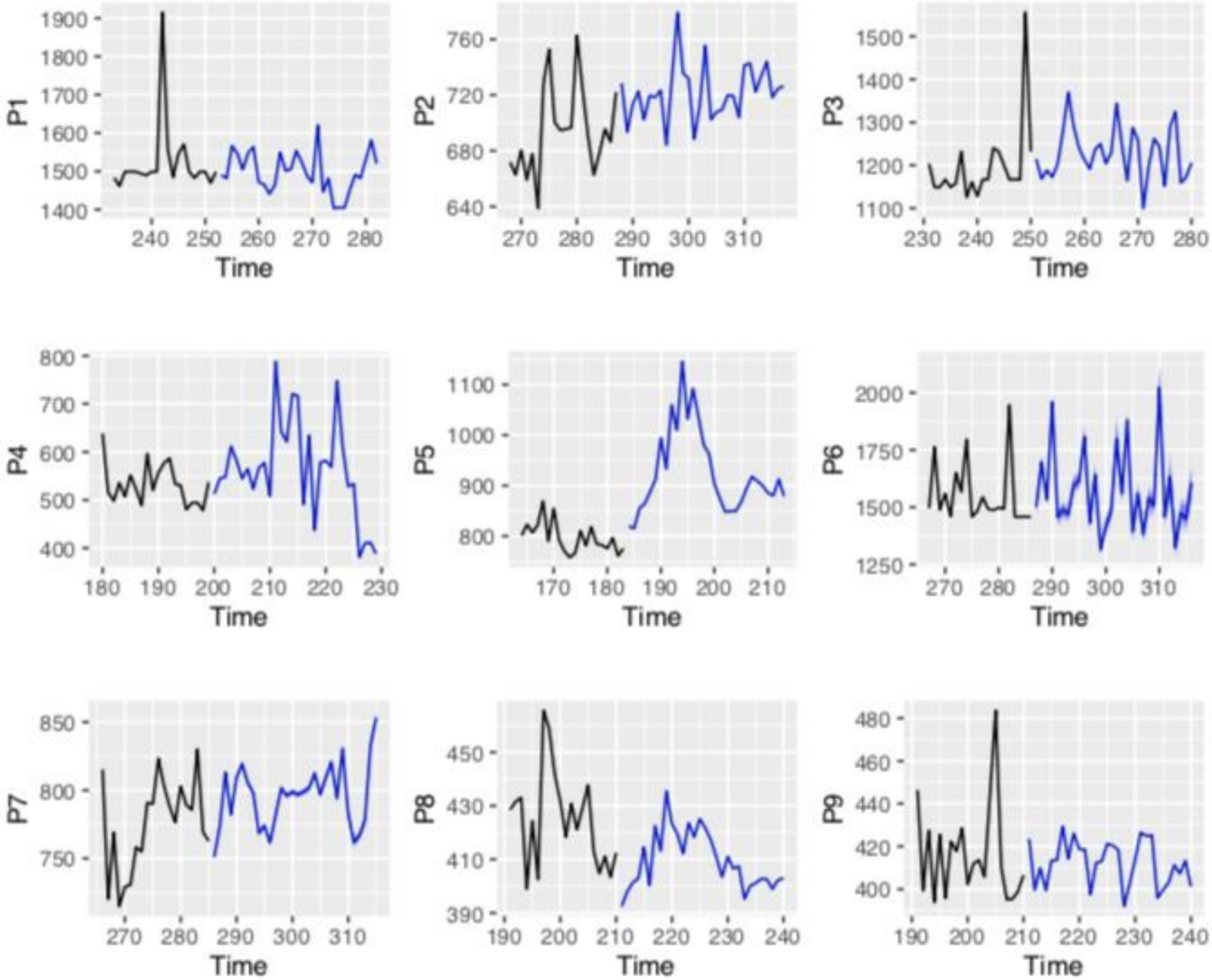
Fine tuning process:

- p = k = 30 are imposed to the neural network, so that it can capture the monthly variation and the nature of the nonlinear dynamics of the data

Product ID	NNETAR(30, 30)
P_1	$\widehat{\sigma_e} = 2.67 \times 10^{-5}$
P_2	$\widehat{\sigma_e} = 4.74 \times 10^{-5}$
P_3	$\widehat{\sigma_e} = 7.59 \times 10^{-5}$
P_4	$\widehat{\sigma_e} = 1.54 \times 10^{-4}$
P_5	$\widehat{\sigma_e} = 1.00 \times 10^{-4}$
P_6	$\widehat{\sigma_e} = 9.82 \times 10^{-3}$
P_7	$\widehat{\sigma_e} = 2.95 \times 10^{-4}$
P_8	$\widehat{\sigma_e} = 7.28 \times 10^{-5}$
P_9	$\widehat{\sigma_e} = 8.26 \times 10^{-5}$

'SALES.CSV' DATASET

Plot of the products revenue forecast



'COMP_PRICES.CSV' DATASET

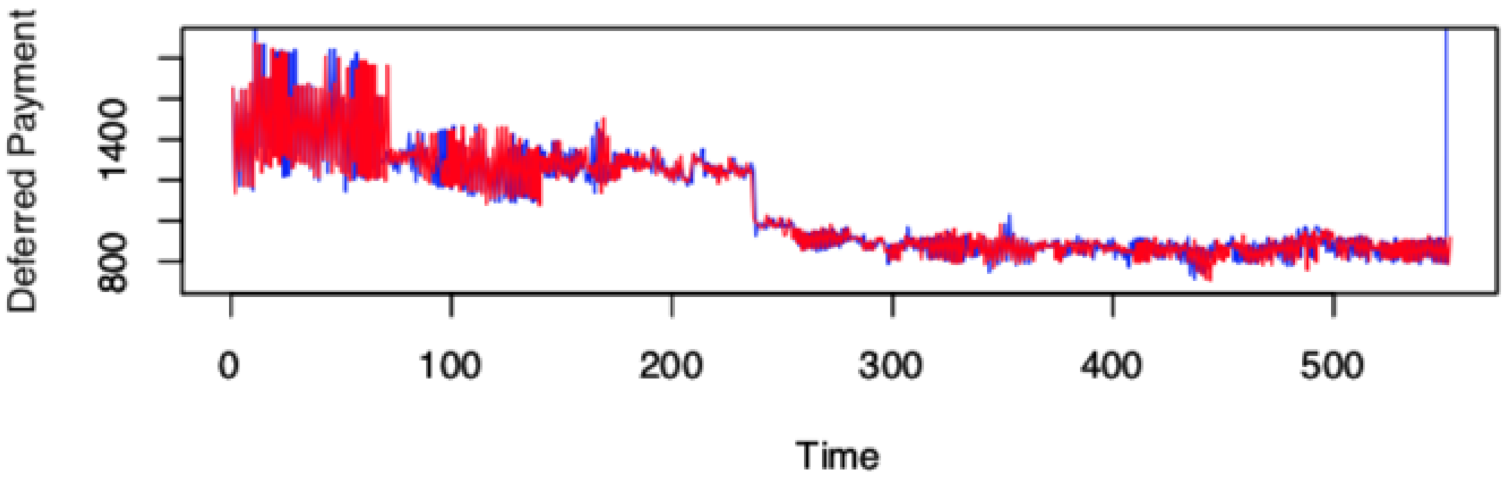
- Nonstationary
- Nonlinear
- Dimensionality reduction

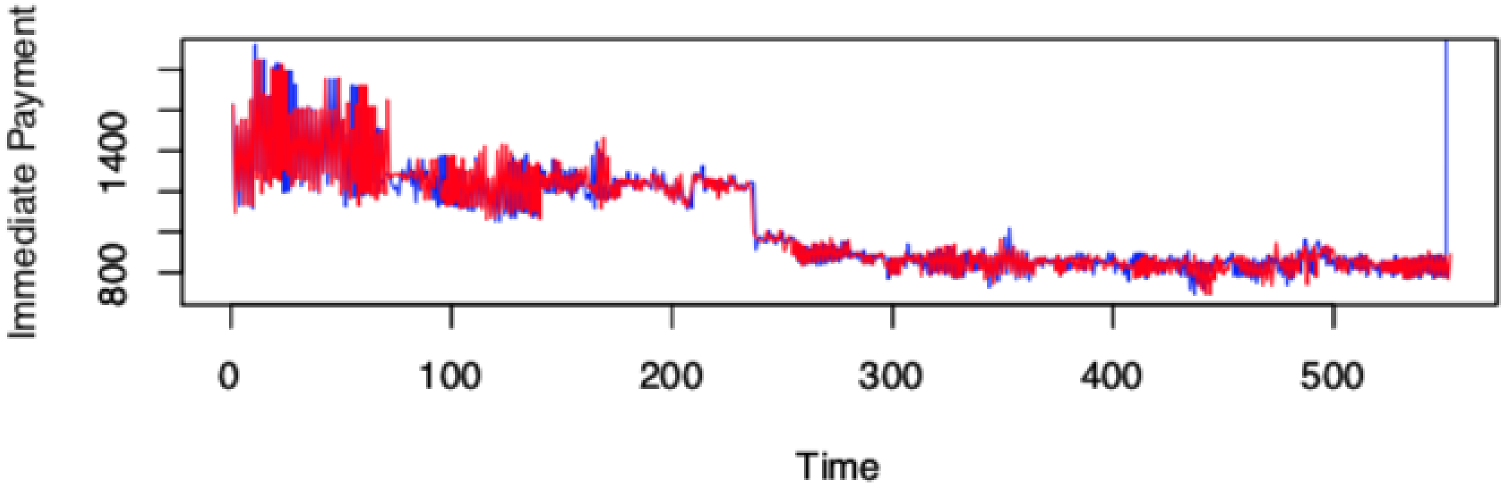
'COMP_PRICES.CSV' DATASET

Plot of payment type

Diurnal: blue line (12am --- 12pm)
Nocturnal: red line (12pm --- 12am)

No differentiation between diurnal and nocturnal



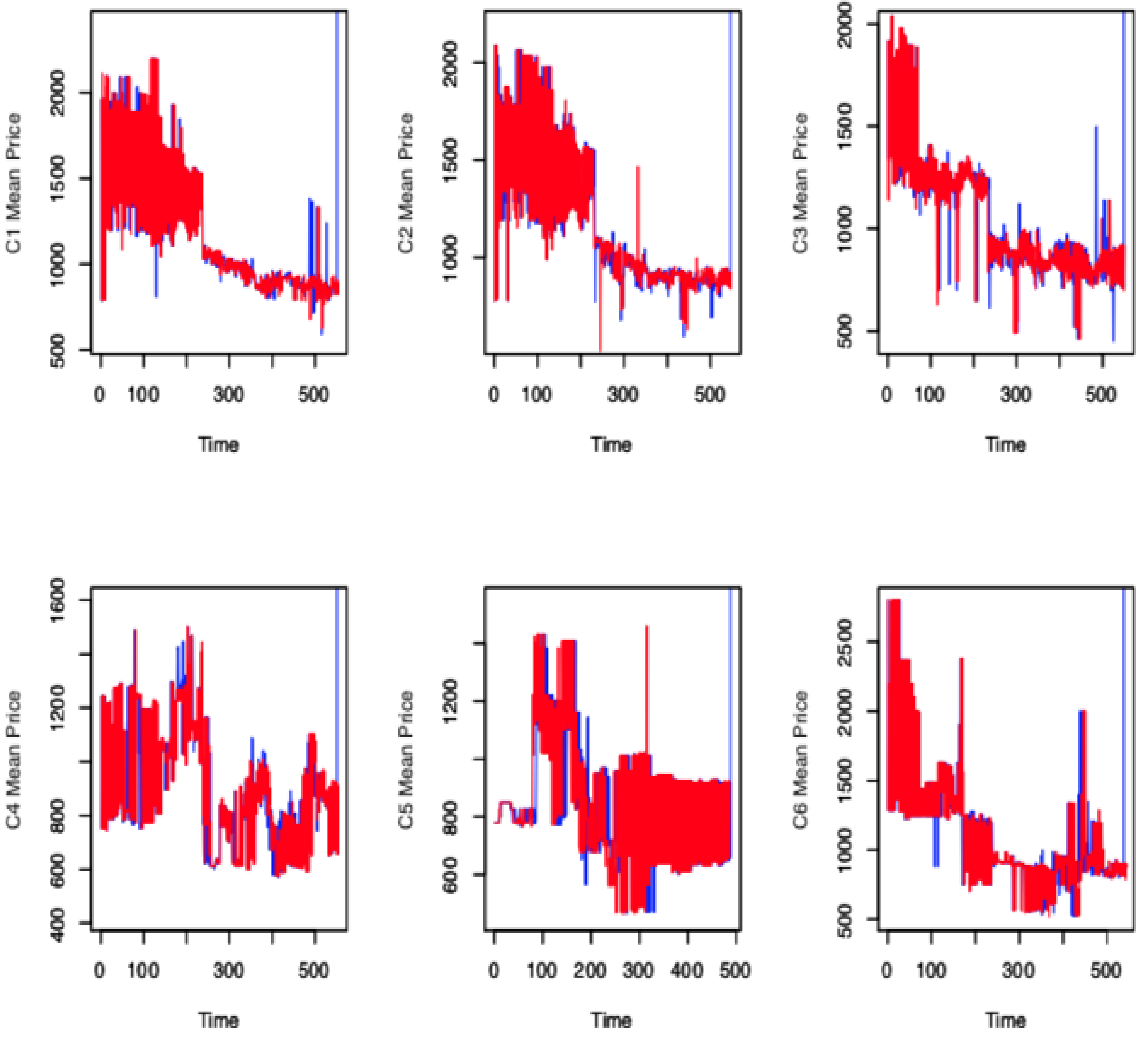


'COMP_PRICES.CSV' DATASET

Competitors prices plots

Diurnal: blue line (12am --- 12pm)
Nocturnal: red line (12pm --- 12am)

No differentiation between diurnal and nocturnal

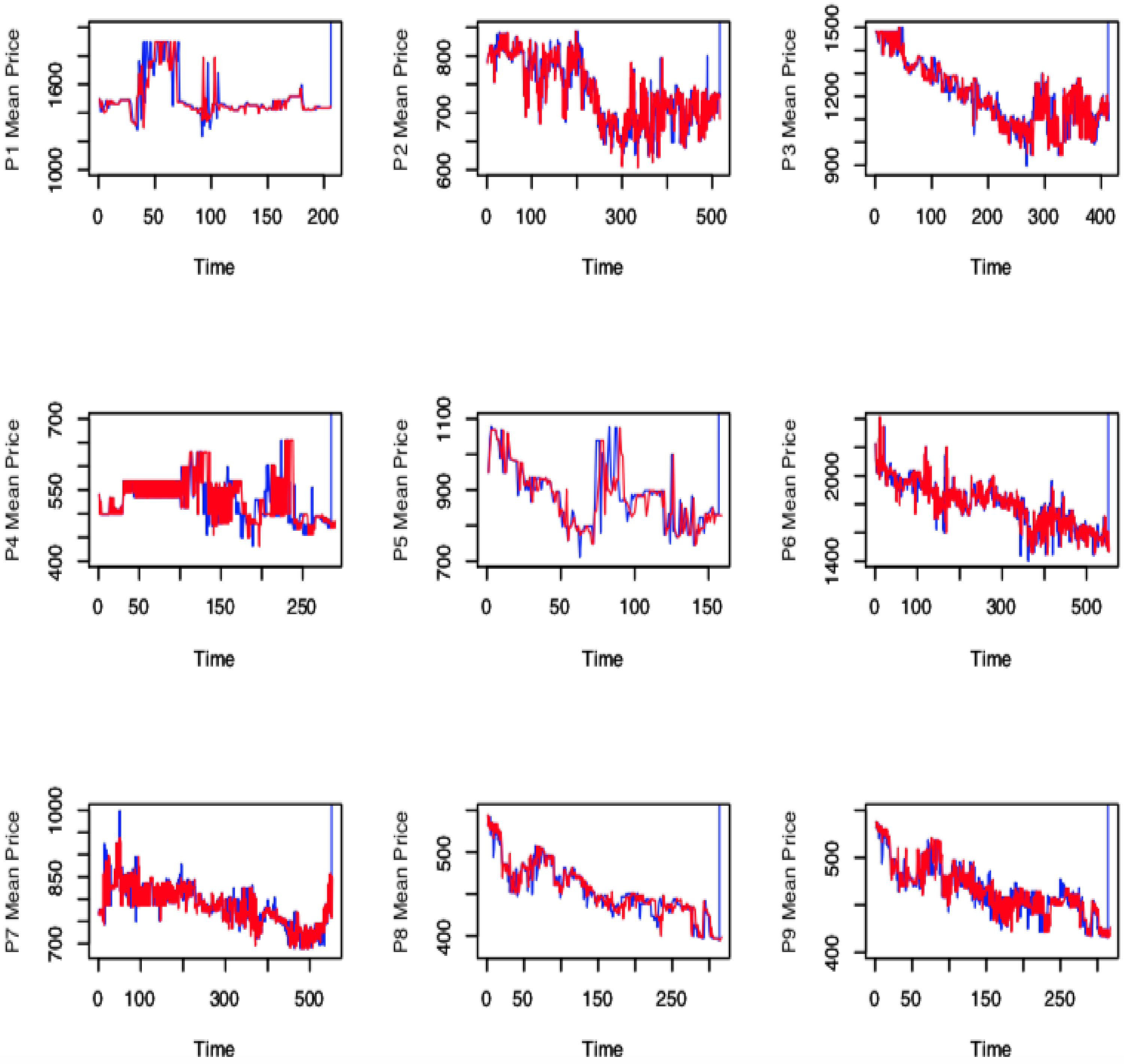


'COMP_PRICES.CSV' DATASET

Plot of the products revenue

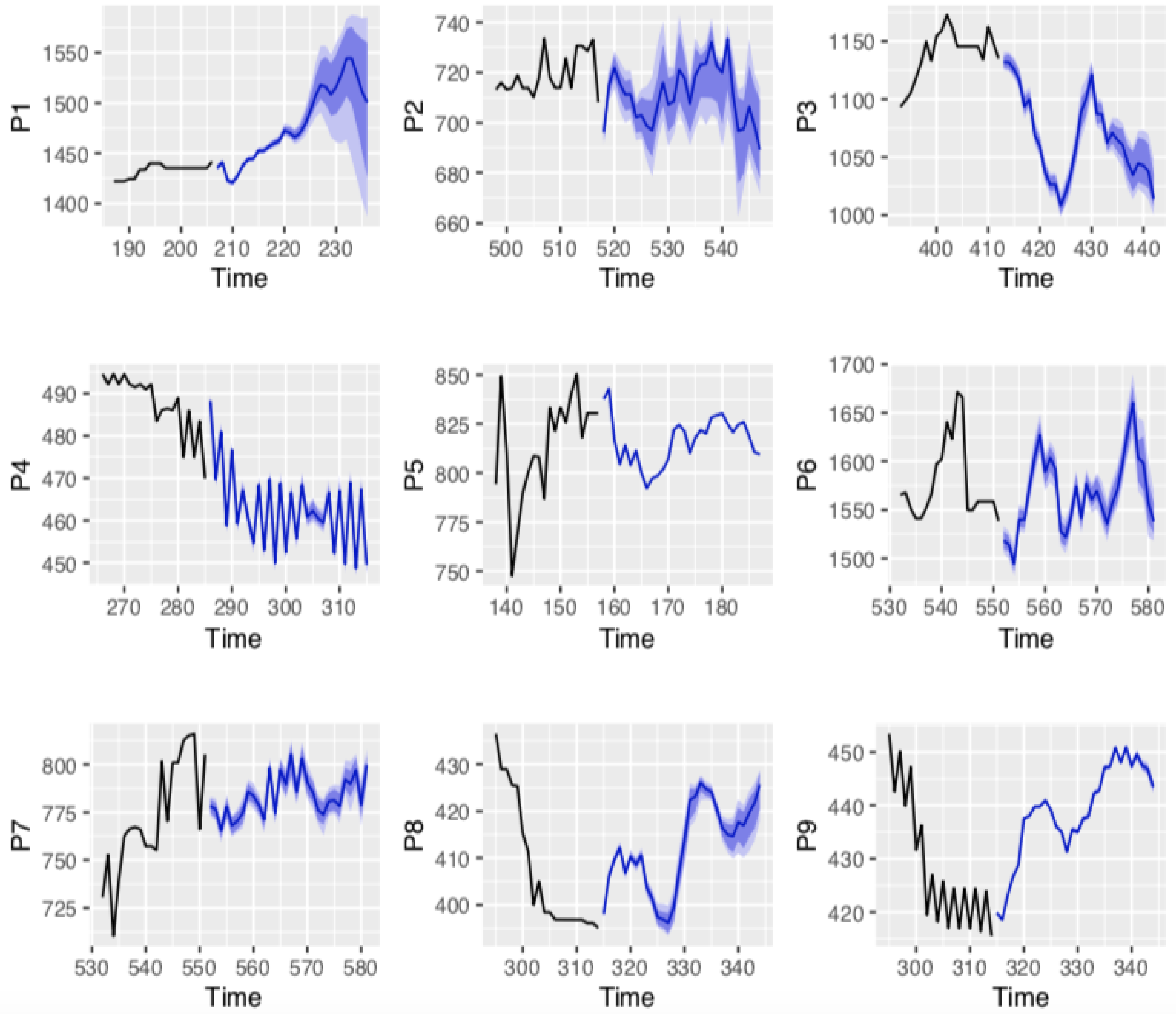
Diurnal: blue line (12am --- 12pm)
Nocturnal: red line (12pm --- 12am)

No differentiation between diurnal and nocturnal



'COMP_PRICES.CSV' DATASET

Plot of the products revenue forecast



PREDICTION MODELS TUNED

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- and possible seasonality.

Fine tuning process:

- p = k = 30 are imposed to the neural network, so that it can capture the monthly variation and the nature of the nonlinear dynamics of the data

Product ID	NNETAR(30, 30)
P_1	$\widehat{\sigma_e} = 1.01 \times 10^{-3}$
P_2	$\widehat{\sigma_e} = 4.05 \times 10^{-3}$
P_3	$\widehat{\sigma_e} = 4.03 \times 10^{-3}$
P_4	$\widehat{\sigma_e} = 5.61 \times 10^{-3}$
P_5	$\widehat{\sigma_e} = 5.77 \times 10^{-4}$
P_6	$\widehat{\sigma_e} = 1.29 \times 10^{-2}$
P_7	$\widehat{\sigma_e} = 8.92 \times 10^{-3}$
P_8	$\widehat{\sigma_e} = 5.19 \times 10^{-3}$
P_9	$\widehat{\sigma_e} = 5.37 \times 10^{-3}$

COMPARISON BETWEEN PREDICTION MODELS

B2W

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COMPETITORS

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CONCLUSIONS

- The predictive models developed for B2W outperforms those for the competition
  - Higher quality of measure (low additive noise)
- More work needs to be done to fine tuning of the model
  - Adjustment with interest rate, taxes, market etc.