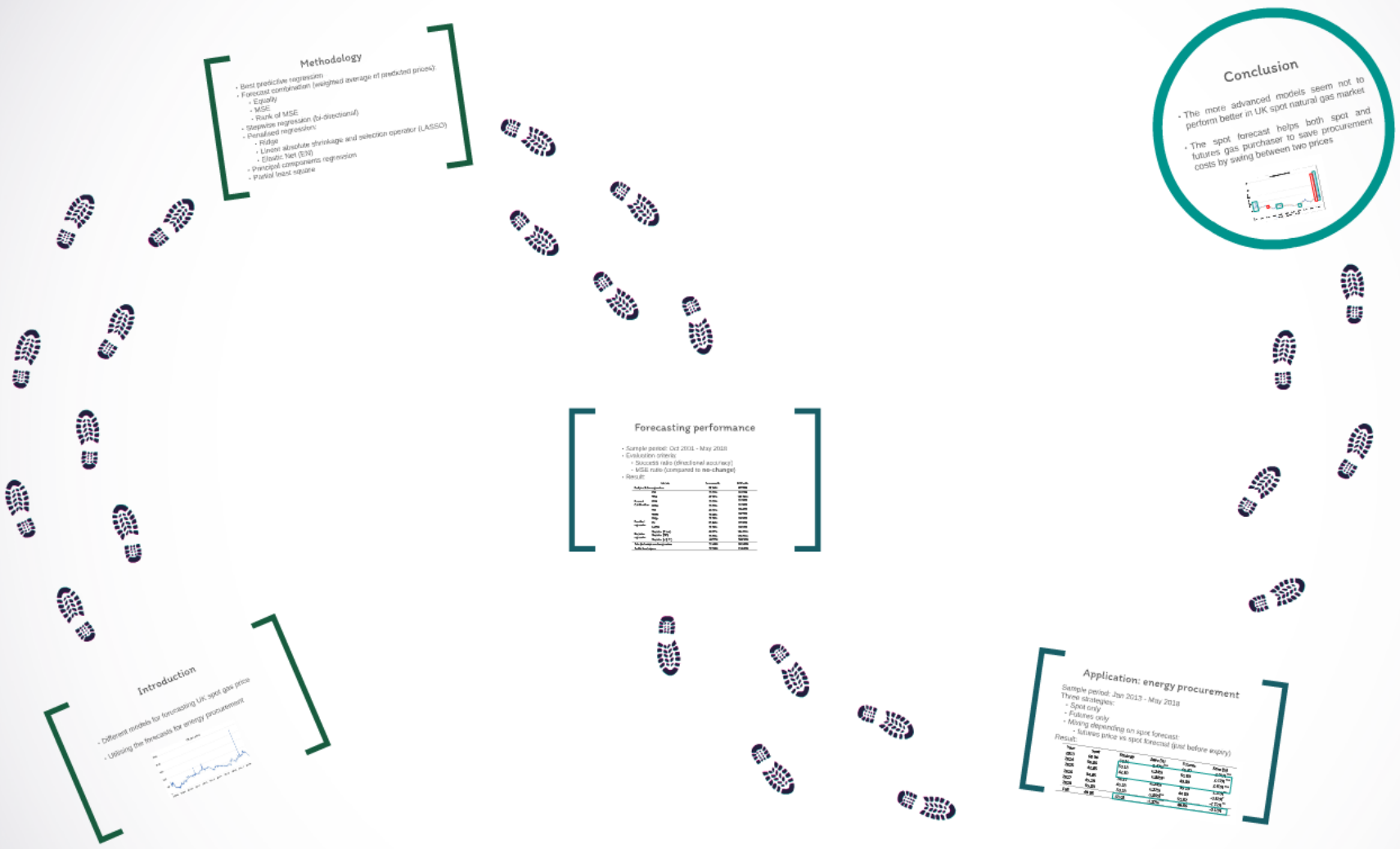


Forecasting spot price in the UK natural gas market



Methodology

- Best predictive regression
- Forecast combination (weighted average of predicted prices):
 - Equally
 - MSE
 - Rank of MSE
- Stepwise regression (bi-directional)
- Penalized regression:
 - Ridge
 - L1 and L2 absolute shrinkage and selection operator (LASSO)
 - Elastic Net (EN)
- Principal components regression
- partial least square

Forecasting performance

- Sample period: Oct 2011 - May 2018
- Evaluation criteria:
 - Success rate (forecast accuracy)
 - MAE, RMSE (compared to the change)
- Result:

Model	Success Rate	MAE	RMSE
Best Predictive Regression	0.65	0.0015	0.0025
Forecast Combination	0.60	0.0018	0.0028
Stepwise Regression	0.55	0.0020	0.0030
Penalized Regression	0.50	0.0022	0.0032
Principal Components Regression	0.45	0.0025	0.0035
Partial Least Square	0.40	0.0028	0.0038

Conclusion

- The more advanced models seem not to perform better in UK spot natural gas market
- The spot forecast helps both spot and futures gas purchaser to save procurement costs by swing between two prices

Introduction

- Different models for forecasting UK spot gas price
- Utilising the forecasts for energy procurement

Application: energy procurement

Sample period: Jan 2013 - May 2018

Three strategies:

- Spot only
- Futures only
- Moving depending on spot forecast

Result: futures price vs spot forecast (just before expiry)

Year	MAE	RMSE	Success Rate	MAE	RMSE
2013	0.0015	0.0025	0.65	0.0018	0.0028
2014	0.0015	0.0025	0.65	0.0018	0.0028
2015	0.0015	0.0025	0.65	0.0018	0.0028
2016	0.0015	0.0025	0.65	0.0018	0.0028
2017	0.0015	0.0025	0.65	0.0018	0.0028
2018	0.0015	0.0025	0.65	0.0018	0.0028

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Forecasting spot price in the UK natural gas market

Introduction

- Different models for forecasting UK spot gas price
- Utilising the forecasts for energy procurement



Methodology

- Best predictive regression
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- Partial least square

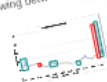
Forecasting performance

- Sample period: Oct 2011 - May 2018
- Evaluation criteria:
 - Success rate (forecast accuracy)
 - MAE, RMSE (compared to the change)
- Result:

Model	Success Rate	MAE	RMSE
Best Predictive Regression	0.75	0.0015	0.0025
Forecast Combination (Equally)	0.72	0.0018	0.0028
Forecast Combination (Rank of MSE)	0.70	0.0020	0.0030
Stepwise Regression	0.68	0.0022	0.0032
Ridge	0.65	0.0025	0.0035
LASSO	0.63	0.0028	0.0038
Elastic Net	0.60	0.0030	0.0040
Principal Components Regression	0.58	0.0032	0.0042
Partial Least Square	0.55	0.0035	0.0045

Conclusion

- The more advanced models seem not to perform better in UK spot natural gas market
- The spot forecast helps both spot and futures gas purchaser to save procurement costs by swing between two prices



Application: energy procurement

Sample period: Jan 2013 - May 2018

Three strategies:

- Spot only
- Futures only
- Forecasting depending on spot forecast

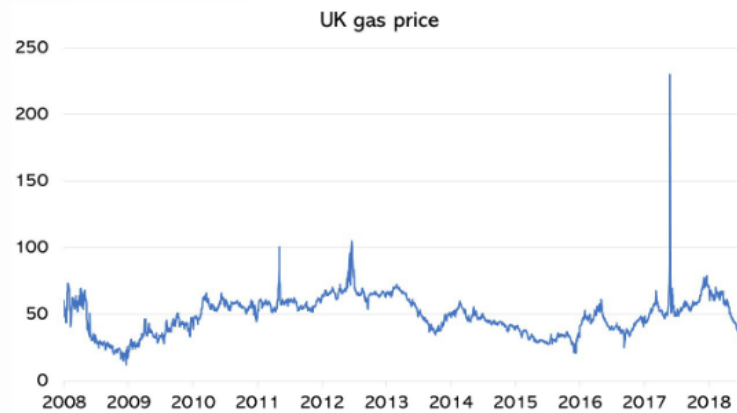
Result: futures price vs spot forecast (just before expiry)

Year	MAE	RMSE	Success Rate	MAE	RMSE
2013	0.0015	0.0025	0.75	0.0018	0.0028
2014	0.0015	0.0025	0.75	0.0018	0.0028
2015	0.0015	0.0025	0.75	0.0018	0.0028
2016	0.0015	0.0025	0.75	0.0018	0.0028
2017	0.0015	0.0025	0.75	0.0018	0.0028
2018	0.0015	0.0025	0.75	0.0018	0.0028
1st	0.0015	0.0025	0.75	0.0018	0.0028
2nd	0.0015	0.0025	0.75	0.0018	0.0028

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Introduction


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Methodology

- Best predictive regression 
- Forecast combination (weighted average of predicted prices):
 - Equally
 - MSE
 - Rank of MSE
- Stepwise regression (bi-directional)
- Penalised regression:
 - Ridge
 - Linear absolute shrinkage and selection operator (LASSO)
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- Principal components regression
- Partial least square

Predictors

- Brent, Carbon, Coal
- Wind generation ratio
- Stock indexes
- Interest rates and bond yields
- Technical analysis indicator
- Some other predictors cannot be disclosed due to confidential

Forecasting performance

- Sample period: Oct 2001 - May 2018
- Evaluation criteria:
 - Success ratio (directional accuracy)
 - MSE ratio (compared to **no-change**)
- Result:

	Models	Success ratio	MSE ratio
	Best predictive regression	57.14%	87.70%
	EW	53.33%	91.27%
	TEW	47.62%	112.08%
Forecast	IMW	53.33%	91.33%
Combination	DMW	53.33%	91.33%
	TW	49.52%	93.46%
	TDTW	50.48%	93.75%
	Ridge	52.38%	99.35%
Penalised regression	EN	55.24%	97.97%
	LASSO	52.38%	99.26%
	Stepwise (F-test)	46.67%	124.65%
Stepwise regression	Stepwise (BIC)	53.33%	106.53%
	Stepwise (adj. R ²)	48.57%	308.50%
	Principal components regression	51.43%	101.69%
	Partial least square	52.38%	110.62%

Models	Success ratio	MSE ratio
regression	57.14%	87.70%
EW	53.33%	91.27%
TEW	47.62%	112.08%
IMW	53.33%	91.33%
DMW	53.33%	91.33%
TW	49.52%	93.46%
TDTW	50.48%	93.75%
Ridge	52.38%	99.35%
EN	55.24%	97.97%
LASSO	52.38%	99.26%
Stepwise (F-test)	46.67%	124.65%
Stepwise (BIC)	53.33%	106.53%
Stepwise (adj. R ²)	48.57%	308.50%
ponents regression	51.43%	101.69%
quare	52.38%	110.62%

Application: energy procurement

Sample period: Jan 2013 - May 2018

Three strategies:

- Spot only
- Futures only
- Mixing depending on spot forecast:
 - futures price vs spot forecast (just before expiry)

Result:

Year	Spot	Strategy	Save (%)	Futures	Save (%)
2013	68.04	66.36	-2.47%***	66.67	-2.01%***
2014	50.06	50.18	0.24%	51.30	2.47%***
2015	42.65	42.89	0.58%**	43.80	2.69%***
2016	34.65	34.57	-0.24%	35.10	1.29%**
2017	45.18	45.28	0.22%	44.80	-0.83%*
2018	55.83	50.28	-9.95%***	51.52	-7.72%**
Full	48.65	48.03	-1.27%***	48.56	-0.18%

Strategy	Save (%)	Futures	Save (%)
66.36	-2.47%***	66.67	-2.01%***
50.18	0.24%	51.30	2.47%***
42.89	0.58%**	43.80	2.69%***
34.57	-0.24%	35.10	1.29%**
45.28	0.22%	44.80	-0.83%*
50.28	-9.95%***	51.52	-7.72%**
48.03	-1.27%***	48.56	-0.18%

g on spot forecast: vs spot forecast (just before expiry)

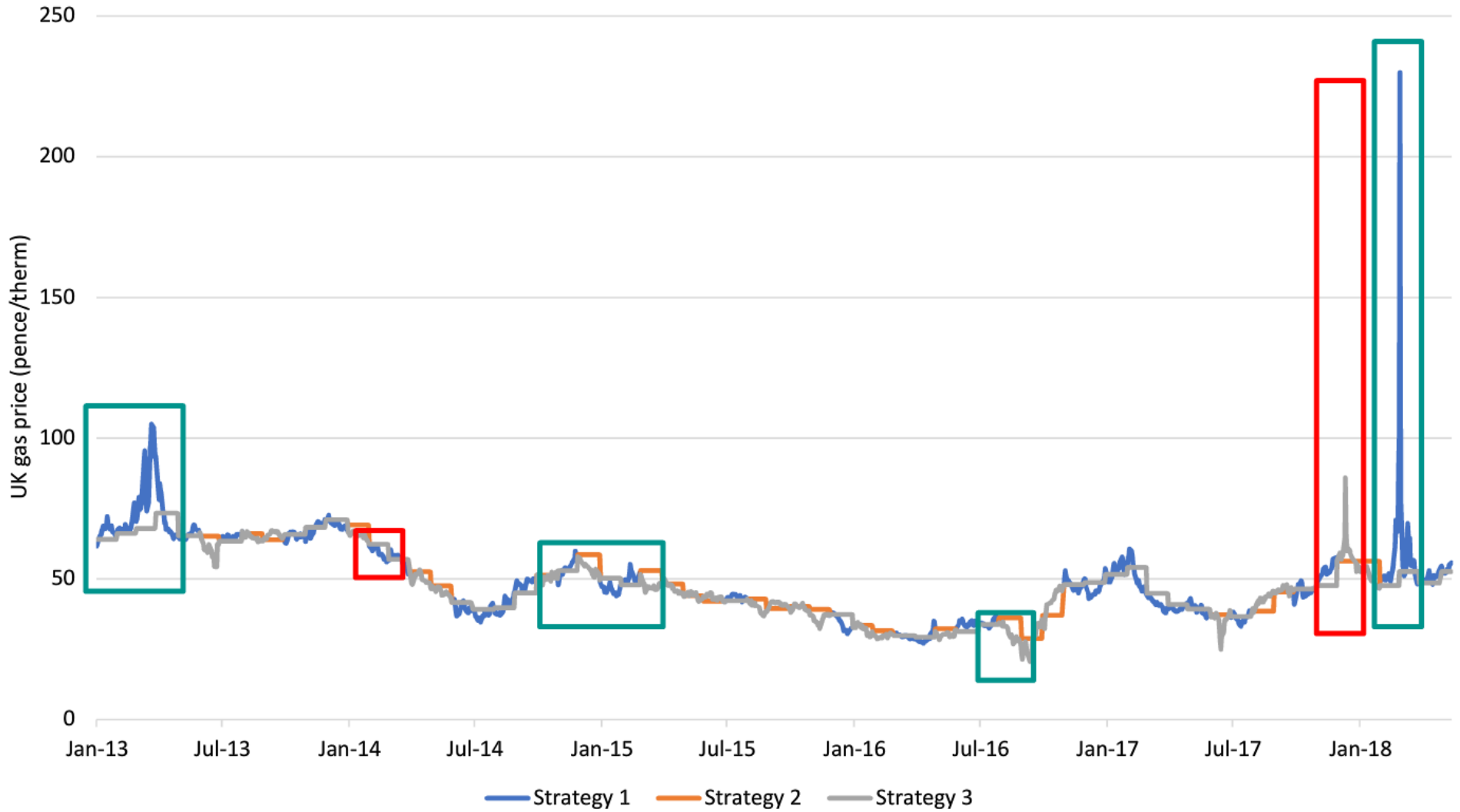
Strategy	Save (%)	Futures	Save (%)
66.36	-2.47%***	66.67	-2.01%***
50.18	0.24%	51.30	2.47%***
42.89	0.58%**	43.80	2.69%***
34.57	-0.24%	35.10	1.29%**
45.28	0.22%	44.80	-0.83%*
50.28	-9.95%***	51.52	-7.72%**
48.03	-1.27%***	48.56	-0.18%

Conclusion

- The more advanced models seem not to perform better in UK spot natural gas market
- The spot forecast helps both spot and futures gas purchaser to save procurement costs by swing between two prices



The comparison between strategies



Future works

- Extend the forecasting horizons
- Extend the models - sparse PCA
- Different trading strategies

Forecasting spot price in the UK natural gas market

Introduction

- Different models for forecasting UK spot gas price
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Methodology

- Best practice regression
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 - MSE
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- Penalized regression:
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- Principal components regression
- Partial least square

Forecasting performance

- Sample period: Oct 2011 - May 2018
- Evaluation criteria:
 - Success rate (forecast accuracy)
 - MAE, RMSE (compared to the change)
- Result:

Model	Success Rate	MAE	RMSE
Best Practice Regression	0.75	0.15	0.25
Forecast Combination	0.70	0.18	0.28
Stepwise Regression	0.65	0.20	0.30
Penalized Regression	0.60	0.22	0.32
Principal Components Regression	0.55	0.25	0.35
Partial Least Square	0.50	0.28	0.38

Application: energy procurement

Sample period: Jan 2013 - May 2018

Three strategies:

- Spot only
- Futures only
- Forecasting depending on spot forecast

Result: futures price vs spot forecast (just before expiry)

Spot	Futures	Forecast	MAE	RMSE
0.00	0.00	0.00	0.00	0.00
0.01	0.01	0.01	0.00	0.00
0.02	0.02	0.02	0.00	0.00
0.03	0.03	0.03	0.00	0.00
0.04	0.04	0.04	0.00	0.00
0.05	0.05	0.05	0.00	0.00
0.06	0.06	0.06	0.00	0.00
0.07	0.07	0.07	0.00	0.00
0.08	0.08	0.08	0.00	0.00
0.09	0.09	0.09	0.00	0.00
0.10	0.10	0.10	0.00	0.00

Conclusion

- The more advanced models seem not to perform better in UK spot natural gas market
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