Deloitte | Centrale Marseille

DRiM Challenge Deloitte

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13.12.2022

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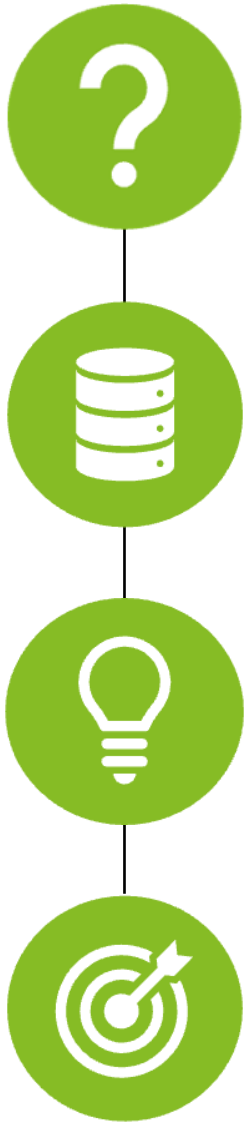
This presentation includes a preliminary analysis of the variables, the forecasting models, and the performance of these



Problem

Problem

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Context

*Bank wants to calculate the **default risk probability** of loan applicants based on their financial history over all other financial institutes*

Credit Risk parameter forecasting models

- IFRS 9
- Credit-stress test systems

Goal

Model to **predict** the annual **default rate** for different time horizons

Portfolio of loans intended for the **purchase** of **automobiles** by retail counterparty

Forecast Horizon

12-month time horizon

24-month time horizon

36-month time horizon

Problem

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Constraints

Restricted Dataset

Constraints Implementation

- Stationarity Test
- Deep Learning
- Bootstrap
- Normality Test (Jarque-Berra)
- Intercorrelation Test (Box-Pierce)

Constraints Model

Regression

Time Series

Dataset Overview

Dataset Overview

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3 risk profiles

- Good quality customers – **CHR2**
- Bad quality customers – **CHR8**
- All portfolios - **Totale**

81 variables

Internal Data

- **8 numerical variables including:**
  - Award score
  - Time since last payment
  - Maximum duration of unpaid invoices
- **5 categorical variables including:**
  - Type of housing
  - Civil status
  - Vehicule quality code

External Data

- **3 macroeconomic variables:**
  - GDP
  - Annual inflation
  - Annual unemployment rate
- **Additional macroeconomic variables:**
  - CAC40 index
  - Exchange rate EURO/USD
  - ECB lending rate

Dataset Overview

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Feature selection w/ $N_{variables} < (34 - period/3)*0.8$

Naive approach	Unsupervised method	Wrapper methods	Filter methods
Graphical approach	Low variance method	Backward selection	Correlation analysis
		Forward selection	Kbest method
		Recursive feature elimination	

Approach

Approach

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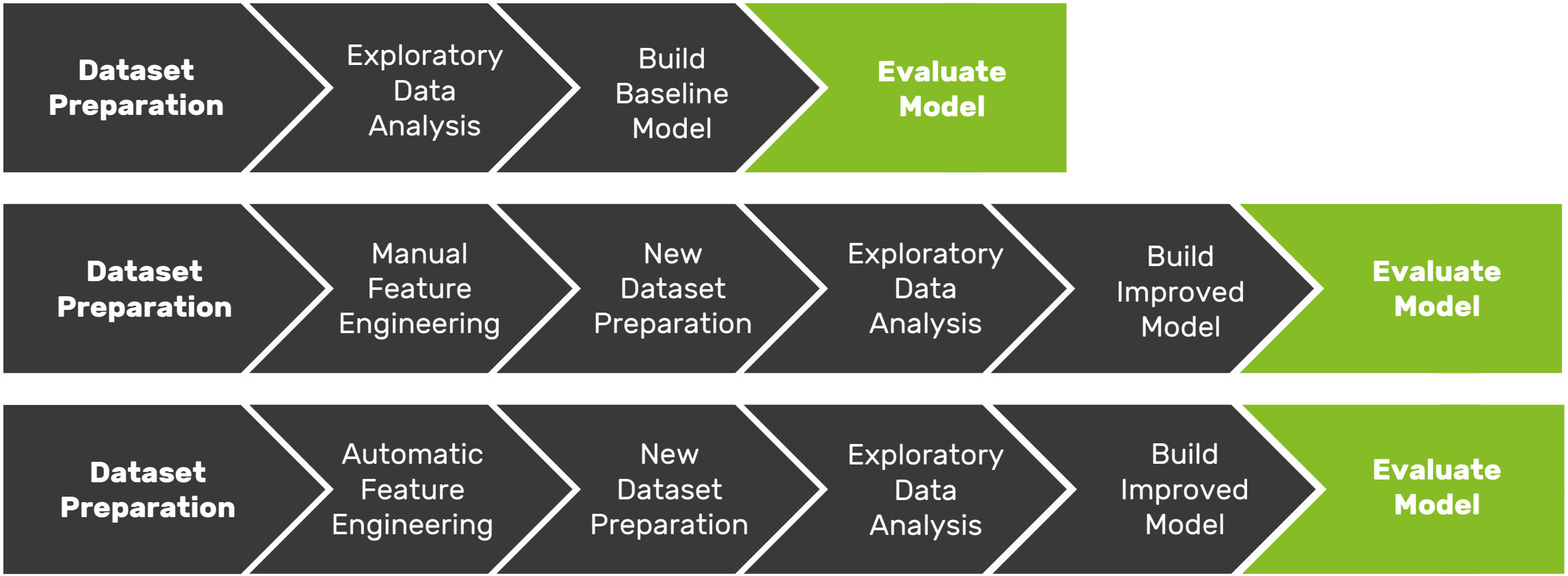
Methodology



Approach

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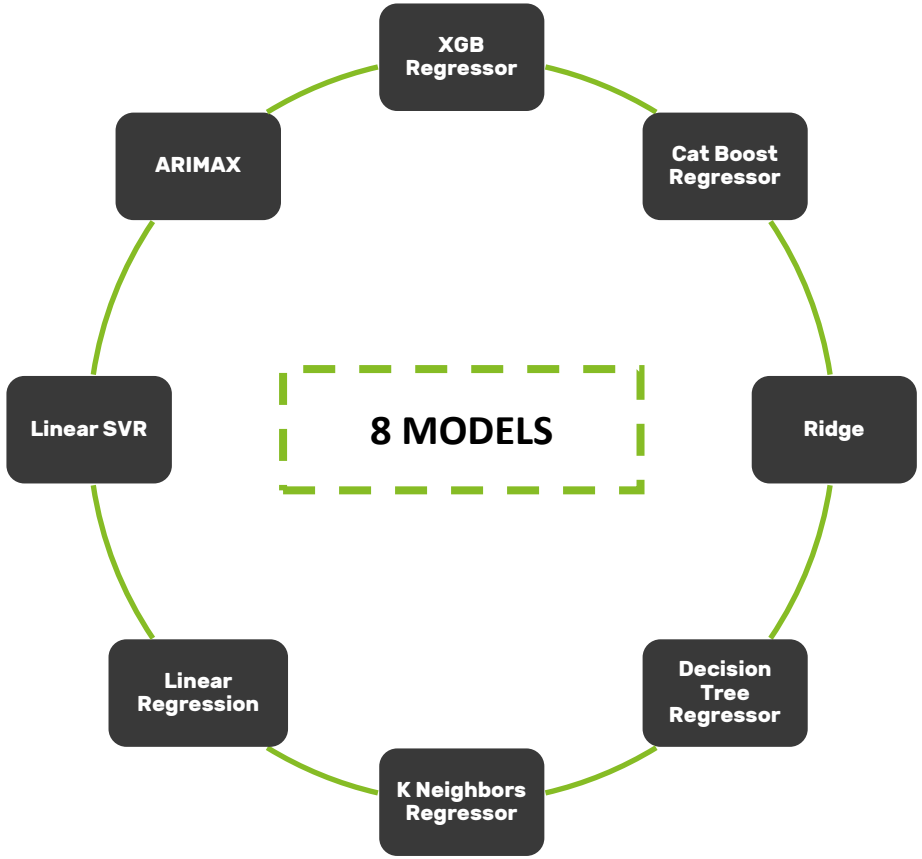
Models used



Model Formulas

Linear Regression

$$R = min_{\omega}(\|X\omega - y\|_2^2)$$

Ridge Regression

$$R = min_{\omega}(\|X\omega - y\|_2^2 + \alpha\|\omega\|_2^2)$$

Lasso

$$R = min_{\omega}(\frac{1}{2n_{samples}}\|X\omega - y\|_2^2 + \alpha\|\omega\|_1)$$

Elastic Net

$$R = min_{\omega}(\frac{1}{2n_{samples}}\|X\omega - y\|_2^2 + \alpha\rho\|\omega\|_1 + \frac{\alpha(1-\rho)}{2}\|X\omega - y\|_2^2)$$

Results and Performance

Results and performance

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Chronique CHR2			
Machine Learning			
DATE	**12-month**	**24-month**	**36-month**
Real Q1 2016	*0,25%*		
Theoretical Q1 2016	*0,249%*		
Real Q1 2015		*0,25%*	
Theoretical Q1 2015		*0,20%*	
Real Q1 2014			*0,25%*
Theoretical Q1 2014			*0,2169%*

Results and performance

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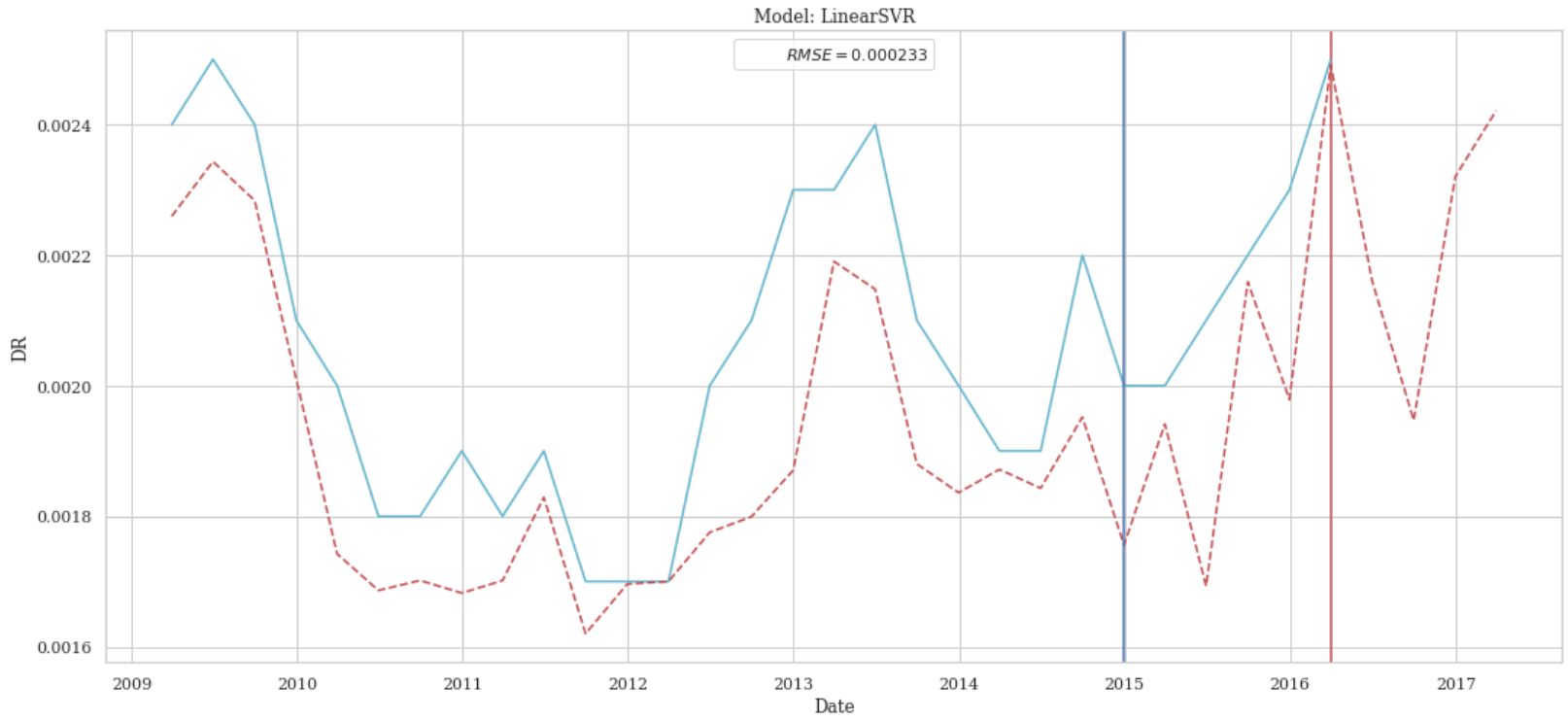
Chronique CHR2

12-month forecast – Linear SVR Model w/ Sequential Forward Feature Selection



Results and performance

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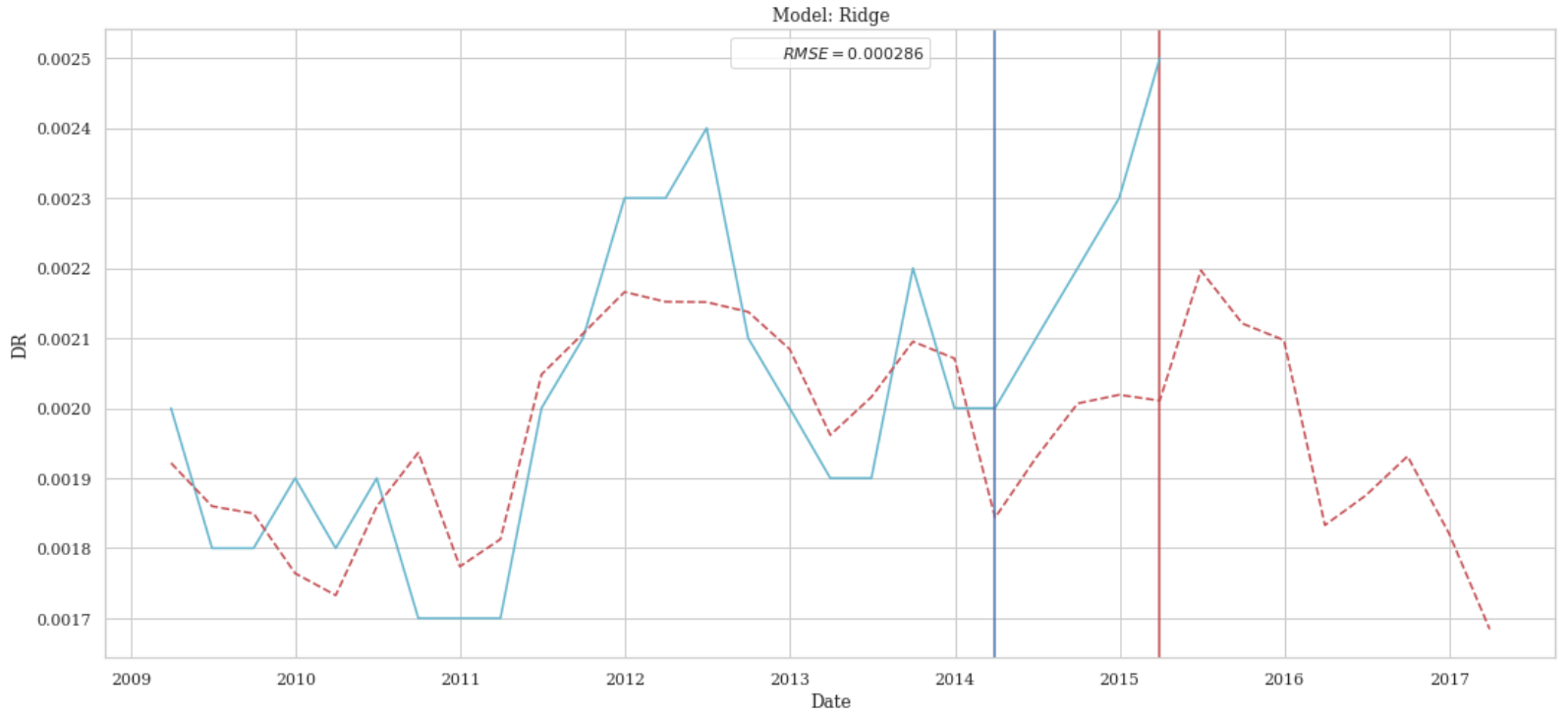
Chronique CHR2

24-month forecast – Ridge Model w/ Tree-Based Feature Selection



Results and performance

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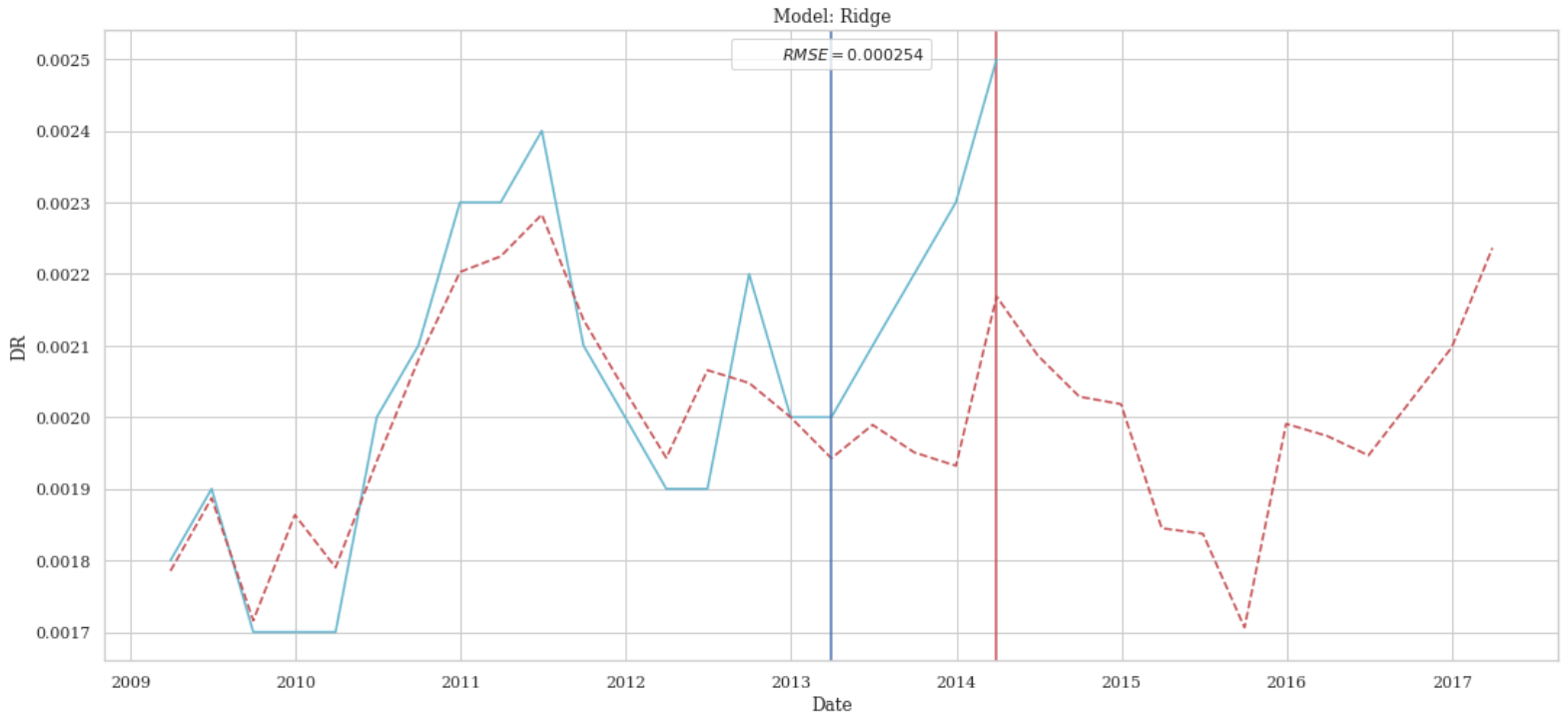
Chronique CHR2

36-month forecast – Ridge Model w/ Low Variance Feature Selection



Results and performance

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Chronique CHR8			
Machine Learning			
DATE	**12-month**	**24-month**	**36-month**
Real Q1 2016	*13,04%*		
Theoretical Q1 2016	*14,36%*		
Real Q1 2015		*13,04%*	
Theoretical Q1 2015		*12,46%*	
Real Q1 2014			*13,04%*
Theoretical Q1 2014			*13,93%*

Results and performance

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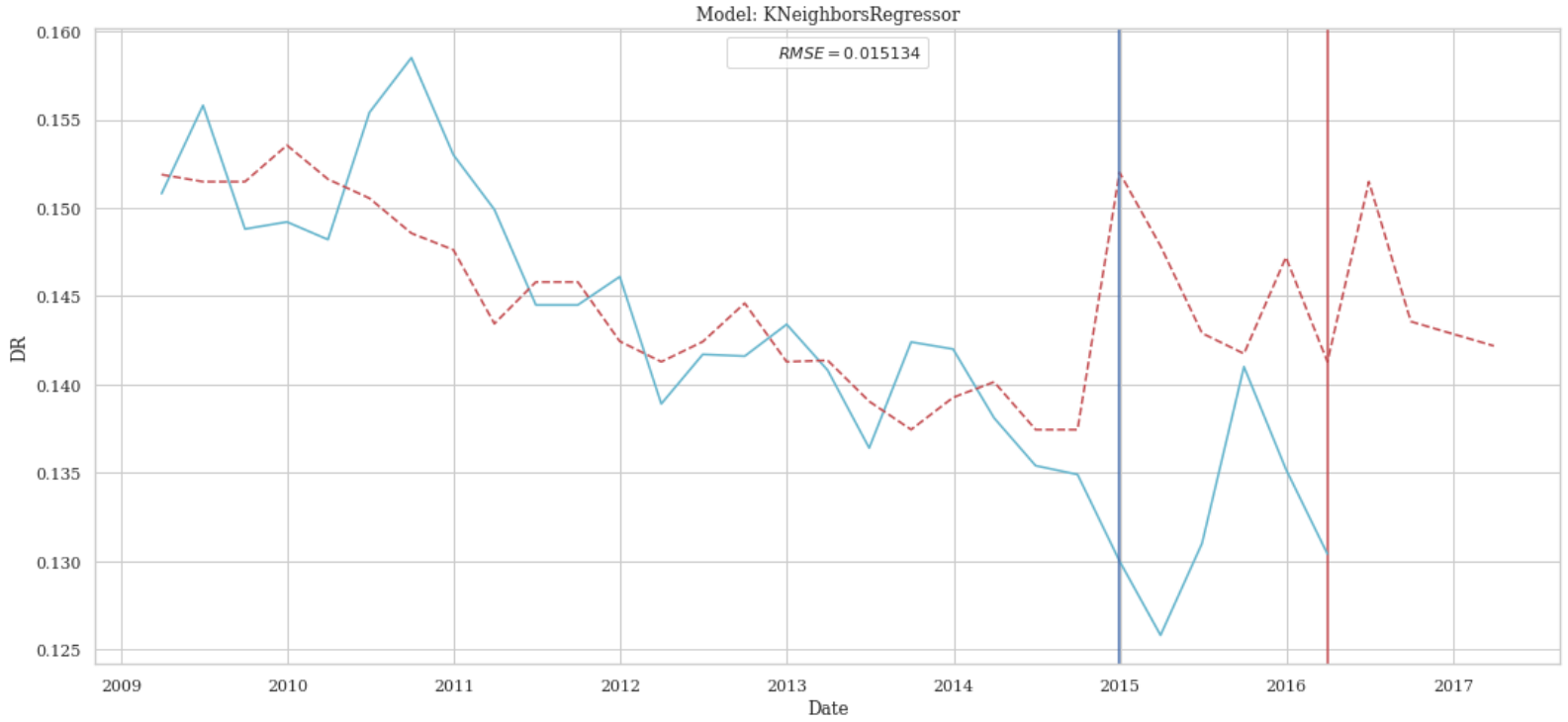
Chronique CHR8

12-month forecast – Kneighbors Regressor Model w/ SelectFromModel Feature Selection



Results and performance

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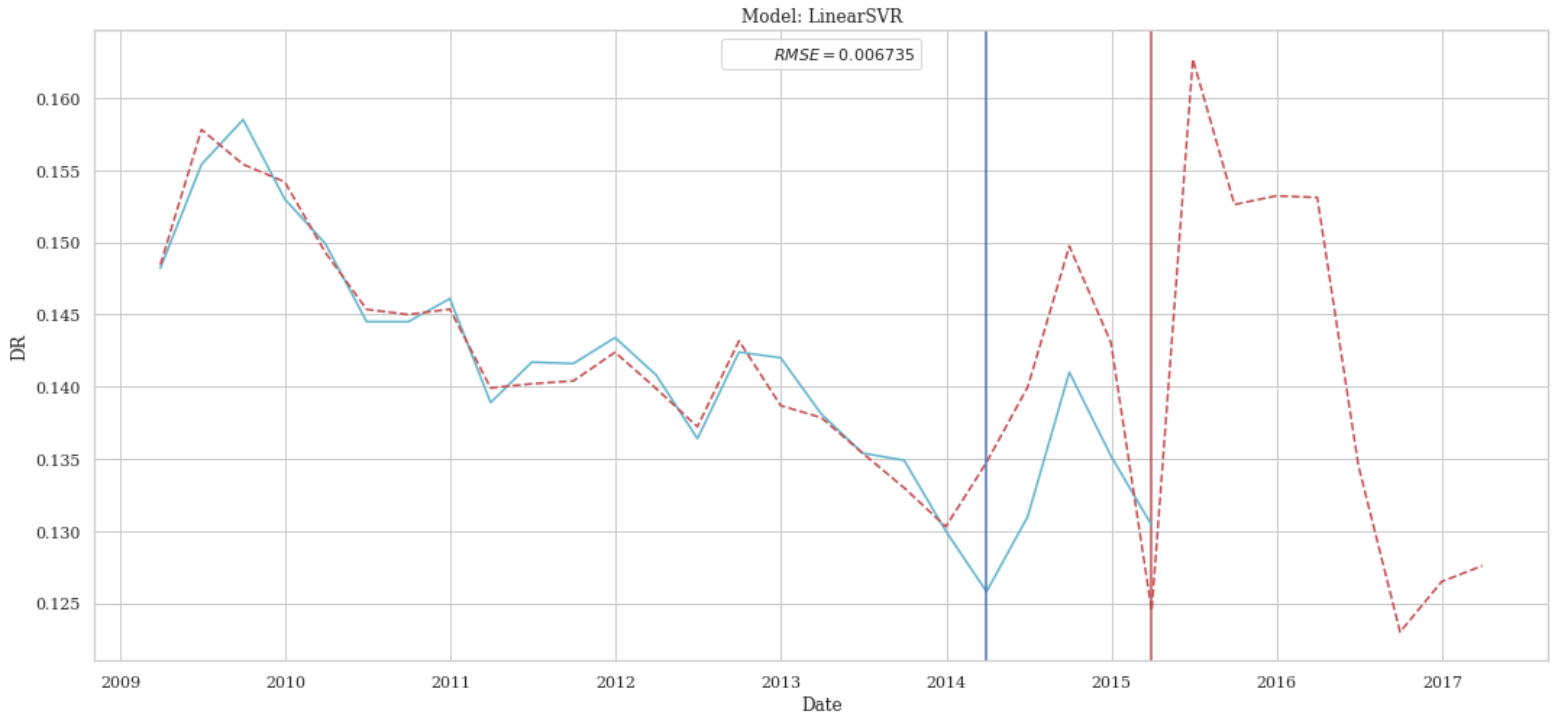
Chronique CHR8

24-month forecast – Linear SVR Model w/ Tree-based Feature Selection



Results and performance

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Chronique CHR8

36-month forecast – Ridge Model w/ Kbest Feature Selection

Results and performance

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Chronique Totale			
Machine Learning			
DATE	**12-month**	**24-month**	**36-month**
Real Q1 2016	*1,41%*		
Theoretical Q1 2016	*1,93%*		
Real Q1 2015		*1,41%*	
Theoretical Q1 2015		*1,56%*	
Real Q1 2014			*1,41%*
Theoretical Q1 2014			*1,52%*

Results and performance

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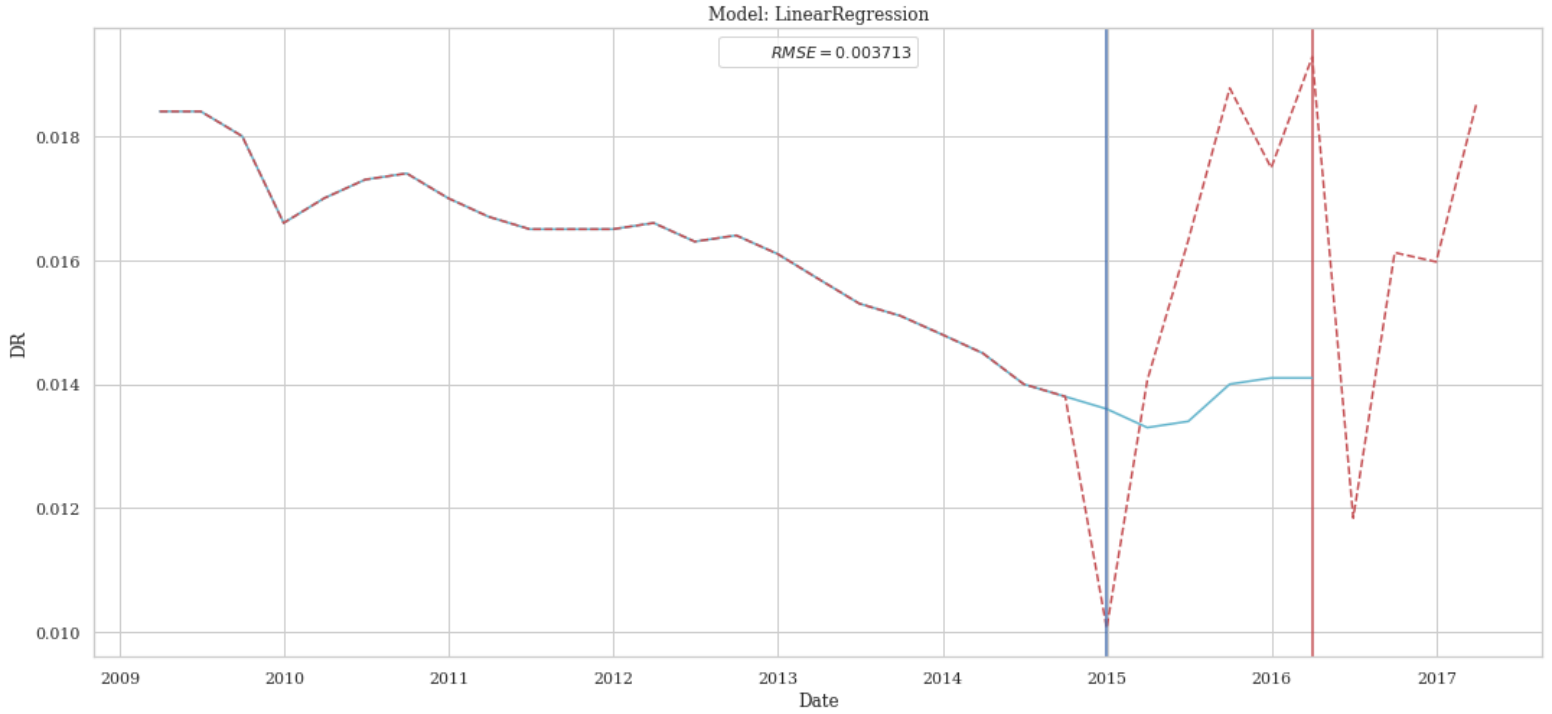
Chronique CHR Totale

12-months forecast – Linear Regression Model w/ Total Recursive Feature Selection



Results and performance

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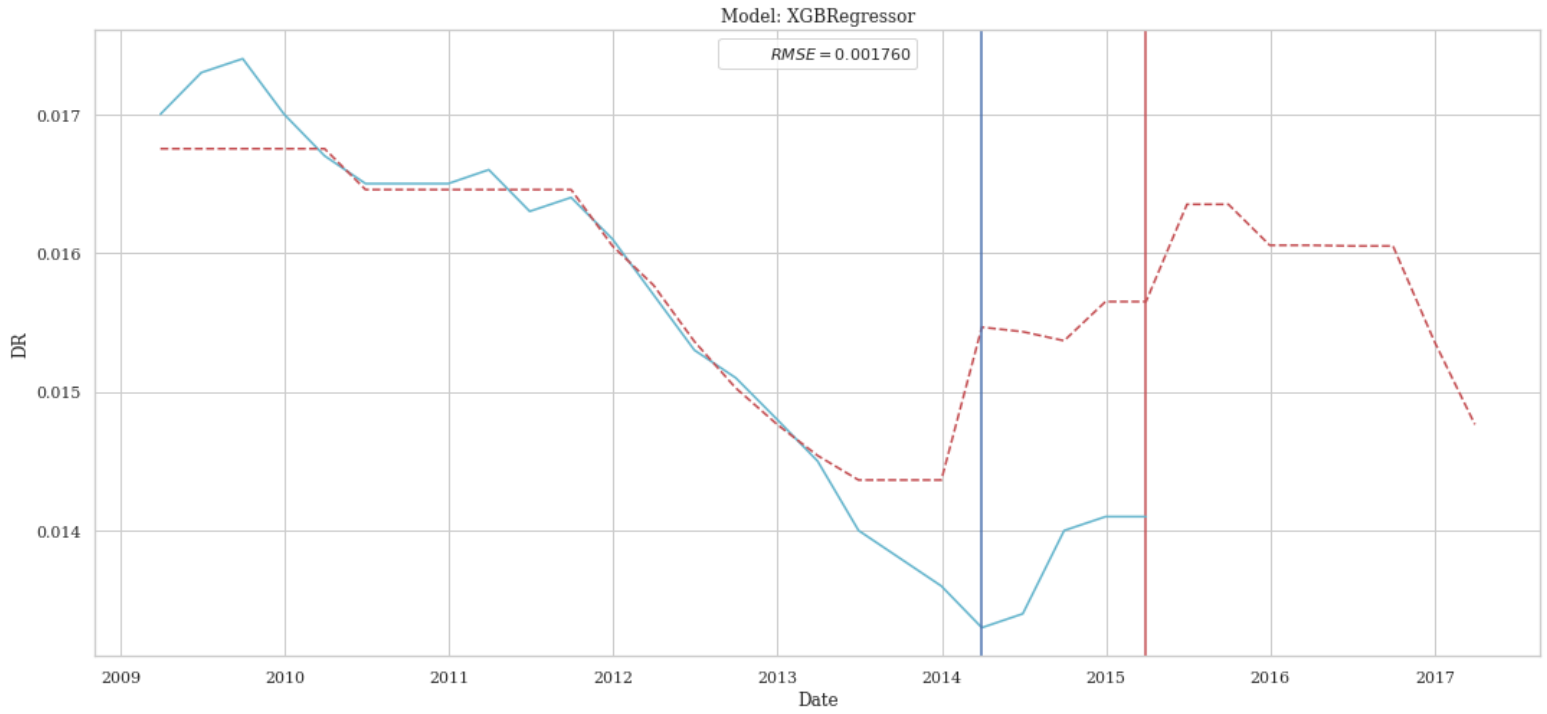
Chronique CHR Totale

24-month forecast – XGB Regressor Model w/ Tree-Based Feature Selection



Results and performance

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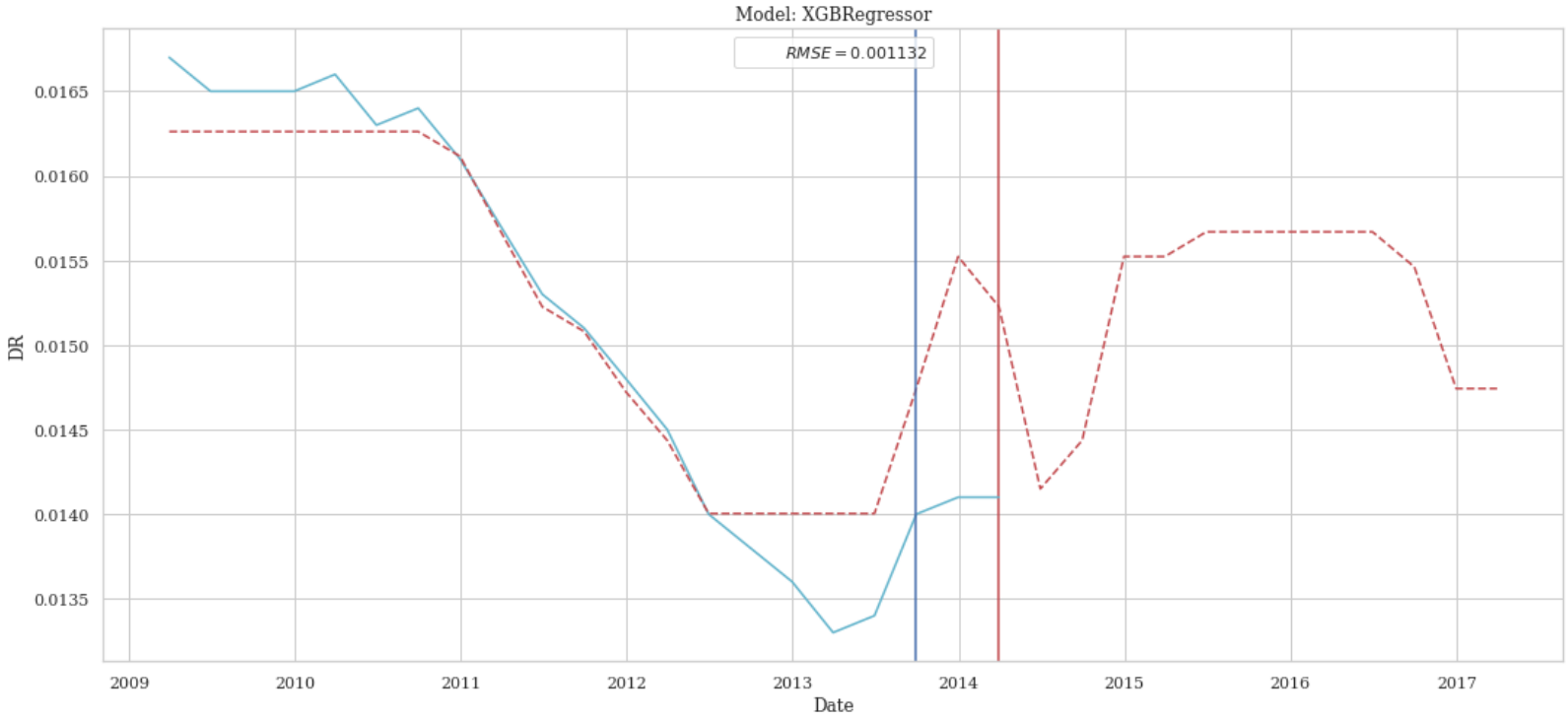
Chronique CHR Totale

36-month forecast – XGB Regressor Model w/ Kbest Feature Selection



Results and performance

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Global Forecast Q1 2017			
DATE	**12-month**	**24-month**	**36-month**
Chronique CHR2	*0,244%*	*0,168%*	*0,223%*
Chronique CHR8	*14,36%*	*12,91%*	*14,8%*
Chronique CHR Totale	*1,85%*	*1,48%*	*1,472%*

Conclusion

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Improvements

I. Automation Features & Model Selection

II. Implementation of a Global Model

III. Verification of Default Rate Forecast

IV. Comparing the Real Costs of Forecast Error