**Research report:**

**Regression Analysis for bond index**

**Data file:**

1. ‘rating.xlsx’: credit rating data (AAA, AA, A, BBB, BB, B, CCC or lower)
2. ‘sector.xlsx’: sectors index data (health care, material, energy, financials, utilities, technology, consumer staples, telecommunication, industrials, consumer discretionary, real estate)
3. ‘alldata2.xlsx’: bundled index data
4. ‘dict\_bond\_index.xlsx’: dictionary for Bloomberg code (notes: we don’t use data with type equal to 0, type 2 data from rating and sector excel, type 1 data from alldata2 excel)

|  |  |  |
| --- | --- | --- |
| name | code | type |
| Utilities BBB+ | IGUUAE3M Index | 0 |
| Utilities BBB- | IGUUAF3M Index | 0 |
| Utilities BBB | IGUUUB3M Index | 1 |
| Utilities BBB | IGUUAG3M Index | 0 |
| Utilities A | IGUUUA3M Index | 1 |
| Technology BBB | IGUUTB3M Index | 1 |
| Technology A | IGUUTA3M Index | 1 |
| RealEstate BBB | DJGRE3BT Index | 1 |
| RealEstate AA | DJGRE2AT Index | 1 |
| RealEstate A | DJGRE1AT Index | 1 |
| Materials BBB | IGUUBB3M Index | 1 |
| Materials A | IGUUBA3M Index | 1 |
| Industrials BBB | IGUUIB3M Index | 1 |
| Industrials BBB | IGUUAD3M Index | 0 |
| Industrials A | IGUUIA3M Index | 1 |
| Industrial BBB+ | IGUUAA3M Index | 0 |
| Industrial BBB- | IGUUAB3M Index | 0 |
| Industrials BB | IGUUI53M Index | 1 |
| HealthCare BBB | BVUSHB3M Index | 1 |
| HealthCare AA | BVUSHE3M Index | 1 |
| HealthCare A | BVUSHA3M Index | 1 |
| Financials BBB | IGUUFB3M Index | 1 |
| Financials BB | IGUUF53M Index | 1 |
| Financials AA | IGUUFD3M Index | 1 |
| Financials A | IGUUFA3M Index | 1 |
| Energy BBB | IGUUEB3M Index | 1 |
| Energy A | IGUUEA3M Index | 1 |
| Corporate BBB | IGUUBC3M Index | 0 |
| Corporate BB | IGUUC53M Index | 0 |
| Corporate B | IGUUI63M Index | 0 |
| Corporate AA | IGUUDC3M Index | 0 |
| Corporate A | IGUUAC3M Index | 0 |
| ConsumerStaples BBB | IGUUNB3M Index | 1 |
| ConsumerStaples AA | IGUUND3M Index | 1 |
| ConsumerStaples A | IGUUNA3M Index | 1 |
| ConsumerDiscretionary BBB | IGUUCB3M Index | 1 |
| ConsumerDiscretionary A | IGUUCA3M Index | 1 |
| Telecommunication BBB | IGUUMB3M Index | 1 |
| Telecommunication A | IGUUMA3M Index | 1 |
| HealthCare | SPTRSC35 Index | 2 |
| Materials | SPTRSC15 Index | 2 |
| Energy | SPTRSC10 Index | 2 |
| Financials | SPTRSC40 Index | 2 |
| Utilities | SPTRSC55 Index | 2 |
| Technology | SPTRSC45 Index | 2 |
| ConsumerStaples | SPTRSC30 Index | 2 |
| Telecommunication | SPTRSC50 Index | 2 |
| Industrials | SPTRSC20 Index | 2 |
| ConsumerDiscretionary | SPTRSC25 Index | 2 |
| RealEstate | SPTRSC60 Index | 2 |
| AAA | C0A1 Index | 2 |
| AA | C0A4 Index | 2 |
| A | C0A3 Index | 2 |
| BBB | C0A2 Index | 2 |
| BB | H0A1 Index | 2 |
| B | H0A2 Index | 2 |
| CCC or lower | H0A3 Index | 2 |

**Code file:**

Package regAnalyst v0.0

preprocess.py: including Distribution, Scale, Regular, Outlier, Missing classes

evaluation.py: including Reg class

regression.py: including Kalman class, ﻿rollingReg function

**Step 1: preprocessing data**

1. Standardization

Transformation formula:

Where:

x is original data

u is mean of x

s is the standard deviation of x

z is transformed data

1. Remove outliers

Remove data outside the range (mean – 3.5×std, mean + 3.5×std)

After removing, we have data with 83.87% size of original dataset

**Step 2: Run regression with intercept = 0**

Result coefficients for sectors:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sector | AAA | AA | A | BBB | BB | B | CCC |
| HealthCare |  |  |  |  |  |  |  |
| Material |  |  |  |  |  |  |  |
| Energy |  |  | 0.002 | -0.043 |  |  |  |
| Financials |  | 0.082 | 0.088 | 0.125 | -0.075 |  |  |
| Utilities |  |  | 0.079 | 0.042 |  |  |  |
| Technology |  |  | 0.094 | 0.057 |  |  |  |
| Consumer Staples |  | 0.089 | 0.040 | 0.051 |  |  |  |
| Telecommunication |  |  | -0.018 | -0.043 |  |  |  |
| Industrials |  |  | 0.042 | 0.117 | -0.077 |  |  |
| Consumer Discretionary |  |  | 0.099 | 0.068 |  |  |  |
| Real Estate |  |  |  |  |  |  |  |

Result coefficients for ratings:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Rating | AAA | AA | A | BBB | BB | B | CCC |
| HealthCare |  |  |  |  |  |  |  |
| Material |  |  |  |  |  |  |  |
| Energy |  |  | -0.236 | -0.219 |  |  |  |
| Financials |  | -0.215 | -0.323 | -0.288 | -0.408 |  |  |
| Utilities |  |  | -0.313 | -0.370 |  |  |  |
| Technology |  |  | -0.339 | -0.271 |  |  |  |
| Consumer Staples |  | -0.285 | -0.325 | -0.398 |  |  |  |
| Telecommunication |  |  | -0.322 | -0.451 |  |  |  |
| Industrials |  |  | -0.323 | -0.389 | -0.262 |  |  |
| Consumer Discretionary |  |  | -0.298 | -0.314 |  |  |  |
| Real Estate |  |  |  |  |  |  |  |

Best regression result (IGUUA3M Energy A):



Worst regression result (IGUUIA3M Industrial A):



Robust testing:

