Austrian Banking System Core Financials

TOMAS KLUGE – CAPSTONE 1 PROJECT

Summary

THE GOAL WAS TO CREATE A MODEL TO PREDICT CORE FINANCIALS RATIOS FOR AUSTRIAN BANKING SYSTEM

THE METHOD WAS A LASSO REGRESSION DONE BOTH THROUGH STATSMODELS AND SCIKIT-LEARN

THE OVERALL SCORE FOR THE DEPENDENT VARIABLES WERE LOW, WITH EXCEPTION OF TIER 1 CAPITAL RATIO

Content

- OVERVIEW OF THE PROJECT
- DATA WRANGLING
- EXPLORATORY DATA ANALYSIS
- STATISTICAL ANALYSIS
- MODELLING

Overview of the project

THE AIM WAS TO PREDICT CORE FINANCIALS OF AUSTRIAN BANKING SYSTEM

DURING THE LAST BANKING CRISIS THE BANKS NEEDED A LOT OF GOVERNMENT SUPPORT

MODEL THAT WOULD PREDICT A FUTURE CRISIS COULD BENEFIT BOTH BANKS AND GOVERNMENTS

- THE DATA WAS DOWNLOADED FROM THE IMF DATA SETS
- THE AIM WAS TO HAVE A TIME-SERIES ON QUARTERLY BASIS FOR EACH VARIABLE
- THE INDEPENDENT VARIABLES WERE MACRO-ECONOMIC INDICATORS, WHILE DEPENDENT VARIABLES WERE CORE BANK INDICATORS
- THE CORE BANK INDICATORS CONSIST OF CAPITALISATION, PROFITABILITY, LIQUIDITY AND ASSET QUALITY

Overview of the project

APPROACH

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Overview of the project

DATA 1/2

- INDEPENDENT VARIABLES

GDP – GROSS DOMESTIC PRODUCT; INFL – INFLATION, UNE – UNEMPLOYMENT; LOA – LOANS; DEP – DEPOSITS; NUM – NUMBER OF BANKS IN THE COUNTRY

- DEPENDENT VARIABLES

CAR – CAPITAL ADEQUACY RATIO; T1 – TIER 1 CAPITAL; NPL – NON-PERFORMING LOANS; NIM – NET INTEREST MARGIN; ROA – RETURN ON ASSETS; ROE – RETURN ON EQUITY; LA – LIQUID ASSETS OVER SHORT TERM LIABILITIES; LATA – LIQUID ASSETS OVER TOTAL ASSETS

Overview of the project

DATA 2/2

Data Wrangling

THE DATA WRANGLING WAS COMPLEX DUE TO INCOMPLETE DATA

THE SOURCE OF DATA WAS IMF DATABANK, DOWNLOADED THROUGH API

RENAMING DATE COLUMN TO ‘DATE’

CHANGING STRING TO DATETIME

SETTING IT AS AN INDEX

SHIFTING THE INDEX BY 1 MONTH FORWARD

RESAMPLING YEARLY DATA TO QUARTERLY AND FILLING THE MISSING DATA WITH 0 SO I COULD JOIN MISSING COLUMN TO THE QUARTERLY

EXTRACTING COLUMN

Data Wrangling

DATA 1/2

JOINING THE ADJUSTED

REPLACING THE 0 RESAMPLED VALUES FOR DE FOR NAN

RESAMPLING THE NAN VALUES FOR ALL COLUMNS WITH LINEAR FUNCTION

DROPPING THE NAN VALUES FOR THE STARTING PERIOD

EDA ANALYSIS FOR THE TIDY DATA

MELTING THE DATASETS SO THE SEABORN CAN CREATE A LINE GRAPH

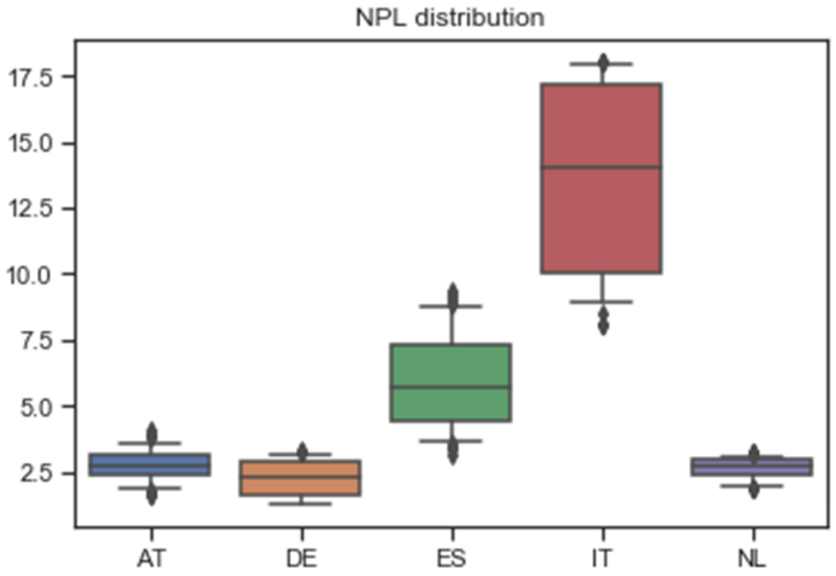
Data Wrangling

DATA 2/2

Exploratory Data Analysis

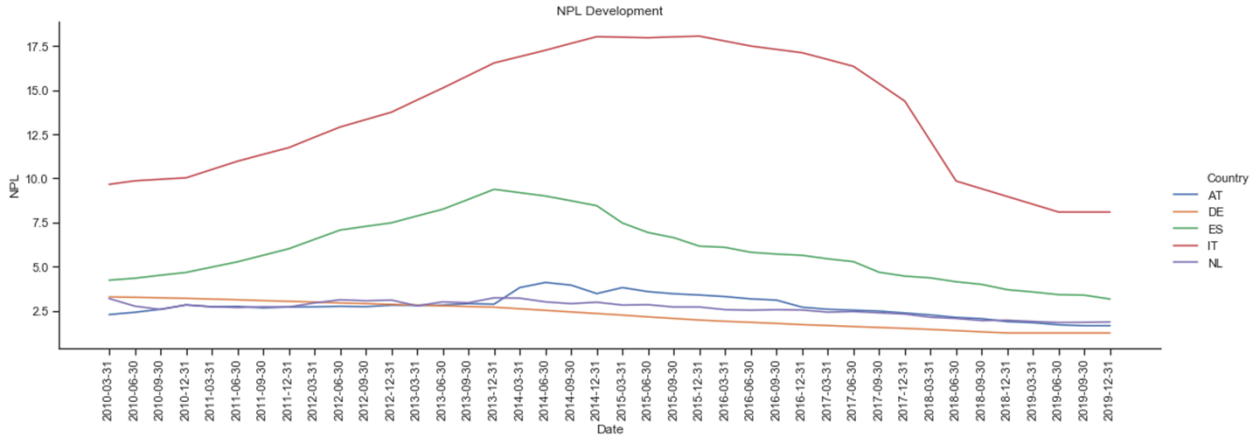
BASIC OVERVIEW OF THE VARIABLES IN COMPARISON WITH OTHER COUNTRIES

STATISTICAL OVERVIEW



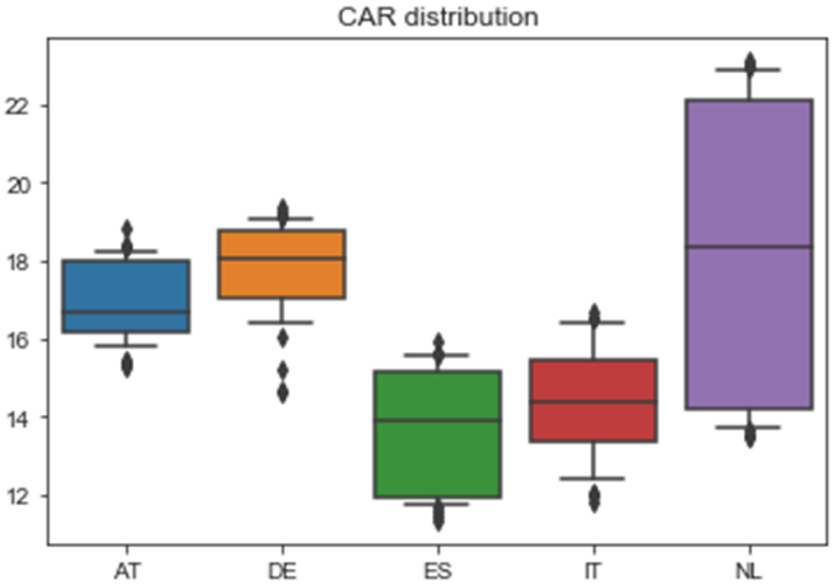
STABLE DEVELOPMENT OF NPLs IN AUSTRIA COMPARED TO OTHER COUNTRIES

LOW VARIABILITY OF THE PERFORMANCE



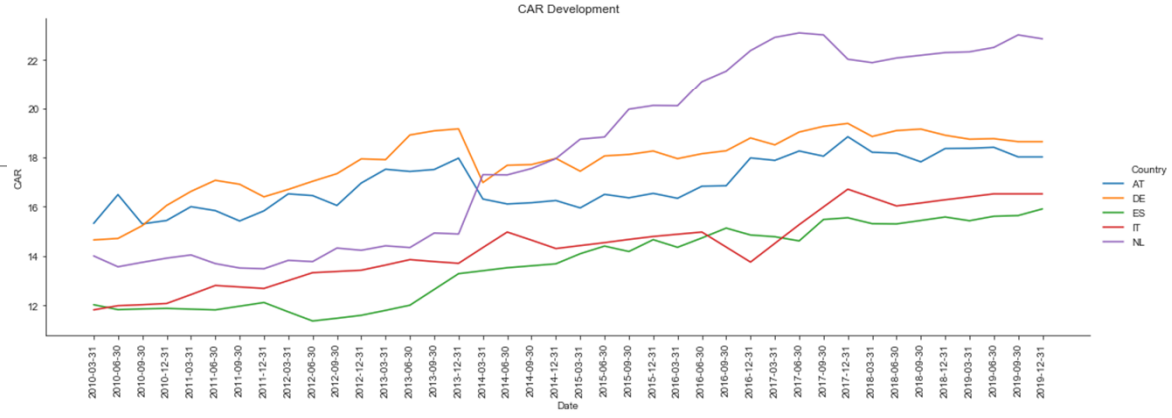
Asset quality

NON – PERFORMING LOANS



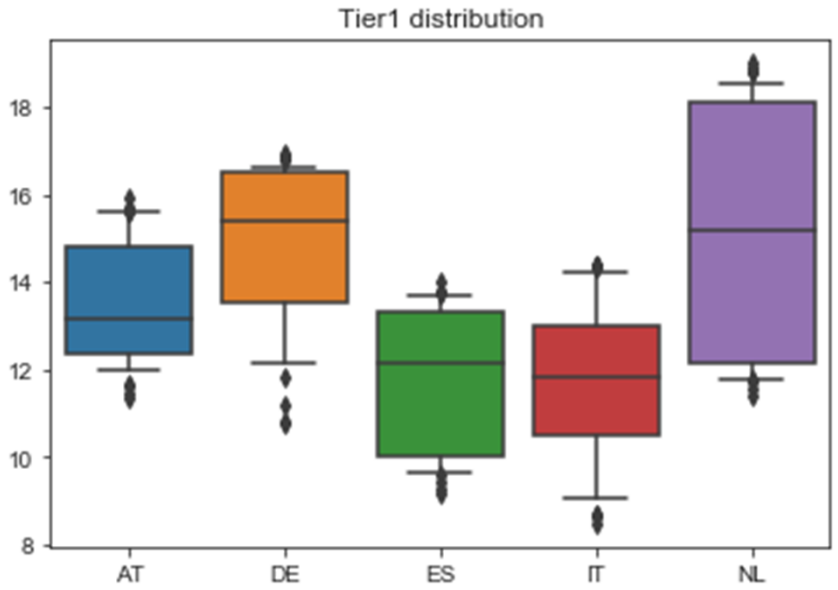
AUSTRIA HAS ONE OF THE LARGER CAPITALIZATION AMONG THE COUNTRIES

THE TOTAL LEVELS ARE INCREMENTALLY INCREASING; SIMILAR TO OTHER PEERS



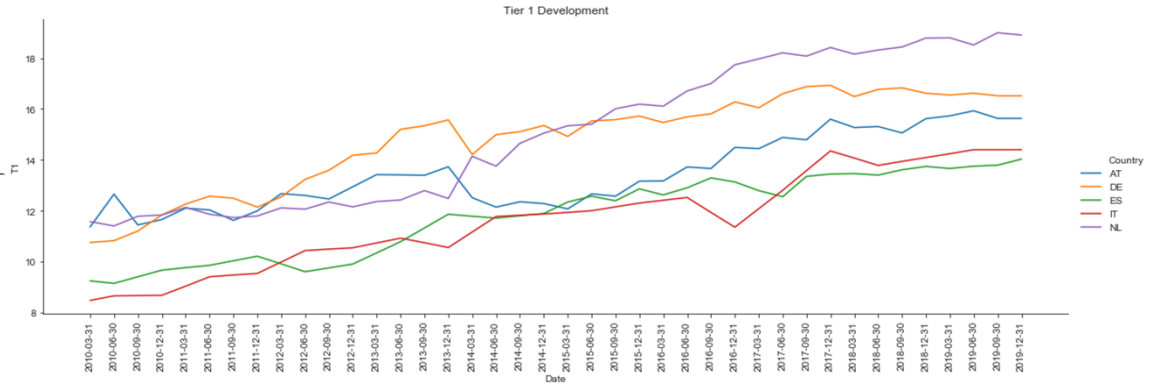
Capitalization

CAPITAL ADEQUACY RATIO



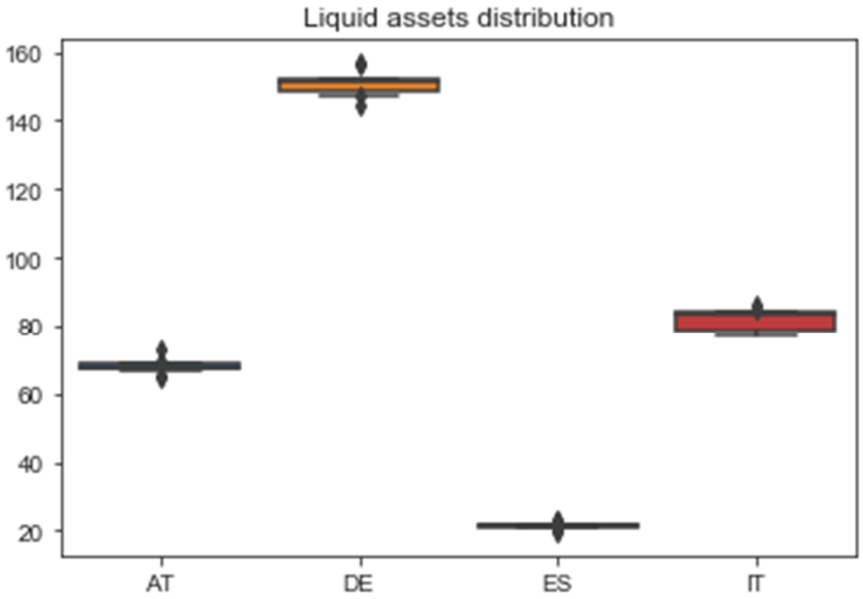
SIMILAR PERFORMANCE AS CAPITAL ADEQUACY RATIO

THE TOTAL LEVELS ARE INCREMENTALLY INCREASING; SIMILAR TO OTHER PEERS



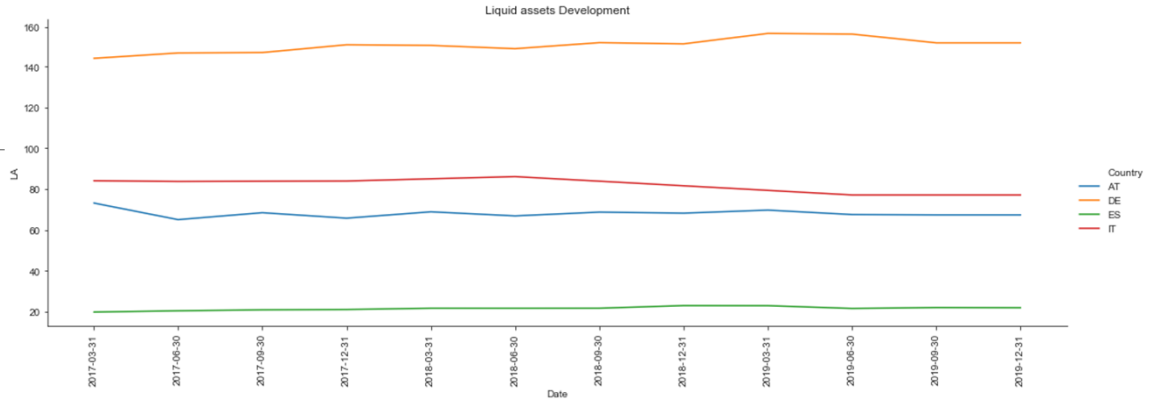
Capitalization

TIER 1 RATIO



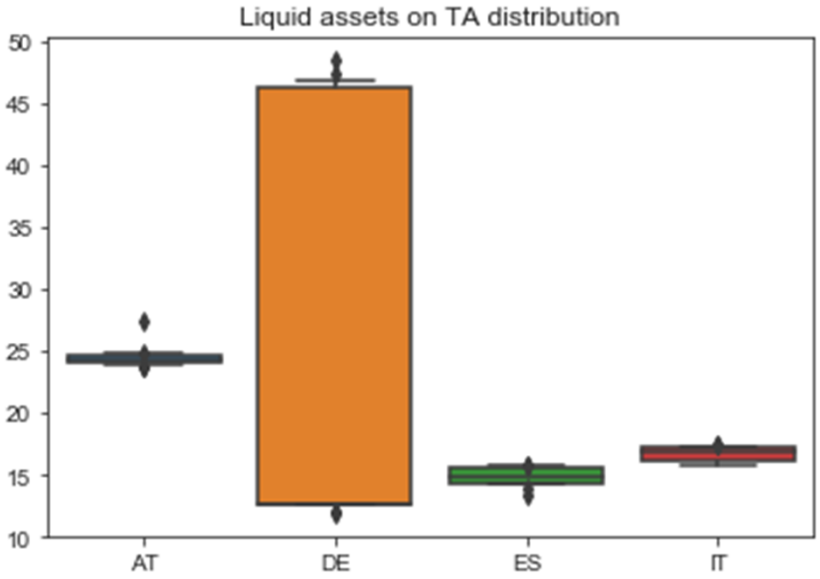
BIG VARIABILITY AMONG THE COUNTRIES

VERY STABLE LEVEL IN AUSTRIA



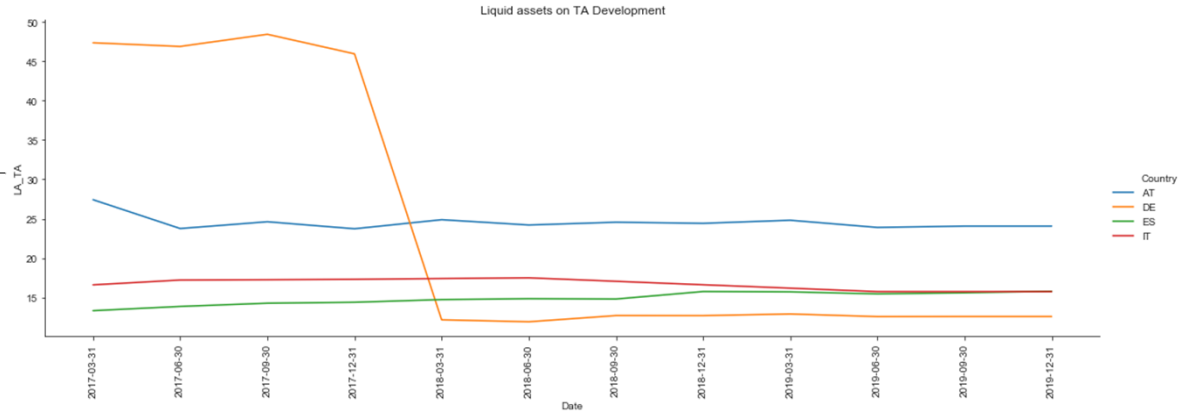
Liquidity

LIQUID ASSETS TO SHORT-TERM FUNDING



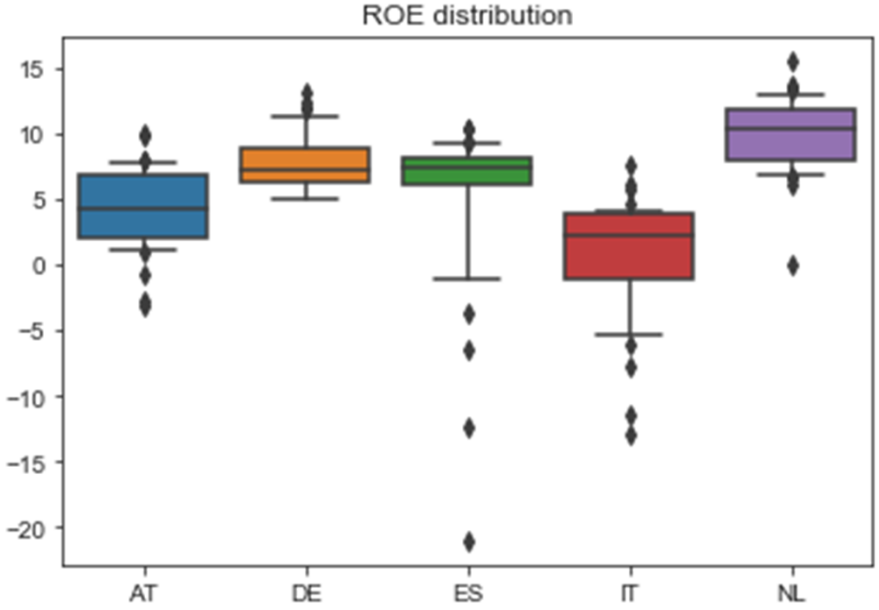
THE BIG CHANGE IN GERMANY IS EXPLAINED BY THE SHIFT IN THE CRITERIAS

OVERALL VERY GOOD AUSTRIAN LEVELS



Liquidity

LIQUID ASSETS TO TOTAL ASSETS

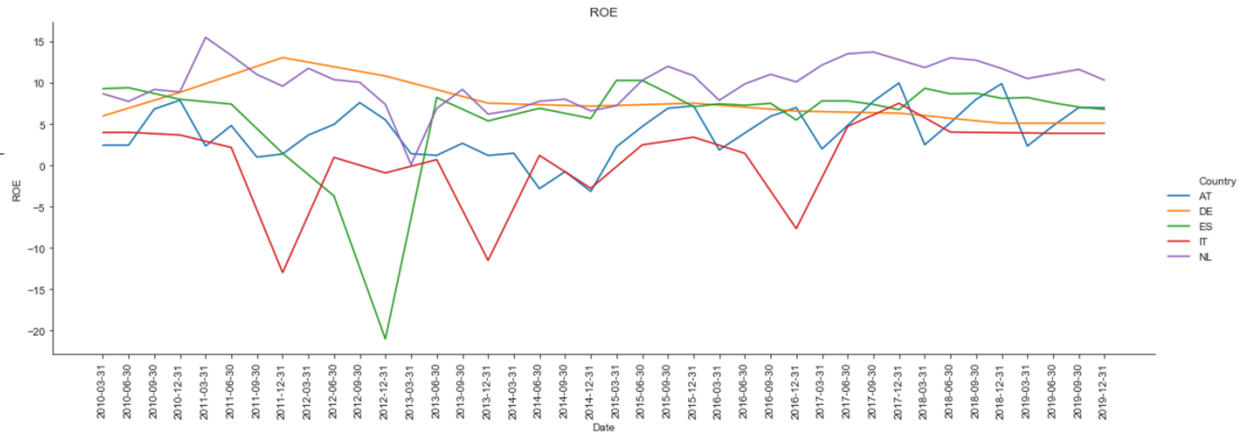


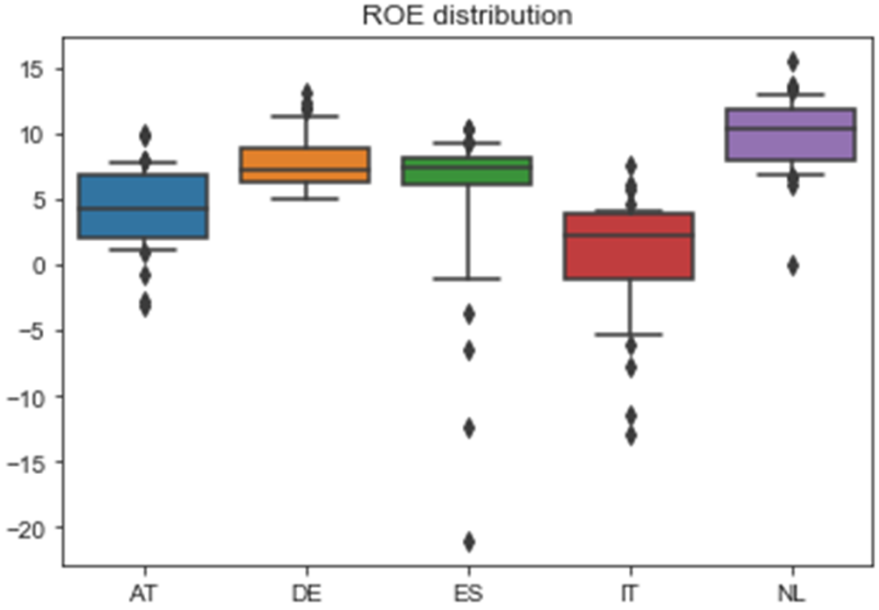
GREAT VARIABILITY AMONGST THE COUNTRIES

SOLID LEVELS FOR AUSTRIA WITH LOW VOLATILITY

Profitability

RETURN ON EQUITY





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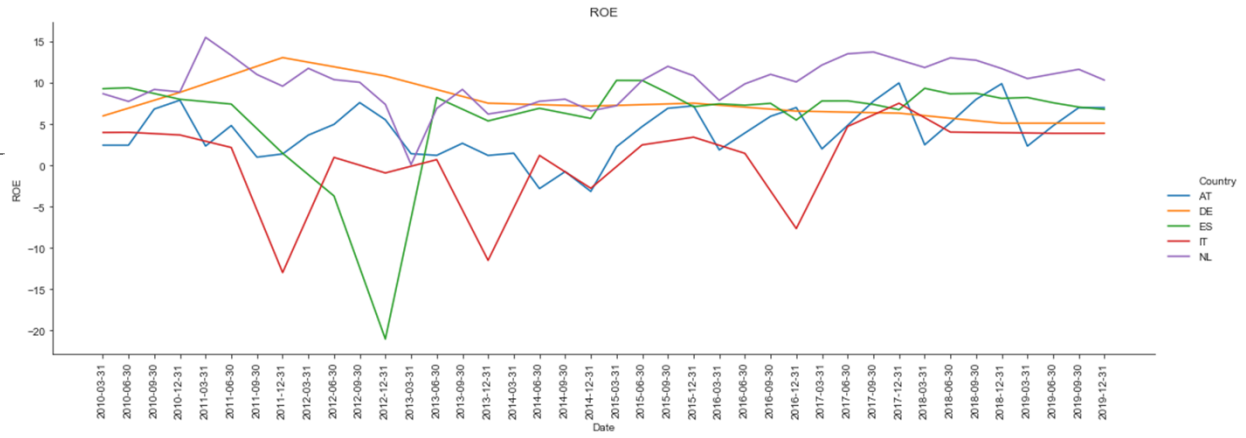

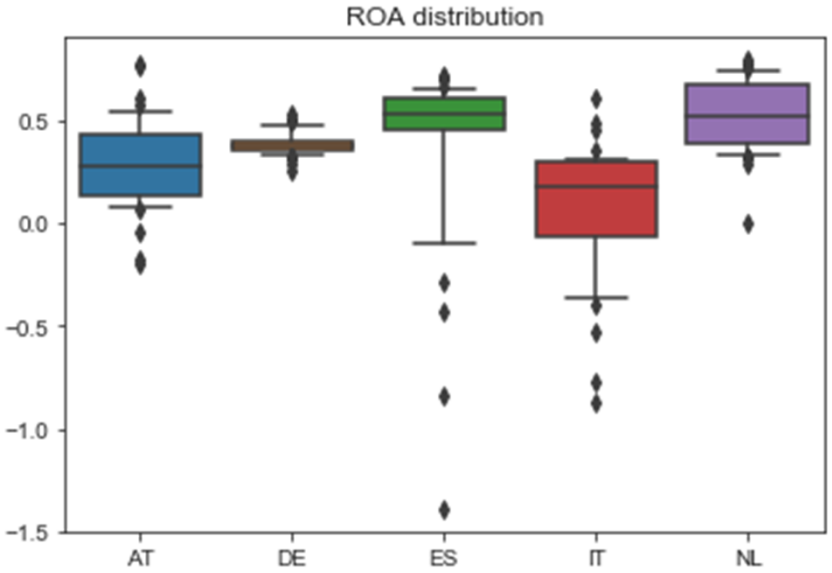

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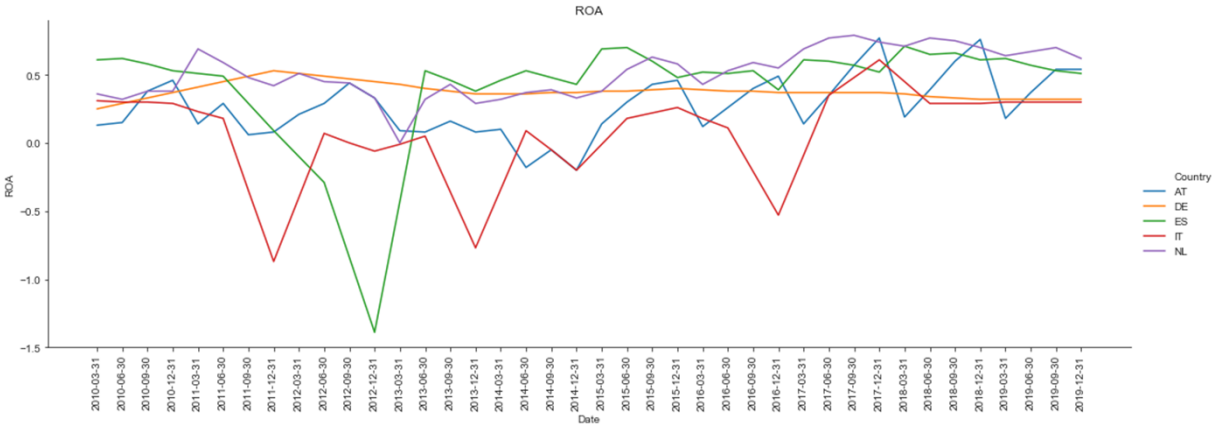
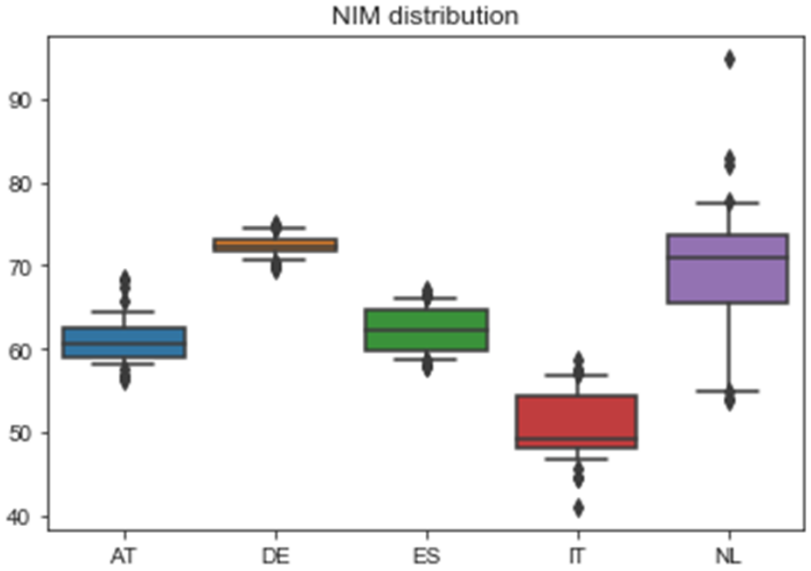


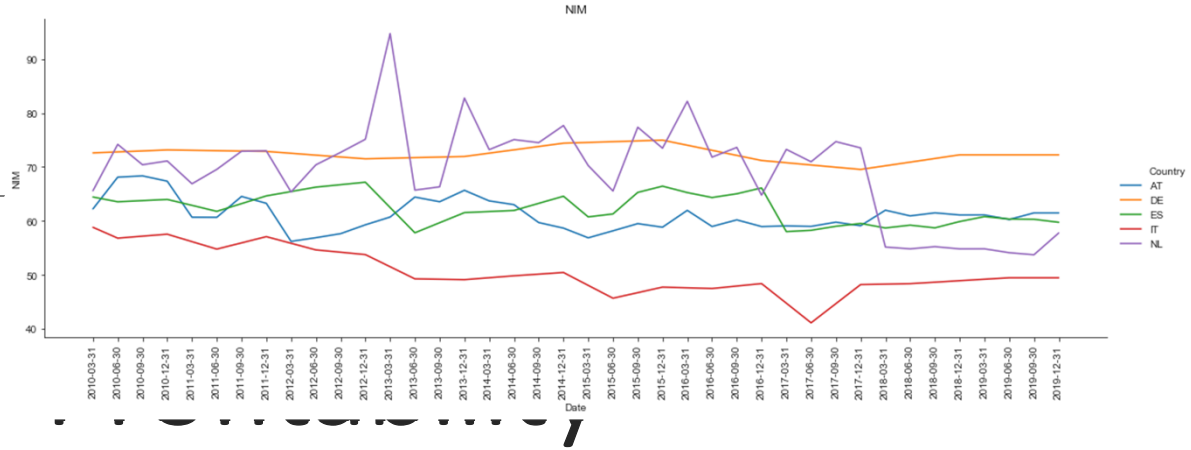
Profitability

RETURN ON ASSETS



GREAT VOLATILITY YEAR-ON-YEAR

AUSTRIA A BIT LAGGING AFTER GERMANY OR NETHERLANDS



Profitability

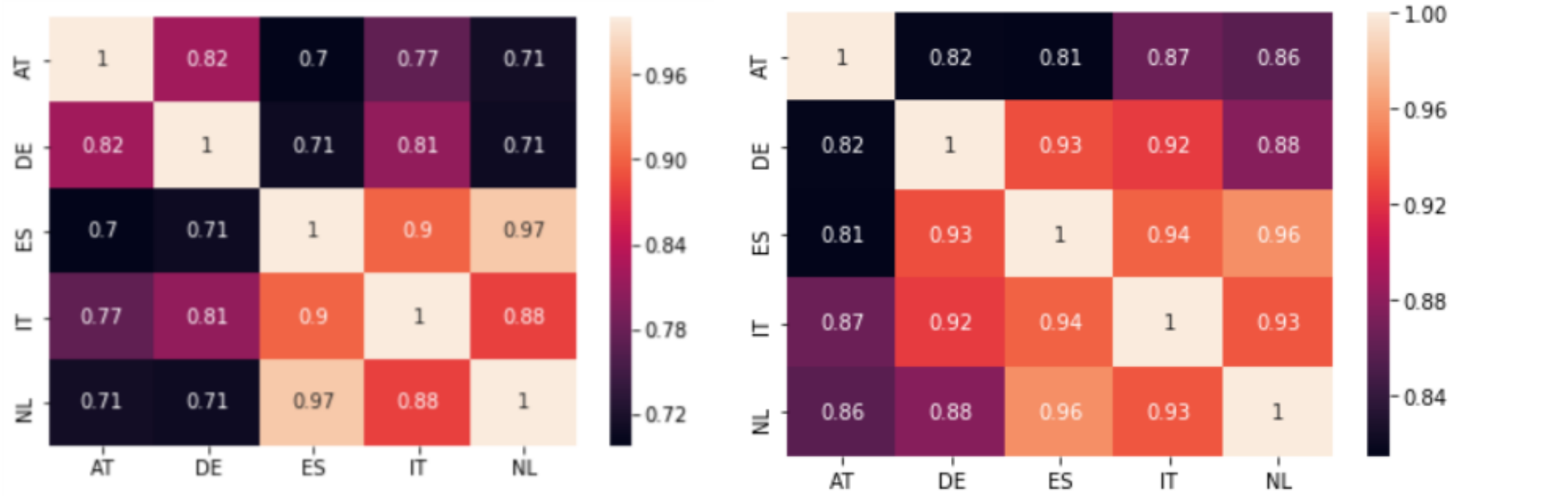
NET INTEREST MARGIN

Statistical Analysis

DUE TO THE NATURE OF THE DATA, THE ONLY MEANINGFUL STATISTICAL ANALYSIS WAS TO DO CORRELATION TABLES

THERE WERE STRONG CORRELATIONS AMONG THE COUNTRIES ONLY IN THE CAPITALIZATION RATIOS

THE REASON IS THE STRONG REGULATION ACROSS EUROPE IN THESE RATIOS



Statistical analysis

CORRELATION MATRICES FOR CAR AND T1 RESPECTIVELY

Modelling

THE MODELLING WAS DONE THROUGH SIMPLE AND LASSO REGRESSION

THE MODELS USED WERE STATSMODELS AND SCIKIT-LEARN

	INFL	DEP	LOA	UNE	GDP	NUM	CAR	T1	NPL	NIM	ROA	ROE	LA	LATA
count	40.000000	40.000000	40.000000	40.00000	40.000000	40.000000	40.000000	40.000000	40.000000	40.000000	40.000000	40.00000	40.00000	40.00000
mean	109.751638	28.675000	27.900000	5.22550	106.622698	42.587500	16.966000	13.453250	2.756000	61.102000	0.276000	4.13100	70.43450	24.74050
std	5.494802	0.729858	3.287895	0.46138	4.620427	3.349584	1.034933	1.418514	0.625836	2.928023	0.223639	3.20757	3.39787	1.07947
min	99.048490	28.000000	24.000000	4.51000	98.140928	38.000000	15.300000	11.360000	1.630000	56.210000	-0.200000	-3.16000	63.93000	22.53000
25%	105.970648	28.000000	25.000000	4.80250	103.492810	39.875000	16.147500	12.332500	2.400000	59.057500	0.127500	1.96000	67.90250	24.15750
50%	110.113449	29.000000	27.000000	5.19500	104.708923	42.000000	16.685000	13.165000	2.725000	60.680000	0.275000	4.31000	69.68000	24.64500
75%	113.907504	29.000000	31.000000	5.65250	110.395567	45.312500	17.990000	14.812500	3.117500	62.427500	0.432500	6.93000	73.01000	25.32500
max	119.054094	30.000000	33.000000	6.03000	115.073540	50.000000	18.840000	15.930000	4.100000	68.360000	0.770000	9.98000	77.00000	27.41000

DATA CONSIST OF 40 DATA POINT – 10 YEARS BY 4 QUARTERS

MISSING DATA WERE RESAMPLED

Modelling

DATA OVERVIEW

IN THE SIMPLE REGRESSION ONLY 2 DEPENDENT VARIABLES HAD ADJUSTED R SQUARED HIGHER THAN 0.8 – NPL AND T1

OLS Regression Results

Dep. Variable:	NPL	R-squared:	0.860
Model:	OLS	Adj. R-squared:	0.834
Method:	Least Squares	F-statistic:	33.66
Date:	Sun, 14 Jun 2020	Prob (F-statistic):	1.05e-12
Time:	14:22:39	Log-Likelihood:	1.7516
No. Observations:	40	AIC:	10.50
Df Residuals:	33	BIC:	22.32
Df Model:	6		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	59.8558	14.764	4.054	0.000	29.819	89.893
UNE	0.1112	0.199	0.560	0.579	-0.293	0.516
GDP	-0.3211	0.039	-8.232	0.000	-0.400	-0.242
INFL	-0.0531	0.069	-0.766	0.449	-0.194	0.088
DEP	0.0924	0.086	1.076	0.290	-0.082	0.267
LOA	0.0743	0.098	0.761	0.452	-0.124	0.273
NUM	-0.5245	0.107	-4.885	0.000	-0.743	-0.306

Omnibus:	1.275	Durbin-Watson:	0.875
Prob(Omnibus):	0.529	Jarque-Bera (JB):	0.997
Skew:	-0.382	Prob(JB):	0.607
Kurtosis:	2.877	Cond. No.	6.00e+04

OLS Regression Results

Dep. Variable:	T1	R-squared:	0.910
Model:	OLS	Adj. R-squared:	0.894
Method:	Least Squares	F-statistic:	55.85
Date:	Wed, 10 Jun 2020	Prob (F-statistic):	7.06e-16
Time:	15:32:48	Log-Likelihood:	-21.997
No. Observations:	40	AIC:	57.99
Df Residuals:	33	BIC:	69.82
Df Model:	6		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	-75.0414	26.733	-2.807	0.008	-129.429	-20.654
UNE	0.8849	0.360	2.459	0.019	0.153	1.617
GDP	0.3630	0.071	5.140	0.000	0.219	0.507
INFL	0.2810	0.126	2.239	0.032	0.026	0.536
DEP	-0.3578	0.155	-2.302	0.028	-0.674	-0.042
LOA	0.1343	0.177	0.760	0.453	-0.225	0.494
NUM	0.4892	0.194	2.516	0.017	0.094	0.885

Omnibus:	6.560	Durbin-Watson:	1.054
Prob(Omnibus):	0.038	Jarque-Bera (JB):	5.199
Skew:	0.786	Prob(JB):	0.0743
Kurtosis:	3.806	Cond. No.	6.00e+04

Modelling

SIMPLE LINEAR REGRESSION

NPL

```
Parameters:  Intercept    0.000000
UNE          0.000000
GDP          0.016392
INFL         0.002163
DEP          0.000000
LOA          0.011115
NUM          0.010612
dtype: float64
```

CAR

```
Parameters:  Intercept    0.000000
UNE          0.797361
GDP          0.120488
INFL         0.000000
DEP          0.000000
LOA         -0.000945
NUM          0.000000
dtype: float64
```

T1

```
Parameters:  Intercept    0.000000
UNE          0.499931
GDP          0.126073
INFL         0.000000
DEP         -0.024334
LOA         -0.068296
NUM          0.000000
dtype: float64
```

NIM

```
Parameters:  Intercept    4.524967
UNE          6.066688
GDP          0.151470
INFL        -0.004990
DEP          0.005705
LOA          0.332400
NUM          0.000000
dtype: float64
```

Modelling

LASSO REGRESSION STATSMODELS 1/2

ROA

```
Parameters:  Intercept    0.000000
UNE          0.000000
GDP          0.002543
INFL         0.000000
DEP          0.000000
LOA          0.000000
NUM          0.000000
dtype: float64
```

LA

```
Parameters:  Intercept    10.736264
UNE           5.935717
GDP           0.136117
INFL          0.000000
DEP           0.061476
LOA           0.526426
NUM          -0.049144
dtype: float64
```

ROE

```
Parameters:  Intercept    0.000000
UNE          0.000000
GDP          0.064190
INFL         0.000000
DEP         -0.035042
LOA         -0.061389
NUM          0.000000
dtype: float64
```

LATA

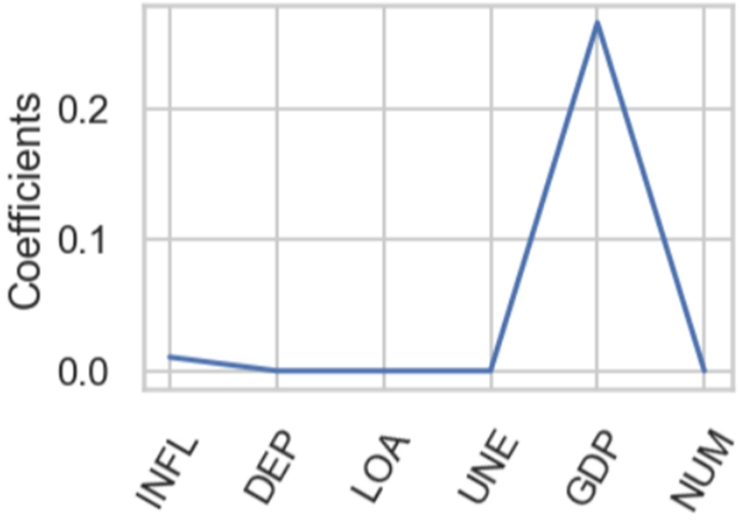
```
Parameters:  Intercept    0.000000
UNE          1.547753
GDP          0.119395
INFL         0.000000
DEP          0.000000
LOA          0.142126
NUM          0.000000
dtype: float64
```

Modelling

LASSO REGRESSION STATSMODELS 2/2

OVERALL THE LASSO REGRESSION THROUGH SCIKIT-LEARN WAS NOT SUCCESSFULL

THE HIGHEST TRAINING SCORE WAS 0.88 FOR T1 AND 0.83 FOR TEST SCORE



Modelling

LASSO SCIKIT-LEARN