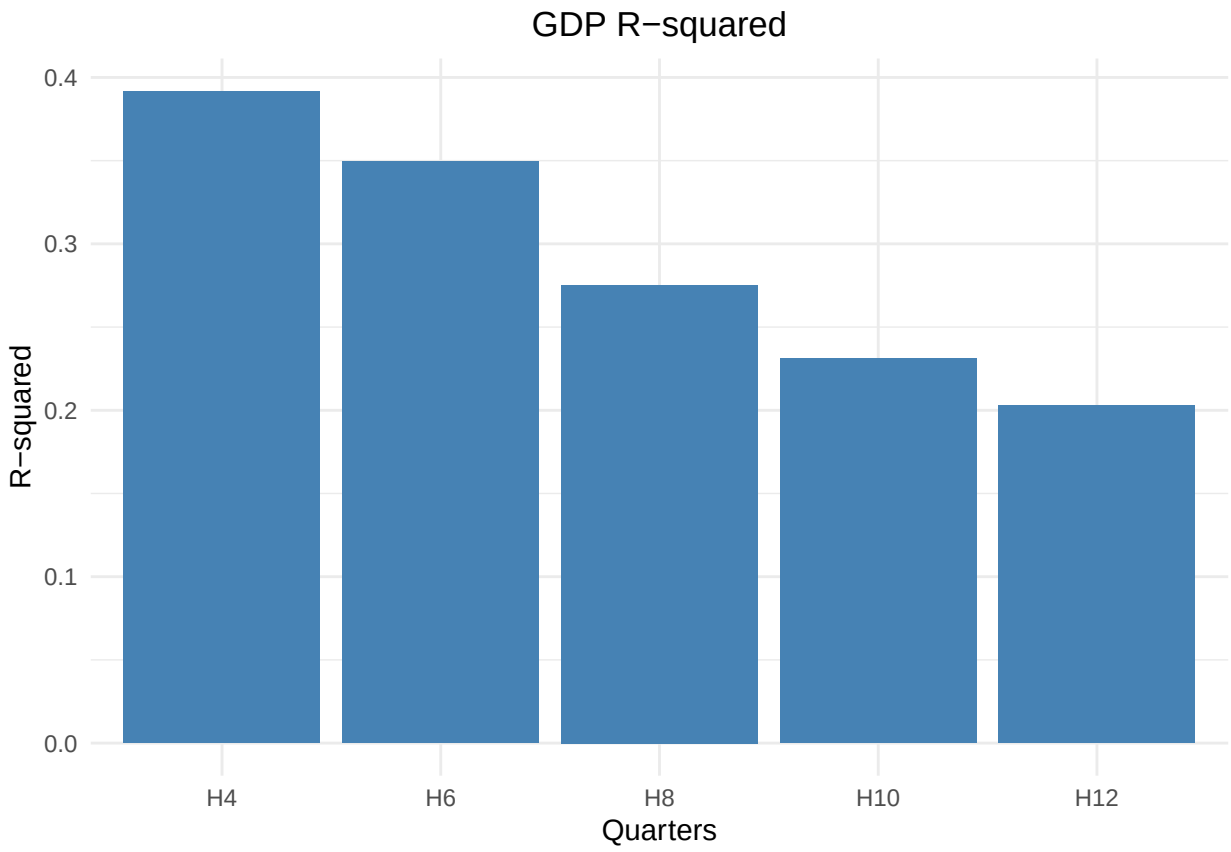
Appendices

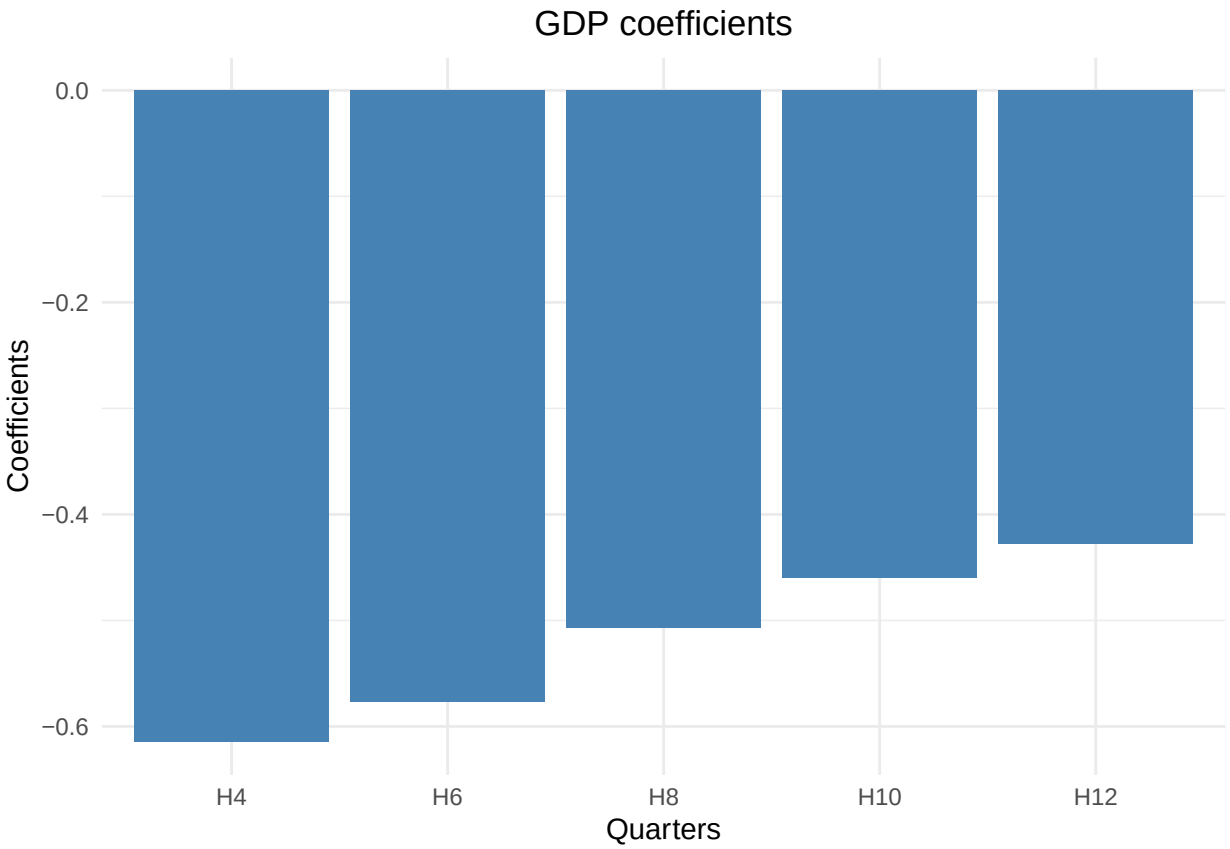
12.11-2020

1 Appendices

1.1 Appendix A

```
## Warning: attributes are not identical across measure variables;
## they will be dropped
```




GDP coefficients
0.0
−0.2
−0.4
−0.6
Coefficients
H4
H6
H8
H10
H12
Quarters

1.2 Appendix B

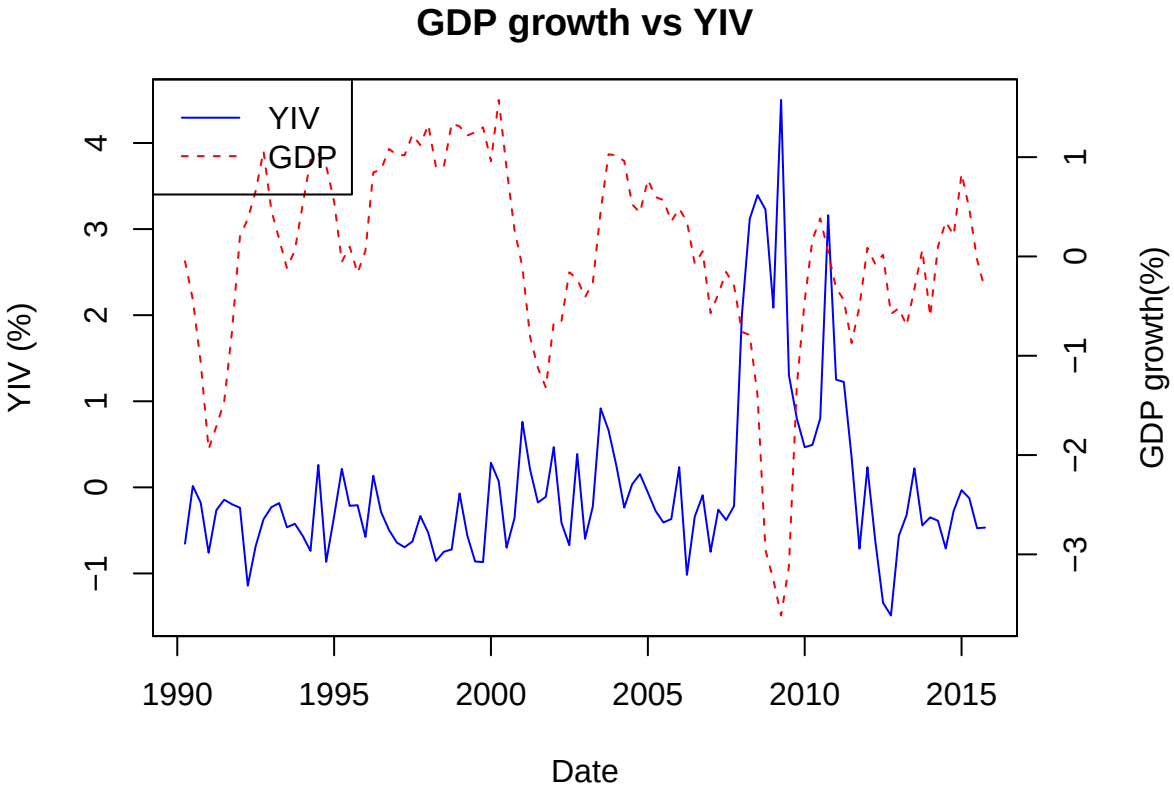


Figure 1.1: GDP Growth(%) vs 5-year Treasury Implied Volatility

1.3 Appendix C

Notes: This table includes summary statistics for main variables used in our research. Statistics include mean, standard deviation,, min, 1st quartile, median, 3rd quartile, max & number of valid data points. In Panel A, different YIV data is summarized. In Panel B, we have listed the main dependent variables which are used for predictions. GDP denotes the year-on-year growth rate(quarterly data), CON denotes YOY consumption growth(monthly data), EMP describes YOY growth rate for non-farm payroll and lastly IND stands for Industrial production YOY growth (monthly data). In Panel C, different control variables are listed: SVEN1F01 - 1 year treasury bond par yield.

Table 1.1: Summary Statistics

Variable	Mean	Std.Dev	Min	Q1	Median	Q3	Max	N.Valid
Panel A: YIV								
AAA	0	1	-1.82	-0.67	-0.14	0.79	2.09	103
Panel B: Dependent Variables								
CON	0	1	-4.07	-0.55	0.16	0.68	1.84	103
DBAA	0	1	-1.83	-0.68	0.05	0.70	2.33	103
DGS1	0	1	-1.32	-1.17	0.09	0.89	2.14	103
DGS10	0	1	-1.75	-0.74	-0.04	0.76	2.14	103
Panel C: Control Variables								
DGS3MO	0	1	-1.26	-1.20	0.08	0.93	2.18	103
DGS5	0	1	-1.69	-0.94	0.13	0.80	2.10	103
DGS6MO	0	1	-1.29	-1.18	0.07	0.88	2.15	103
EMP	0	1	-3.55	-0.47	0.32	0.66	1.40	103
F1	0	1	-3.66	-0.43	0.08	0.82	1.54	102
F10	0	1	-3.78	-0.44	0.04	0.81	1.49	93
F11	0	1	-3.77	-0.44	0.05	0.80	1.50	92
F12	0	1	-3.75	-0.45	0.04	0.82	1.50	91
F2	0	1	-3.65	-0.43	0.09	0.81	1.53	101
F3	0	1	-3.67	-0.44	0.08	0.81	1.52	100
F4	0	1	-3.74	-0.46	0.07	0.81	1.52	99
F5	0	1	-3.80	-0.46	0.05	0.80	1.52	98
F6	0	1	-3.84	-0.45	0.04	0.79	1.51	97
F7	0	1	-3.84	-0.43	0.07	0.79	1.50	96
F8	0	1	-3.82	-0.45	0.03	0.80	1.50	95
F9	0	1	-3.80	-0.44	0.03	0.80	1.49	94
GDP	0	1	-3.62	-0.44	0.07	0.83	1.58	103
housng	0	1	-3.01	-0.39	0.21	0.64	2.22	103
IND	0	1	-4.26	-0.12	0.18	0.55	1.59	103
lag1	0	1	-3.67	-0.43	0.08	0.82	1.54	102
lag2	0	1	-3.65	-0.43	0.09	0.82	1.53	101
lag3	0	1	-3.63	-0.45	0.08	0.82	1.53	100

Table 1.1: Summary Statistics *(continued)*

Variable	Mean	Std.Dev	Min	Q1	Median	Q3	Max	N.Valid
lag4	0	1	-3.62	-0.47	0.08	0.84	1.53	99
SRT03M	0	1	-3.13	-0.19	0.16	0.38	2.18	102
TRM0503	0	1	-2.31	-0.80	0.12	0.82	1.93	103
TRM0506	0	1	-2.19	-0.75	0.14	0.76	1.95	103
TRM1003	0	1	-2.20	-0.90	0.15	0.77	1.54	103
TRM1006	0	1	-2.07	-0.88	0.14	0.78	1.59	103
TRM1012	0	1	-1.84	-0.88	0.14	0.87	1.66	103
VIX	0	1	-1.20	-0.77	-0.31	0.57	5.30	103
YIV	0	1	-1.49	-0.56	-0.26	0.22	4.50	103

Note:
Additional control variables will be added upon construction. Furthermore, currently the frequency of the datasets differs for different variables but this will be addressed in the research process.

1.4 Appendix D.

Notes: This table depicts the output of regression with YIV as independent variable. The equation for the regression is following:

$$\sum_{j=1}^{j=H} log(1 + GDP_{i,t+j})/H = \alpha_H + \beta_H \sigma_{IV,t}^{INT} + \varepsilon_{t+H} \quad (1)$$

```
## Warning: attributes are not identical across measure variables;
## they will be dropped
```

Table 1.2: Regression output

	H4	H6	H8	H10	H12
			Panel A: YIV		
(Intercept)_estimate	0.01	0.01	0.02	0.02	0.02
(Intercept)_std.error	0.15	0.16	0.17	0.19	0.20
(Intercept)_p.value	0.96	0.94	0.93	0.94	0.92
YIV_estimate	-0.61	-0.58	-0.51	-0.46	-0.43
YIV_std.error	0.15	0.15	0.13	0.11	0.10
YIV_p.value	0.00	0.00	0.00	0.00	0.00
r.squared	0.39	0.35	0.28	0.23	0.20
adj.r.squared	0.39	0.34	0.27	0.22	0.19
RMSE	0.78	0.81	0.86	0.88	0.90

Note:

*** - p<0.01, ** - p<0.05, * - p<0.1. Reported standard error is adjusted for heteroskedasticity

1.5 Appendix E.

Notes: YIV and dummy as independent variables. The equation for the regression is following:

$$\sum_{j=1}^{j=H} log(1 + GDP_{i,t+j})/H = \alpha_H + \beta_H \sigma_{IV,t}^{INT} + Dummy + \varepsilon_{t+H} \quad (2)$$

```
## Warning: attributes are not identical across measure variables;
## they will be dropped
```

Table 1.3: Regression with state-dependency

	H4	H6	H8	H10	H12
			Panel A		
(Intercept)_estimate	0.01	0.02	0.02	0.02	0.02
(Intercept)_std.error	0.09	0.09	0.13	0.18	0.20
(Intercept)_p.value	0.90	0.84	0.87	0.90	0.91
YIV_estimate	-0.33	-0.32	-0.30	-0.30	-0.30
YIV_std.error	0.08	0.09	0.08	0.08	0.08
YIV_p.value	0.00	0.00	0.00	0.00	0.00
dum_estimate	-0.54	-0.50	-0.40	-0.30	-0.24
dum_std.error	0.08	0.06	0.07	0.07	0.07
dum_p.value	0.00	0.00	0.00	0.00	0.00
r.squared	0.61	0.54	0.40	0.30	0.25
adj.r.squared	0.60	0.53	0.39	0.29	0.23
RMSE	0.63	0.69	0.78	0.85	0.88

Note:

*** - p<0.01, ** - p<0.05, * - p<0.1. Reported standard error is adjusted for heteroskedasticity

1.6 Appendix F.

Notes: This table includes regression using YIV and GDP lags. The equation for the regression is following:

$$\sum_{j=1}^{j=H} log(1 + GDP_{i,t+j})/H = \alpha_H + \beta_H \sigma_{IV,t}^{INT} + lag[log(1 + GDP_{i,t+j})] + \varepsilon_{t+H} \quad (3)$$

```
## [1]    2.0000 -157.0232

## [1]    3.0000 -170.6049

## [1]    4.0000 -170.2828

## [1]    5.0000 -169.6153

## [1] 142.3152

## [1] 128.4811

## [1] 128.5307

## [1] 128.9052

## Warning: attributes are not identical across measure variables;
## they will be dropped
```

Table 1.4: Regression with state-dependency

	H4	H6	H8	H10	H12
			Panel A		
(Intercept)_estimate	0.04	0.05	0.04	0.03	0.03
(Intercept)_std.error	0.09	0.13	0.15	0.18	0.20
(Intercept)_p.value	0.70	0.70	0.78	0.86	0.90
YIV_estimate	-0.38	-0.41	-0.35	-0.31	-0.31
YIV_std.error	0.13	0.15	0.13	0.10	0.10
YIV_p.value	0.00	0.01	0.01	0.00	0.00
lag1_estimate	0.93	0.69	0.61	0.61	0.55
lag1_std.error	0.12	0.13	0.14	0.16	0.18
lag1_p.value	0.00	0.00	0.00	0.00	0.00
lag2_estimate	-0.50	-0.37	-0.31	-0.34	-0.35
lag2_std.error	0.12	0.11	0.11	0.12	0.14
lag2_p.value	0.00	0.00	0.01	0.01	0.02
r.squared	0.65	0.51	0.40	0.34	0.28
adj.r.squared	0.64	0.50	0.38	0.32	0.26
RMSE	0.60	0.70	0.78	0.83	0.87

Note:

*** - p<0.01, ** - p<0.05, * - p<0.1. Reported standard error is adjusted for heteroskedasticity

1.7 Appendix G.

Notes: This table includes regression using GDP lags and controls. The equation for the regression is following:

$$\sum_{j=1}^{j=H} log(1 + GDP_{i,t+j})/H = \alpha_H + \beta_H \sigma_{IV,t}^{INT} + lag[log(1 + GDP_{i,t+j})] + \varepsilon_{t+H} \quad (4)$$

```
## Warning: attributes are not identical across measure variables;
## they will be dropped
```

Table 1.5: Regression with state-dependency

	H4	H6	H8	H10	H12
			Panel A		
(Intercept)_estimate	0.04	0.05	0.03	0.00	-0.03
(Intercept)_std.error	0.07	0.09	0.10	0.11	0.11
(Intercept)_p.value	0.60	0.55	0.76	0.97	0.78
lag1_estimate	0.61	0.39	0.31	0.33	0.29
lag1_std.error	0.11	0.13	0.14	0.13	0.13
lag1_p.value	0.00	0.00	0.03	0.01	0.02
lag2_estimate	-0.26	-0.06	0.05	0.00	-0.04
lag2_std.error	0.10	0.10	0.11	0.10	0.10
lag2_p.value	0.01	0.53	0.63	0.97	0.70
DGS1_estimate	3.29	5.40	8.51	11.21	13.37
DGS1_std.error	1.69	1.82	1.93	2.18	2.50
DGS1_p.value	0.05	0.00	0.00	0.00	0.00
DGS10_estimate	-0.81	-0.49	0.23	0.52	0.70
DGS10_std.error	1.02	1.27	1.22	1.17	1.18
DGS10_p.value	0.43	0.70	0.85	0.66	0.55
DGS5_estimate	-7.69	-13.31	-18.37	-21.03	-23.39
DGS5_std.error	2.84	2.91	3.30	3.70	4.13
DGS5_p.value	0.01	0.00	0.00	0.00	0.00
DGS3MO_estimate	6.76	10.61	12.02	11.49	11.38
DGS3MO_std.error	2.50	2.67	2.63	2.59	2.67
DGS3MO_p.value	0.01	0.00	0.00	0.00	0.00
TRM0506_estimate	3.70	5.75	7.10	7.64	8.19
TRM0506_std.error	1.15	1.24	1.30	1.36	1.47
TRM0506_p.value	0.00	0.00	0.00	0.00	0.00
SRT03M_estimate	0.20	0.29	0.30	0.21	0.14
SRT03M_std.error	0.07	0.12	0.14	0.14	0.12
SRT03M_p.value	0.01	0.02	0.04	0.13	0.26
AAA_estimate	0.74	0.39	0.45	0.99	1.55

AAA_std.error	0.76	0.83	0.88	0.94	0.99
AAA_p.value	0.33	0.64	0.61	0.29	0.12
DBAA_estimate	-1.16	-0.77	-0.51	-0.62	-0.83
DBAA_std.error	0.40	0.50	0.48	0.44	0.47
DBAA_p.value	0.01	0.12	0.29	0.16	0.09
VIX_estimate	-0.05	-0.04	-0.06	-0.02	0.00
VIX_std.error	0.04	0.06	0.07	0.07	0.07
VIX_p.value	0.30	0.51	0.42	0.77	0.98
housng_estimate	-0.02	0.01	0.08	0.15	0.11
housng_std.error	0.08	0.09	0.09	0.10	0.09
housng_p.value	0.81	0.94	0.41	0.13	0.22
r.squared	0.77	0.70	0.67	0.67	0.67
adj.r.squared	0.74	0.65	0.62	0.62	0.62
RMSE	0.51	0.58	0.61	0.62	0.62

Note:

*** - p<0.01, ** - p<0.05, * - p<0.1. Reported standard error is adjusted for heteroskedasticity

1.8 Appendix H.

Notes: YIV, dummy, GDP lags and controls as independent variables. The equation for the regression is following:

$$\sum_{j=1}^{j=H} log(1 + GDP_{i,t+j})/H = \alpha_H + \beta_H \sigma_{IV,t}^{INT} + lag[log(1 + GDP_{i,t+j})] + \varepsilon_{t+H} \quad (5)$$

```
## Warning: attributes are not identical across measure variables;
## they will be dropped
```

Table 1.6: Regression with state-dependency

	H4	H6	H8	H10	H12
			Panel A		
(Intercept)_estimate	0.03	0.05	0.02	-0.01	-0.03
(Intercept)_std.error	0.06	0.08	0.09	0.10	0.10
(Intercept)_p.value	0.54	0.53	0.80	0.91	0.73
YIV_estimate	-0.09	-0.12	-0.12	-0.14	-0.13
YIV_std.error	0.07	0.08	0.08	0.07	0.06
YIV_p.value	0.20	0.15	0.11	0.04	0.05
dum_estimate	-0.36	-0.38	-0.34	-0.28	-0.27
dum_std.error	0.08	0.11	0.10	0.08	0.07
dum_p.value	0.00	0.00	0.00	0.00	0.00
lag1_estimate	0.47	0.22	0.16	0.20	0.16
lag1_std.error	0.10	0.10	0.11	0.11	0.12
lag1_p.value	0.00	0.03	0.16	0.08	0.18
lag2_estimate	-0.14	0.07	0.17	0.10	0.06
lag2_std.error	0.10	0.10	0.11	0.10	0.10
lag2_p.value	0.15	0.46	0.11	0.32	0.53
DGS1_estimate	3.96	6.21	9.30	11.81	14.04
DGS1_std.error	1.64	2.09	2.20	2.33	2.53
DGS1_p.value	0.02	0.00	0.00	0.00	0.00
DGS10_estimate	-1.21	-0.81	-0.03	0.30	0.51
DGS10_std.error	0.79	1.10	1.06	1.04	1.05
DGS10_p.value	0.13	0.46	0.97	0.77	0.62
DGS5_estimate	-6.75	-12.42	-17.54	-20.10	-22.61
DGS5_std.error	2.51	2.99	3.53	3.76	4.04
DGS5_p.value	0.01	0.00	0.00	0.00	0.00
DGS3MO_estimate	5.18	8.80	10.26	9.79	9.74
DGS3MO_std.error	1.95	2.11	2.19	2.23	2.33
DGS3MO_p.value	0.01	0.00	0.00	0.00	0.00
TRM0506_estimate	3.35	5.33	6.69	7.20	7.78

TRM0506_std.error	1.04	1.25	1.33	1.35	1.42
TRM0506_p.value	0.00	0.00	0.00	0.00	0.00
SRT03M_estimate	0.04	0.12	0.14	0.07	0.01
SRT03M_std.error	0.07	0.10	0.13	0.12	0.10
SRT03M_p.value	0.55	0.22	0.27	0.55	0.94
AAA_estimate	0.45	0.07	0.16	0.72	1.33
AAA_std.error	0.56	0.66	0.74	0.86	0.88
AAA_p.value	0.42	0.91	0.83	0.40	0.13
DBAA_estimate	-0.59	-0.14	0.08	-0.08	-0.34
DBAA_std.error	0.37	0.50	0.46	0.42	0.42
DBAA_p.value	0.11	0.78	0.85	0.85	0.41
VIX_estimate	-0.01	-0.01	-0.04	0.00	0.01
VIX_std.error	0.04	0.05	0.06	0.06	0.06
VIX_p.value	0.71	0.91	0.57	0.98	0.83
housng_estimate	0.01	0.04	0.11	0.19	0.15
housng_std.error	0.06	0.07	0.08	0.10	0.09
housng_p.value	0.81	0.52	0.17	0.05	0.10
r.squared	0.84	0.78	0.74	0.73	0.73
adj.r.squared	0.81	0.74	0.69	0.68	0.67
RMSE	0.43	0.50	0.55	0.57	0.57

Note:

*** - p<0.01, ** - p<0.05, * - p<0.1. Reported standard error is adjusted for heteroskedasticity

1.9 Appendix I.

	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H11	H12
Out-of-sample RMSFE	0.95	0.98	1.05	1.13	1.21	1.24	1.21	1.17	1.15	1.15	1.12	1.10
Recessionary	1.87	1.94	2.12	2.17	2.17	1.85	1.34	1.07	1.24	1.33	0.94	0.82
Expansionary	0.73	0.75	0.78	0.89	1.00	1.12	1.19	1.18	1.13	1.12	1.14	1.14
Naive	0.53	0.85	1.10	1.27	1.32	1.34	1.33	1.28	1.22	1.13	1.04	1.00
TRM	1.02	0.96	0.93	1.01	1.00	0.94	0.91	0.86	0.90	0.93	1.02	1.12
CRS	0.84	1.08	1.41	1.62	1.51	1.33	1.13	1.05	1.04	1.02	1.00	0.97