THE OUT-OF-SAMPLE FAILURE OF EMPIRICAL EXCHANGE RATE MODELS – A NONLINEAR PERSPECTIVE.

Marco Hassan
Milano, IT 20124
marco.hassan30@gmail.com

Master Thesis
Presented to the University of St. Gallen
In Fulfillment Of the Requirements for the Master of Arts in
Banking and Finance

Supervisor: Prof. PhD. Francesco Audrino
Co-Supervisor: Prof. PhD. Juan-Pablo Ortega

May 4, 2019

Appendix A – Main Results

Table 1: Mean Absolute Error – Univariate Models
Equal Predictive Ability p-value in Parenthesis

Univariate Models				
Lag	Model	Switzerland	United Kingdom	Japan
MAE 1	Random Walk	0.0193 (0.503)	0.0168 (0.506)	0.0162 (0.506)
	Transfer Function Model	0.0205 (0.119)	0.0176 (0.128)	0.0173 (0.228)
	OLS - unrestricted	0.0234 (0.031)	0.0211 (0.053)	0.0194 (0.192)
MAE 3	Random Walk	0.0390 (0.307)	0.0330 (0.093)	0.0291 (0.534)
	Transfer Function Model	0.0384 (0.499)	0.0341 (0.094)	0.0280 (0.111)
	OLS - unrestricted	0.0603 (0.133)	0.0443 (0.143)	0.0497 (0.000)
MAE 6	Random Walk	0.0580 (0.483)	0.0495 (0.785)	0.0439 (0.484)
	Transfer Function Model	0.0581 (0.468)	0.0498 (0.526)	0.0442 (0.396)
	OLS - unrestricted	0.0789 (0.003)	0.0531 (0.486)	0.0669 (0.000)
MAE 12	Random Walk	0.0964 (0.171)	0.0584 (0.726)	0.0753 (0.505)
	Transfer Function Model	0.0954 (0.489)	0.0598 (0.678)	0.0752 (0.147)
	OLS - unrestricted	0.1210 (0.000)	0.0744 (0.523)	0.1001 (0.000)

Table 2: Johansen Cointegration Test – Trace Statistics

			Quantiles Test Statistics		
Series		Trace Score	90%	95%	99%
Structural JP-US	Cointegrated Series <= 3	26.46	28.71	31.52	37.22
	Cointegrated Series <= 2	48.79	45.23	48.28	55.43
	Cointegrated Series <= 1	87.80	66.49	70.60	78.87
	Cointegrated Series = 0	138.18	85.18	90.39	104.20
Structural CH-US	Cointegrated Series <= 3	25.97	28.71	31.52	37.22
	Cointegrated Series <= 2	53.22	45.23	48.28	55.43
	Cointegrated Series <= 1	85.88	66.49	70.60	78.87
	Cointegrated Series = 0	145.12	85.18	90.39	104.20
Structural UK-US	Cointegrated Series <= 3	26.94	28.71	31.52	37.22
	Cointegrated Series <= 2	51.26	45.23	48.28	55.43
	Cointegrated Series <= 1	88.47	66.49	70.60	78.87
	Cointegrated Series = 0	178.10	85.18	90.39	104.20

Table 3: Mean Absolute Error – Multivariate Models
Equal Predictive Ability p-value in Parenthesis

Multivariate Models				
Lag	Model	Switzerland	United Kingdom	Japan
	Random Walk	0.0193 (0.125)	0.0168 (0.177)	0.0162 (0.625)
MAE 1	VAR	0.0183 (0.207)	0.0186 (0.178)	0.0160 (0.170)
	VECM	0.0176 (0.491)	0.0174 (0.476)	0.0153 (0.355)
	Random Walk	0.0390 (0.392)	0.0330 (0.495)	0.0291 (0.529)
MAE 3	VAR	0.0394 (0.359)	0.0333 (0.486)	0.0292 (0.488)
	VECM	0.0376 (0.624)	0.0328 (0.016)	0.0320 (0.770)
	Random Walk	0.0580 (0.675)	0.0495 (0.081)	0.0439 (0.449)
MAE 6	VAR	0.0578 (0.666)	0.0488 (0.504)	0.0418 (0.575)
	VECM	0.0580 (0.535)	0.0483 (0.355)	0.0434 (0.647)
	Random Walk	0.0964 (0.258)	0.0584 (0.232)	0.0753 (0.458)
MAE 12	VAR	0.0974 (0.165)	0.0603 (0.092)	0.0763 (0.267)
	VECM	0.0881 (0.507)	0.0542 (0.676)	0.0731 (0.573)

Table 4: Mean Absolute Error – Generalized Tree Structure Model

Multivariate Models				
Lag	Model	Switzerland	Japan	United Kingdom
MAE 1	Random Walk	0.0193	0.0168	0.0162
	VAR	0.0183	0.0186	0.0160
	VECM	0.0176	0.0174	0.0153
	GTS-OLS	0.0082	0.0084	0.0101
MAE 3	Random Walk	0.0390	0.0330	0.0291
	VAR	0.0394	0.0333	0.0292
	VECM	0.0376	0.0328	0.0320
	GTS-OLS	0.0089	0.0081	0.0096
MAE 6	Random Walk	0.0580	0.0495	0.0439
	VAR	0.0578	0.0488	0.0418
	VECM	0.0580	0.0483	0.0434
	GTS-OLS	0.0075	0.0080	0.0099
MAE 12	Random Walk	0.0964	0.0584	0.0753
	VAR	0.0974	0.0603	0.0763
	VECM	0.0881	0.0542	0.0731
	GTS-OLS	0.0078	0.0088	0.0095

Appendix B – Figures

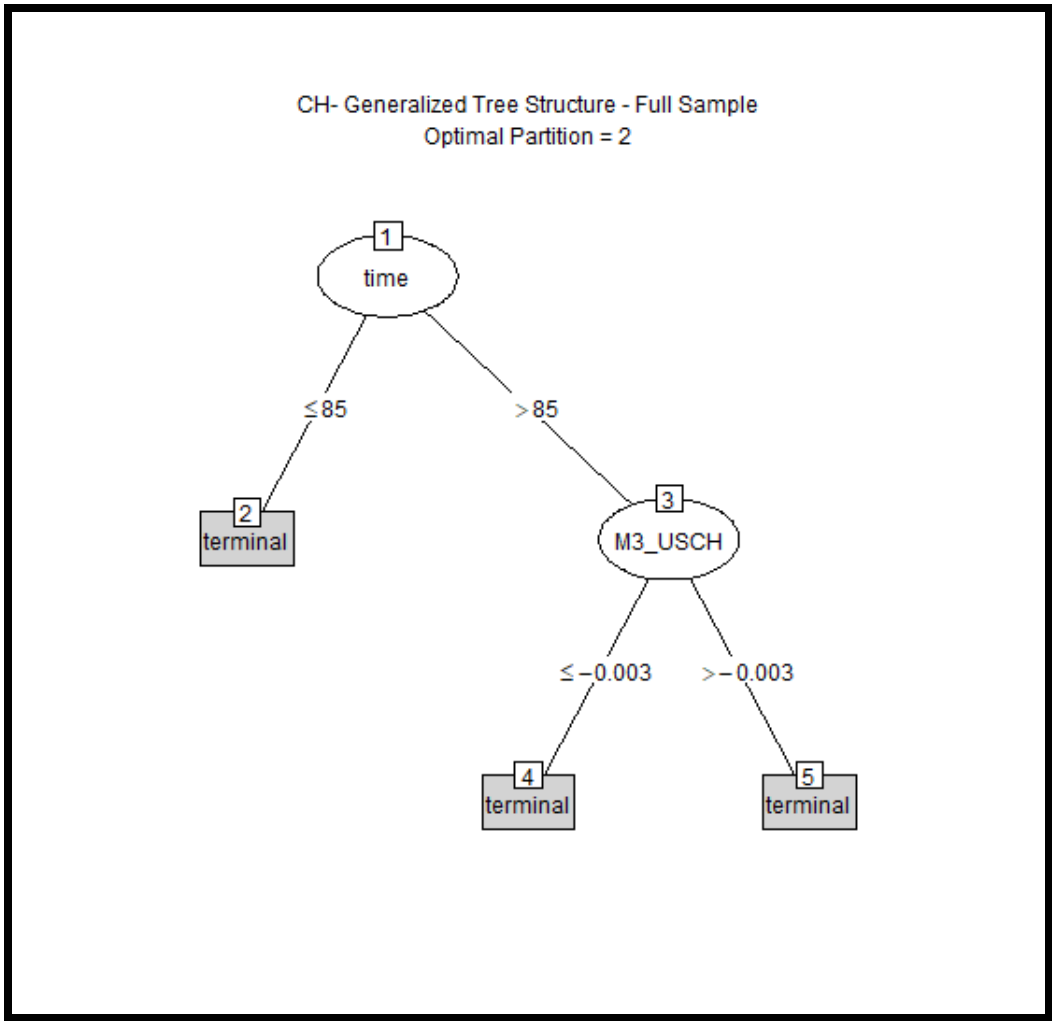

Figure 1: Switzerland GTS Partitions
Full Sample 1986 –2006

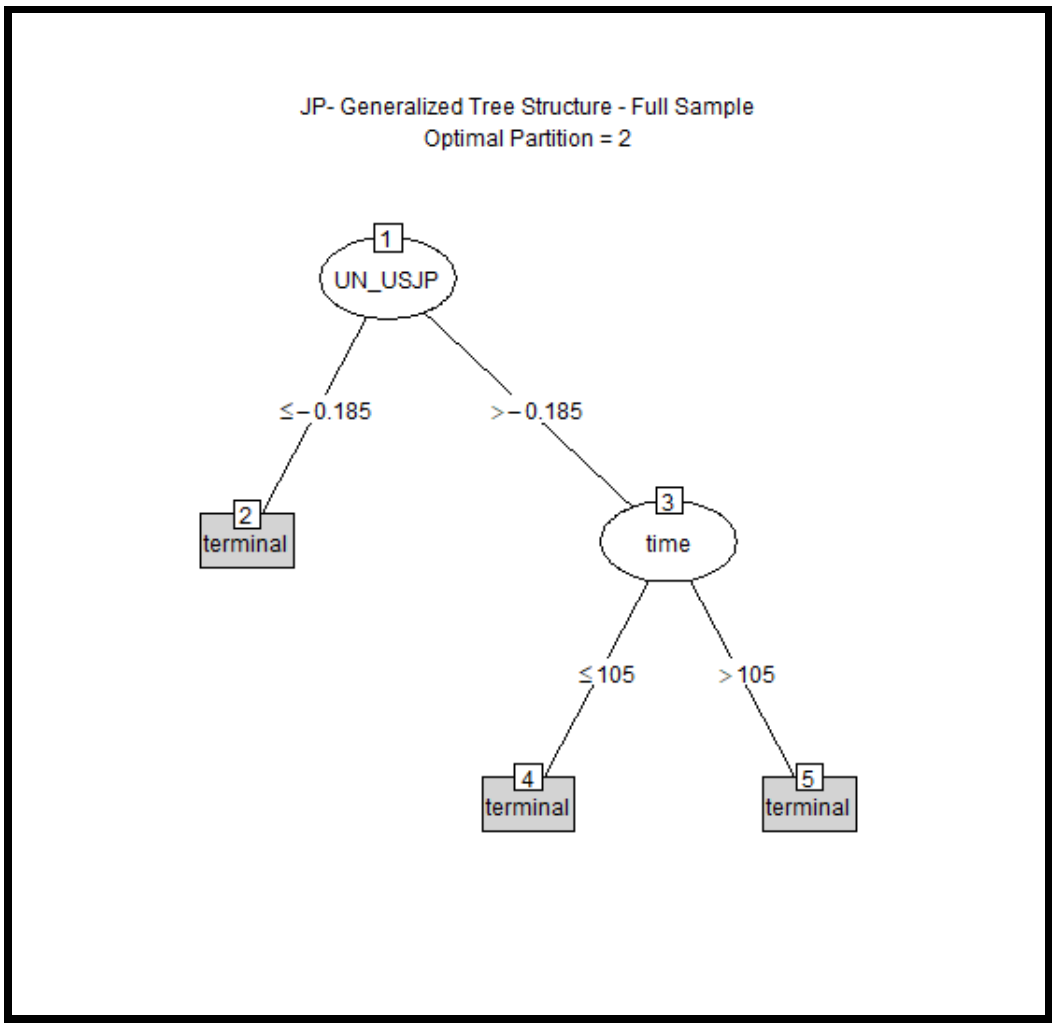

Figure 2: Japan GTS Partitions

Full Sample 1986 –2006

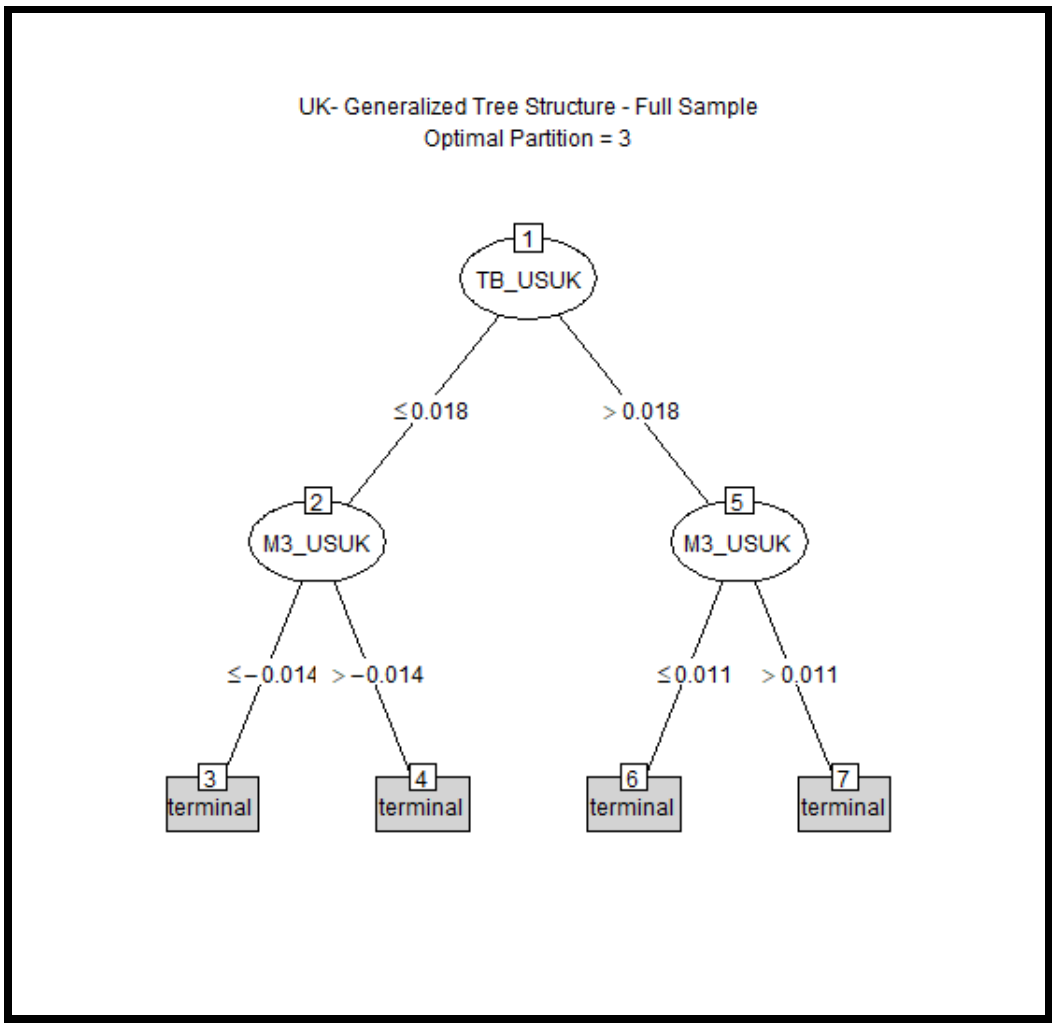

Figure 3: United Kingdom GTS Partitions

Full Sample 1986 –2006

Appendix C – GTS Tables

Table 5: Generalized Tree Structured Model – Optimal Number of Partitions in Rolling Forecasts

Pruned Tree – Optimal Number of Partitions			
Lag	Switzerland	Japan	United Kingdom
Lag 1	1 Optimal Partition: 19 times 2 Optimal Partitions: 23 times	1 Optimal Partition: 23 times 2 Optimal Partitions: 25 times	1 Optimal Partition: 23 times 2 Optimal Partitions: 25 times
Lag 3	1 Optimal Partition: 19 times 2 Optimal Partitions: 21 times	1 Optimal Partition: 21 times 2 Optimal Partitions: 25 times	1 Optimal Partition: 21 times 2 Optimal Partitions: 25 times
Lag 6	1 Optimal Partition: 19 times 2 Optimal Partitions: 18 times	1 Optimal Partition: 18 times 2 Optimal Partitions: 25 times	1 Optimal Partition: 17 times 2 Optimal Partitions: 25 times
Lag 12	1 Optimal Partition: 16 times 2 Optimal Partitions: 20 times	1 Optimal Partition: 13 times 2 Optimal Partitions: 24 times	1 Optimal Partition: 12 times 2 Optimal Partitions: 23 times

Table 6: Optimal First Partiton in Rolling Forecast – Switzerland

Lag	Partition Variable	Partition Interval	Break Occurrences
Lag 1	Monetary Mass M3	56.25%	31 times
	Time	37.5%	1 times
		43.75%	3 times
		50%	6 times
		56.25%	7 times
Lag 3	Monetary Mass M3	56.25%	29 times
	Time	37.5%	1 times
		43.75%	3 times
		50%	6 times
		56.25%	7 times
Lag 6	Monetary Mass M3	56.25%	26 times
	Time	37.5%	1 times
		43.75%	3 times
		50%	6 times
		56.25%	7 times
Lag 12	Monetary Mass M3	56.25%	20 times
	Time	37.5%	1 times
		43.75%	3 times
		50%	6 times
		56.25%	7 times

Table 7: Optimal First Partiton in Rolling Forecast – Japan

Lag	Partition Variable	Partition Interval	Break Occurrences
Lag 1	Trade	56.25%	10 times
	Unemployement	31.25%	12 times
		37.5%	18 times
	Monetary Mass M3	43.75%	5 times
		68.75%	3 times
Lag 3	Trade	56.25%	10 times
	Unemployement	31.25%	10 times
		37.5%	18 times
	Monetary Mass M3	43.75%	5 times
		68.75%	3 times
Lag 6	Trade	56.25%	10 times
	Unemployement	31.25%	8 times
		37.5%	18 times
	Monetary Mass M3	43.75%	5 times
		68.75%	2 times
Lag 12	Trade	56.25%	10 times
	Unemployement	31.25%	5 times
		37.5%	18 times
	Monetary Mass M3	43.75%	4 times
		68.75%	4 times

Table 8: Optimal First Partiton in Rolling Forecast – United Kingdom

Lag	Partition Variable	Partition Interval	Break Occurrences
Lag 1	Time	31.25%	3 times
		37.5%	3 times
	Unemployement	43.75%	4 times
	Treasury Bills	37.5%	5 times
		43.75%	7 times
		50.00%	16 times
		56.25%	10 times
Lag 3	Time	31.25%	3 times
		37.5%	3 times
	Unemployement	43.75%	4 times
	Treasury Bills	37.5%	5 times
		43.75%	7 times
		50.00%	14 times
		56.25%	10 times
Lag 6	Time	31.25%	3 times
		37.5%	3 times
	Unemployement	43.75%	4 times
	Treasury Bills	37.5%	5 times
		43.75%	7 times
		50.00%	11 times
		56.25%	10 times
Lag 12	Time	31.25%	3 times
		37.5%	3 times
	Unemployement	43.75%	4 times
	Treasury Bills	37.5%	5 times
		43.75%	7 times
		50.00%	11 times
		56.25%	10 times

Table 9: GTS Partition Analysis

Lag	Rollling Forecast	Partition Tuples	Occurrences
Switzerland	1-16	Time – Consumer Price Index	6
		Time – Monetary Mass 3	3
		Time – Interest Rates	1
	18-48	Monetary Mass 3 – Monetary Mass 3	6
		Monetary Mass 3 – Unempolyment	16
		Monetary Mass 3 – Time	5
		Monetary Mass 3 – Interst rates	2
		Monetary Mass 3 – Trade	2
Japan	1-18	Monetary Mass 3 – Trade	18
	19-24	Trade – Monetary Mass 3	6
	25-48	Unemployment – Trade	13
		Monetary Mass 3 –Trade	3
		Monetary Mass 3 –Time	2
		Monetary Mass 3 –Unemployment	1
		Trade – Monetary Mass 3	4
United Kingdom	1-6	Time – Interest Rates	6
	7-18	Interest Rates – Monetary Mass 3	1
		Interest Rates – Unemployment	6
		Interest Rates – Interst Rates	4
		Interest Rates – Time	1
	19-22	Unemployment – Interest Rates	4
	23-48	Interest Rates – Interest Rates	9
		Interest Rates – Time	1