

Appendix 1. VAR Estimation for GPR

	HEU		HMM		KLC		KSS		POC	
	GPR	VOL	GPR	VOL	GPR	VOL	GPR	VOL	GPR	VOL
GPR(-1)	-0.041 [-0.661]	-0.137 [-1.176]	-0.046 [-0.759]	-0.012 [-0.181]	-0.045 [-0.747]	-0.101* [-1.461]	-0.269*** [-3.688]	-0.280* [-1.652]	-0.271*** [-3.683]	-0.104 [-0.621]
GPR(-2)	-0.091* [-1.453]	-0.011 [-0.095]	-0.086* [-1.415]	-0.002 [-0.023]	-0.086* [-1.419]	0.149** [2.130]	-0.127* [-1.634]	0.043 [0.240]	-0.175 [-2.276]**	0.450*** [2.579]
GPR(-3)			-0.048 [-0.789]	0.180*** [2.674]					-0.186 [-2.422]**	0.104 [0.597]
VOL(-1)	-0.016 [-0.489]	-0.329*** [-5.398]	-0.001 [-0.027]	-0.444*** [-7.415]	0.034 [0.668]	-0.339*** [-5.759]	0.012 [0.380]	-0.449*** [-6.372]	0.017 [0.523]	-0.343*** [-4.632]
VOL(-2)	0.016 [0.479]	-0.176*** [-2.819]	-0.050 [-0.854]	-0.179*** [-2.774]	-0.003 [-0.064]	-0.206*** [-3.518]	0.007 [0.218]	-0.260 [-3.711]***	-0.047* [-1.453]	-0.273*** [-3.671]
VOL(-3)			0.012 [0.225]	-0.080* [-1.342]					-0.004 [-0.111]	-0.127** [-1.734]
C	0.048* [1.530]	0.326*** [5.559]	0.052** [1.717]	0.179*** [5.315]	0.043* [1.497]	0.162*** [4.872]	0.030** [1.830]	0.185*** [4.919]	0.036** [2.240]	0.137*** [3.754]
Adj. R ²	-0.003	0.098	-0.005	0.171	-0.004	0.091	0.052	0.191	0.078	0.139

Note : Numbers in [.] are t-statistics. ***, ** and * indicate the statistical significance at 1%, 5% and 10% levels, respectively.

Appendix 2. VAR Estimation for GPRT

	HEU		HMM		KLC		KSS		POC	
	GPR	VOL	GPR	VOL	GPR	VOL	GPR	VOL	GPR	VOL
GPR(-1)	-0.041 [-0.661]	-0.137 [-1.176]	-0.042 [-0.702]	-0.024 [-0.359]	-0.045 [-0.747]	-0.101* [-1.461]	-0.269*** [-3.688]	-0.280* [-1.652]	-0.253*** [-3.584]	-0.032 [-0.199]
GPR(-2)	-0.091* [-1.453]	-0.011 [-0.095]	-0.084* [-1.384]	-0.014 [-0.199]	-0.086* [-1.419]	0.149** [2.130]	-0.127* [-1.634]	0.043 [0.240]	-0.129** [-1.717]	0.434*** [2.548]
VOL(-1)	-0.016 [-0.489]	-0.329*** [-5.398]	-0.002 [-0.044]	-0.435*** [-7.278]	0.034 [0.668]	-0.339*** [-5.759]	0.012 [0.380]	-0.449*** [-6.372]	0.007 [0.219]	-0.312*** [-4.385]
VOL(-2)	0.016 [0.479]	-0.176*** [-2.819]	-0.052 [-0.977]	-0.156*** [-2.622]	-0.003 [-0.064]	-0.206*** [-3.518]	0.007 [0.218]	-0.260*** [-3.711]	-0.044* [-1.424]	-0.244*** [-3.437]
C	0.048* [1.530]	0.326*** [5.559]	0.051** [1.792]	0.175 [5.435]***	0.043 [1.497]*	0.162*** [4.872]	0.030** [1.830]	0.185*** [4.919]	0.031** [2.003]	0.122*** [3.456]
Adj. R ²	-0.003	0.098	0.000	0.152	-0.003	0.136	0.052	0.191	0.063	0.133

Note : Numbers in [.] are t-statistics. ***, ** and * indicate the statistical significance at 1%, 5% and 10% levels, respectively.

Appendix 3. VAR Estimation for GPRA

	HEU		HMM		KLC		KSS		POC	
	GPR	VOL	GPR	VOL	GPR	VOL	GPR	VOL	GPR	VOL
GPR(-1)	-0.001 [-0.024]	-0.092 [-1.174]	-0.005 [-0.089]	-0.015 [-0.343]	-0.012 [-0.200]	-0.062* [-1.345]	-0.186*** [-2.559]	-0.210** [-1.810]	-0.179** [-2.453]	0.005 [0.049]
GPR(-2)	-0.084* [-1.327]	0.002 [0.030]	-0.071 [-1.166]	-0.023 [-0.490]	-0.072 [-1.162]	0.121*** [2.571]	-0.179** [-2.107]	0.108 [0.797]	-0.145** [-1.714]	0.299** [2.311]
VOL(-1)	-0.022 [-0.464]	-0.327*** [-5.366]	-0.028 [-0.355]	-0.435*** [-7.270]	0.064 [0.834]	-0.337*** [-5.738]	-0.033 [-0.743]	-0.438*** [-6.213]	0.065* [1.396]	-0.313*** [-4.381]
VOL(-2)	-0.006 [-0.128]	-0.174 [-2.796]***	-0.074 [-0.930]	-0.154 [-2.585]***	0.000 [0.003]	-0.207*** [-3.540]	0.029 [0.656]	-0.272*** [-3.906]	-0.039 [-0.824]	-0.236*** [-3.292]
C	0.082** [1.776]	0.325 [5.545]***	0.085** [1.972]	0.176 [5.457]***	0.069* [1.586]	0.160*** [4.829]	0.054** [2.289]	0.184*** [4.912]	0.049** [2.107]	0.120*** [3.371]
Adj. R ²	-0.008	0.098	-0.005	0.153	-0.006	0.141	0.036	0.197	0.042	0.125

Note : Numbers in [.] are t-statistics. ***, ** and * indicate the statistical significance at 1%, 5% and 10% levels, respectively.

Appendix 4. Results of Impulse Response (Significant in Causality Tests only)

