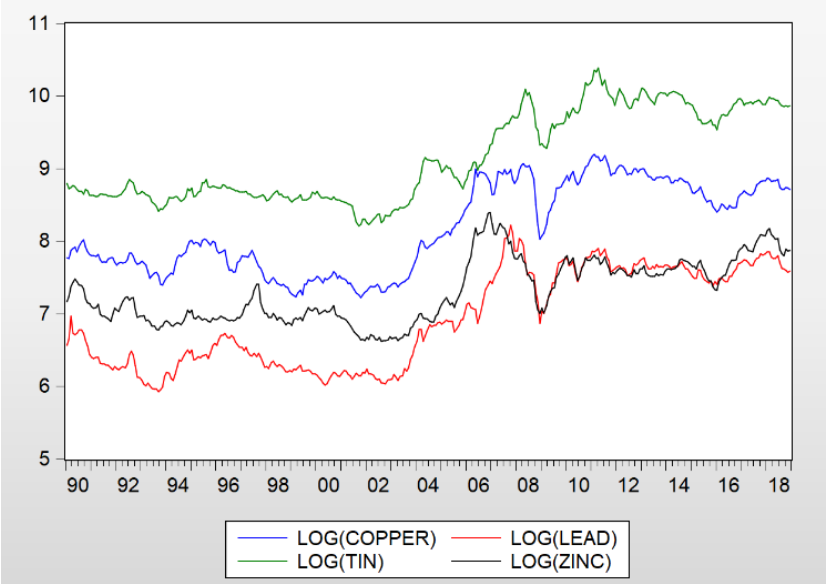
DSC5211C Week 5 Workshop
A0186060J A0186018A A0186567L

MISSION: VAR & COINTEGRATION: Precious Metals

1. Visualization

Plot the logarithmic values of four selected metals



2. Johansen-Cointegration Test

After confirming non-stationarity (omitted), do Johansen-Cointegration test and get such result.

Date: 02/16/19 Time: 15:43
Sample (adjusted): 1990M03 2018M12
Included observations: 346 after adjustments
Trend assumption: No deterministic trend (restricted constant)
Series: LOG(COPPER) LOG(LEAD) LOG(TIN) LOG(ZINC)
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.078118	54.58767	54.07904	0.0450
At most 1	0.044796	26.44455	35.19275	0.3177
At most 2	0.026528	10.58727	20.26184	0.5822
At most 3	0.003706	1.284661	9.164546	0.9101

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

We reject the hypothesis that there is no deterministic trend and accept there is one lag according to the graph.

3.Conduct Vector Error Correction Estimates

Vector Error Correction Estimates
Date: 02/16/19 Time: 15:47
Sample (adjusted): 1990M03 2018M12
Included observations: 346 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LOG(COPPER(-1))	1.000000
LOG(LEAD(-1))	-2.535663 (0.45645) [-5.55520]
LOG(TIN(-1))	1.644632 (0.40814) [4.02953]
LOG(ZINC(-1))	0.166074 (0.34076) [0.48736]
C	-6.925281 (1.93706) [-3.57515]

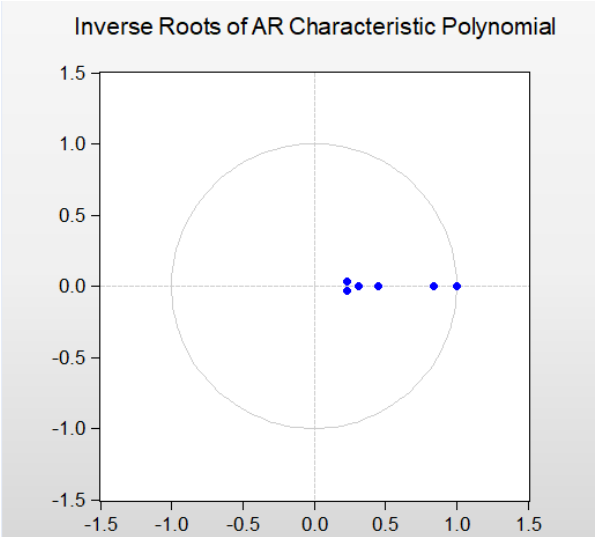
Log(zinc^{-1}) is not significant so we don't include it in the equation. It's not influenced by the long-term relationship.

Error Correction:	D(LOG(CO...	D(LOG(LE...	D(LOG(TIN))	D(LOG(ZINC))
CointEq1	-0.018218 (0.00820) [-2.22041]	0.013266 (0.00982) [1.35031]	-0.025830 (0.00746) [-3.46049]	-0.004341 (0.00838) [-0.51821]
D(LOG(COPPER(-1)))	0.420624 (0.06844) [6.14621]	0.089441 (0.08195) [1.09147]	0.091521 (0.06226) [1.46997]	0.191225 (0.06987) [2.73686]
D(LOG(LEAD(-1)))	-0.089978 (0.05860) [-1.53538]	0.227445 (0.07017) [3.24128]	0.016599 (0.05331) [0.31135]	-0.052085 (0.05983) [-0.87054]
D(LOG(TIN(-1)))	-0.021968 (0.06506) [-0.33765]	-0.153571 (0.07791) [-1.97125]	0.200727 (0.05919) [3.39117]	-0.221108 (0.06643) [-3.32867]
D(LOG(ZINC(-1)))	0.032673 (0.06797) [0.48070]	0.024900 (0.08139) [0.30595]	-0.016137 (0.06184) [-0.26096]	0.303236 (0.06939) [4.36983]
R-squared	0.163207	0.063175	0.112511	0.136039
Adj. R-squared	0.153391	0.052186	0.102100	0.125904
Sum sq. resids	1.119006	1.604394	0.926161	1.166389
S.E. equation	0.057285	0.068593	0.052115	0.058485
F-statistic	16.62706	5.748865	10.80750	13.42340
Log likelihood	501.0290	438.6961	533.7515	493.8543
Akaike AIC	-2.867220	-2.506914	-3.056367	-2.825747
Schwarz SC	-2.811635	-2.451330	-3.000782	-2.770163
Mean dependent	0.002733	0.002682	0.003296	0.001814
S.D. dependent	0.062258	0.070456	0.054999	0.062555

Determinant resid covariance (dof adj.)	3.90E-11
Determinant resid covariance	3.68E-11
Log likelihood	2192.584
Akaike information criterion	-12.52939
Schwarz criterion	-12.25146

Interpretation: Our analysis shows that copper and tin are main drivers of the metal market. And to improve the model we can just remove the variable zinc.

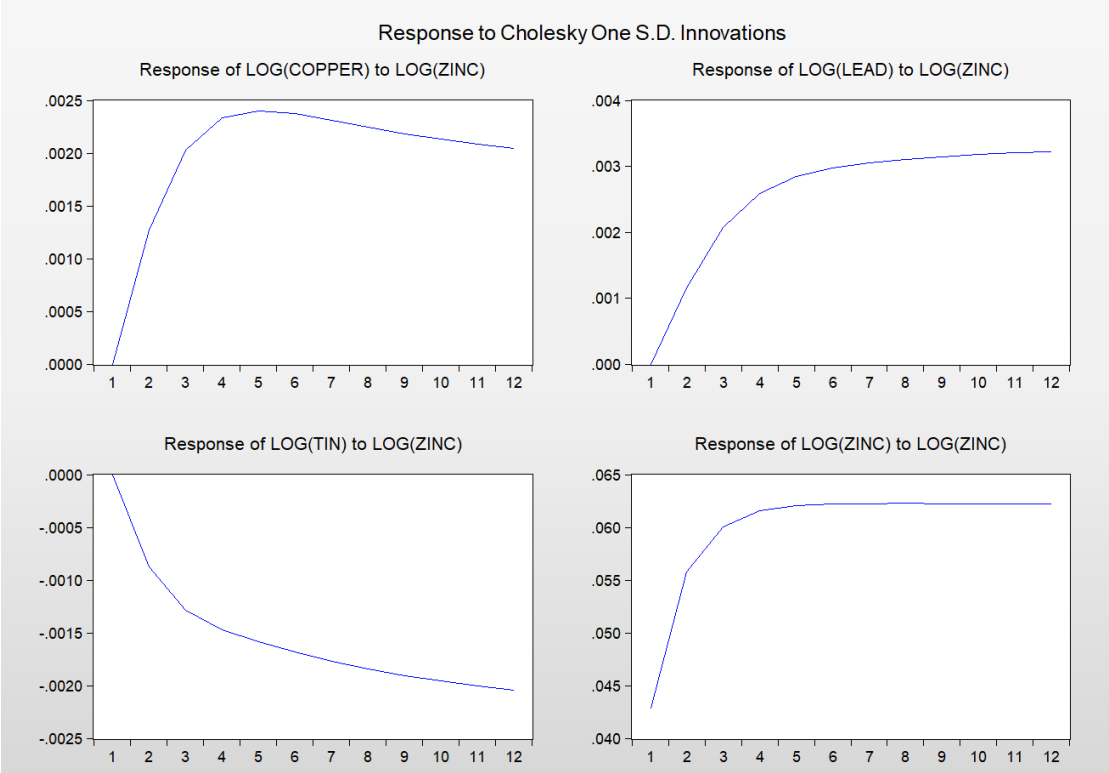
4.Analyze the stability



All points are inside the circle so the result is safe and not explosive.

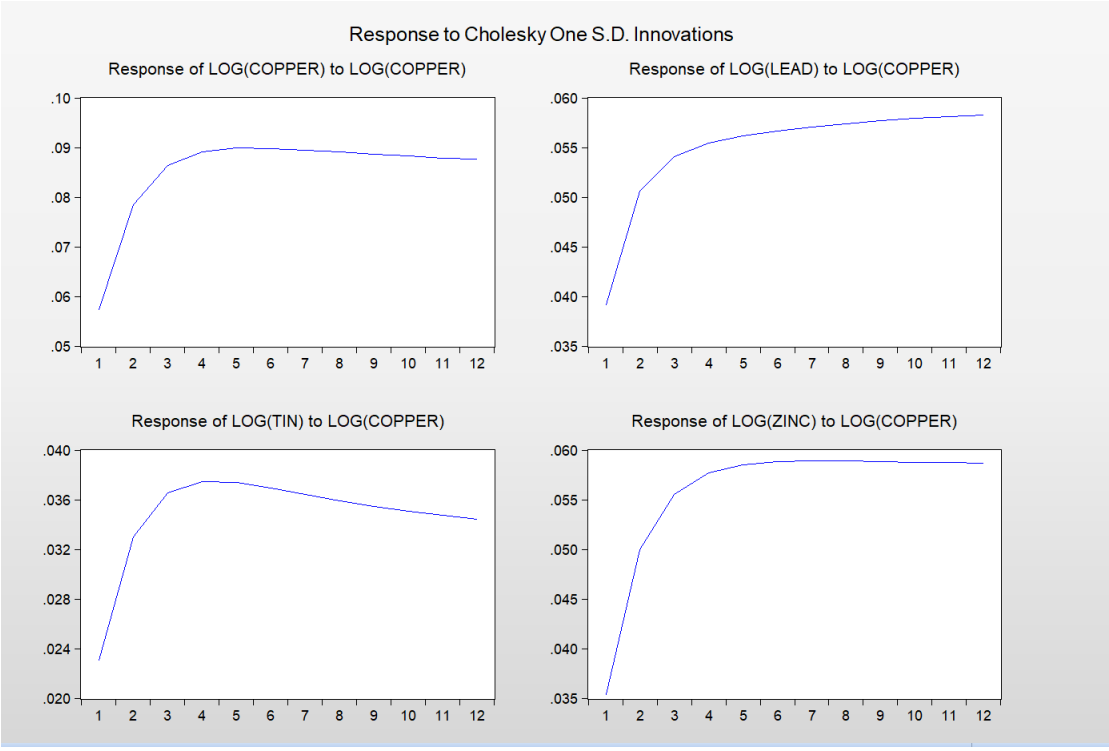
5. Responses to Cholesky one S.D. Innovations of four metals

5.1 Zinc



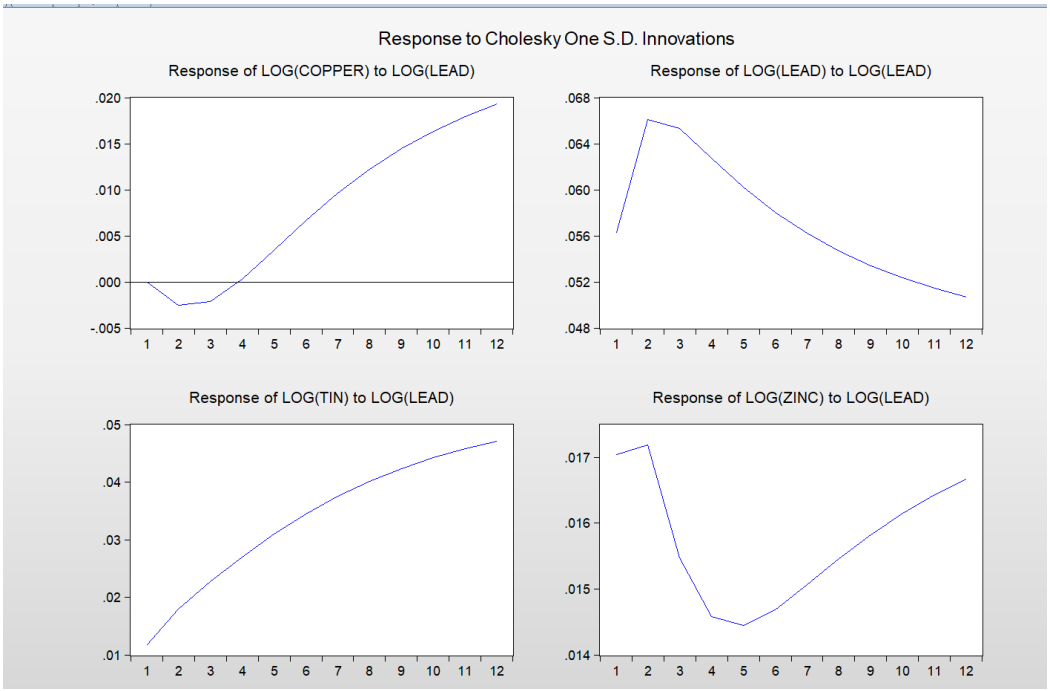
Zinc price exerts different impact on metals and the influence turns gentle after a few months but since zinc should be excluded this interpretation isn't that meaningful.

5.2 Copper



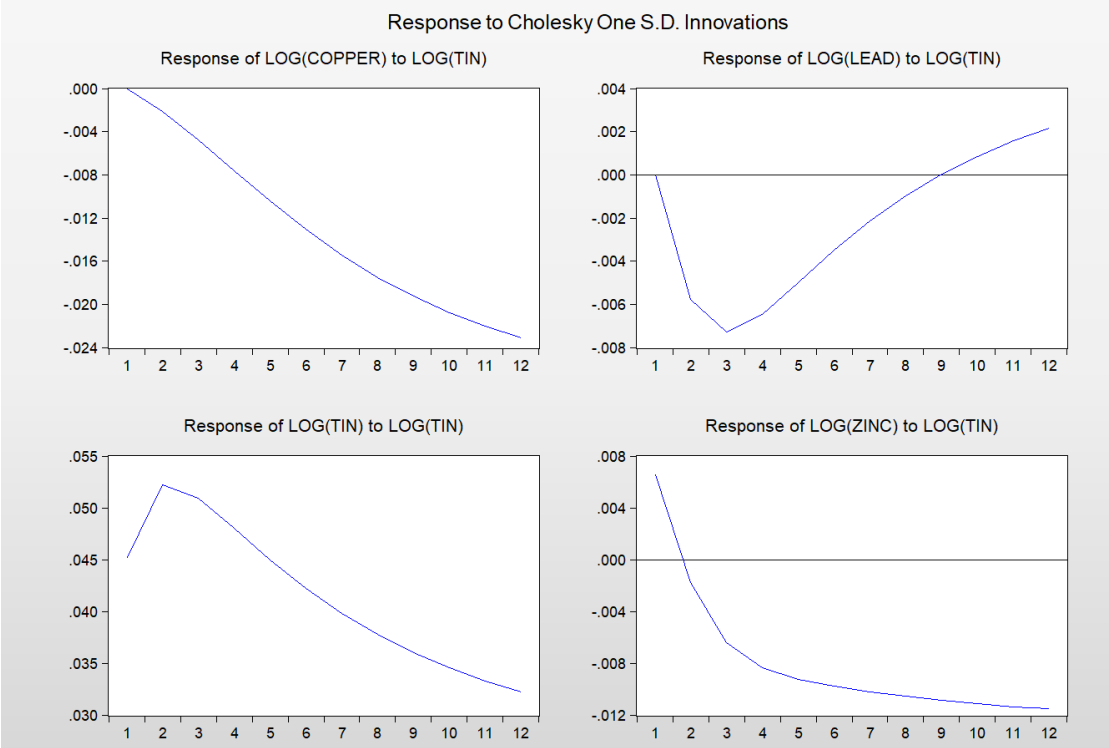
Copper price exerts positive effect on all metals including itself and after 4-5 months the impact becomes stable.

5.3 Lead



Lead price affects copper and tin price positively and gradually increases. Lead price initially had positive impact on itself and then reverses starting at the third month. Finally, it negatively influences zinc price and after 5 months it turns to positive influence.

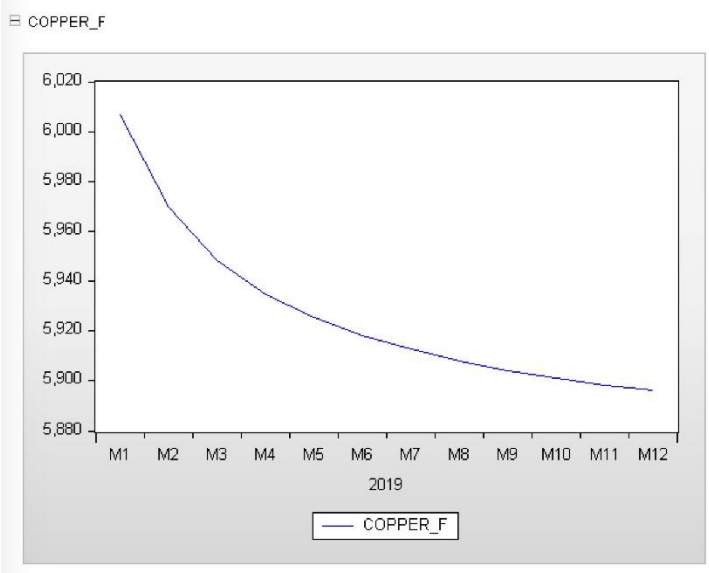
5.4 Tin



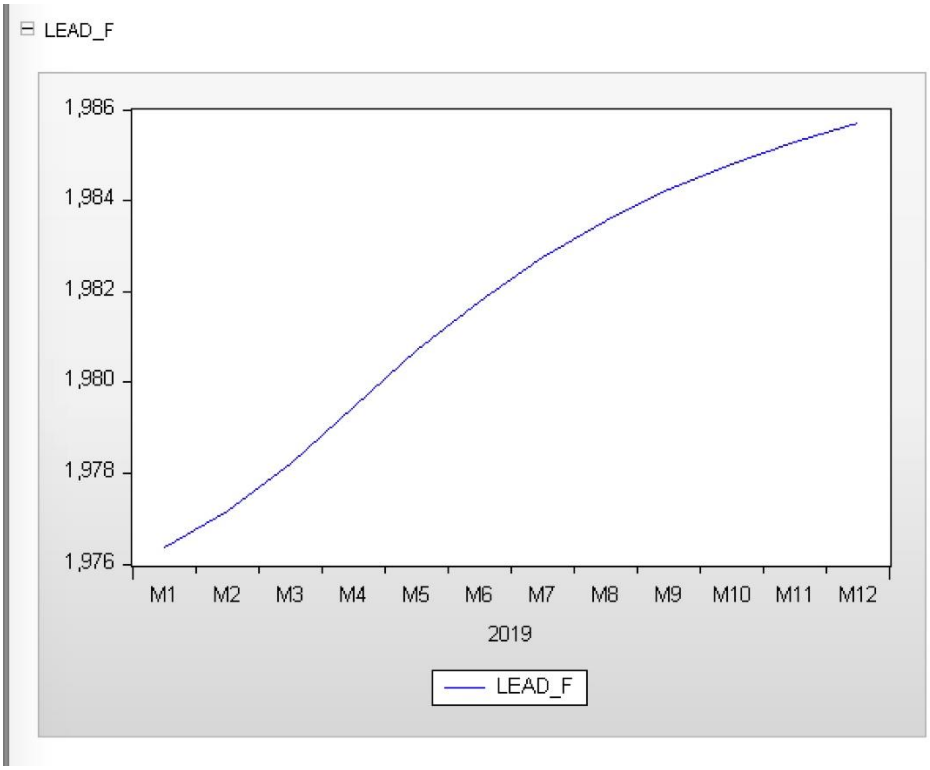
From the big view, tin price negatively influences all metals throughout the year except lead because its influence becomes positive when the third month begins.

6. Forecasts

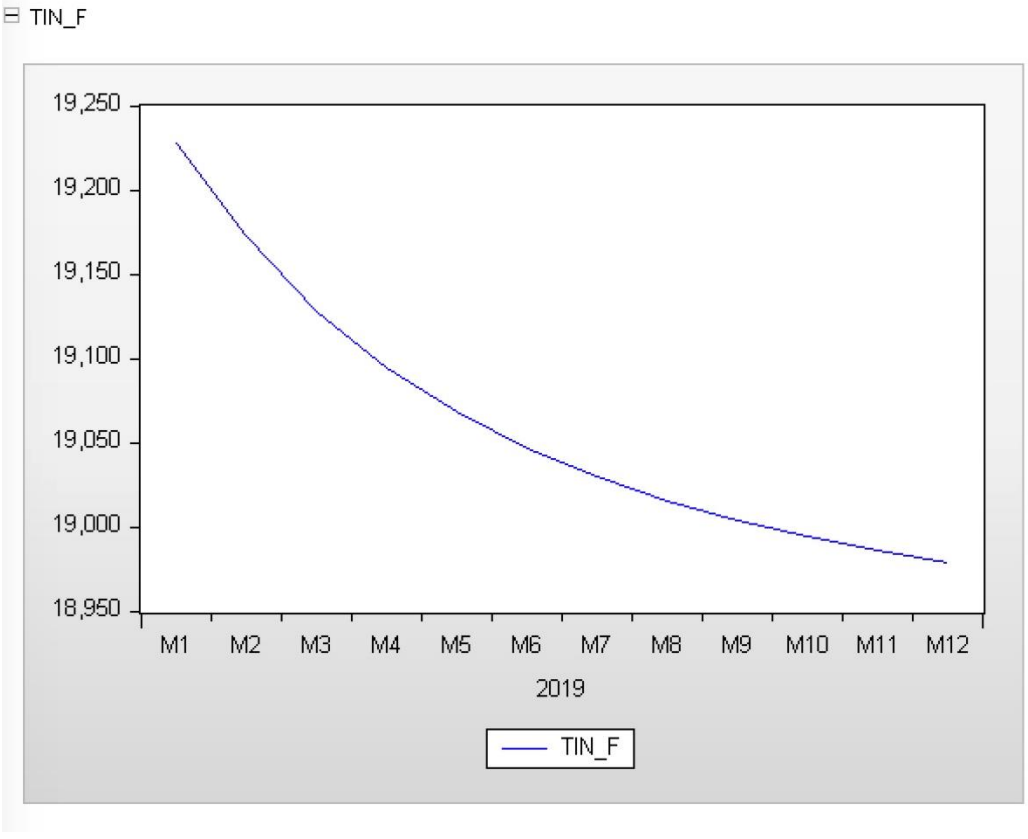
6.1 Forecast value of Copper in 2019



6.2 Forecast value of Lead in 2019



6.3 Forecast value of Tin in 2019



6.4 Forecast value of Zinc in 2019