Commodity Prices and the Business Cycle in resource-dependent Economies

5741 – Money, Credit & Finance

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Literature

Gubler and Hertweck (2013) evaluate the relative importance of commodity price shocks in the United States.

- 9-dimensional SVAR
- Identify commodity price via short-run restrictions
  - Commodity prices only react to lagged impulses
  - Based on Kilian and Vega (2011)

Literature

Mallick and Sousa (2013) assess the transmission of monetary policy and the impact of commodity price fluctuations on BRICS economies.

- Bayesian SVAR, SVAR & Panel VAR
- BVAR ordering in three groups
  - Monetary policy instrument
  - Variables that react with a lag
  - Variables that adjust contemporaneously

Literature

Kilian and Vega (2011) propose a formal test of the hypothesis that energy prices, i.e. oil prices, are predetermined with respect to US macroeconomic aggregates. They find **no compelling evidence of feedback at daily or monthly horizons**. They conclude that short-term restrictions as identification strategy are thus justified.

Based on these findings Roch (2017) argues that domestic variables do not affect ToT contemporaneously.

Data, Accumulation

Further search for data:

- Monetary Policy Rates[1]
  - Missing values filled with short-term Interbank rate[2]
- Stock Indices[3]
- Unemployment[4]
- Money Supply[5]
- Exchange Rates[6]

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[1] National Central Banks, FRED
[2] for Australia & Norway, OECD
[3] Datastream
[4] OECD, National Statistic Bureaus, Datastream
[5] OECD, FRED, Datastream
[6] IMF

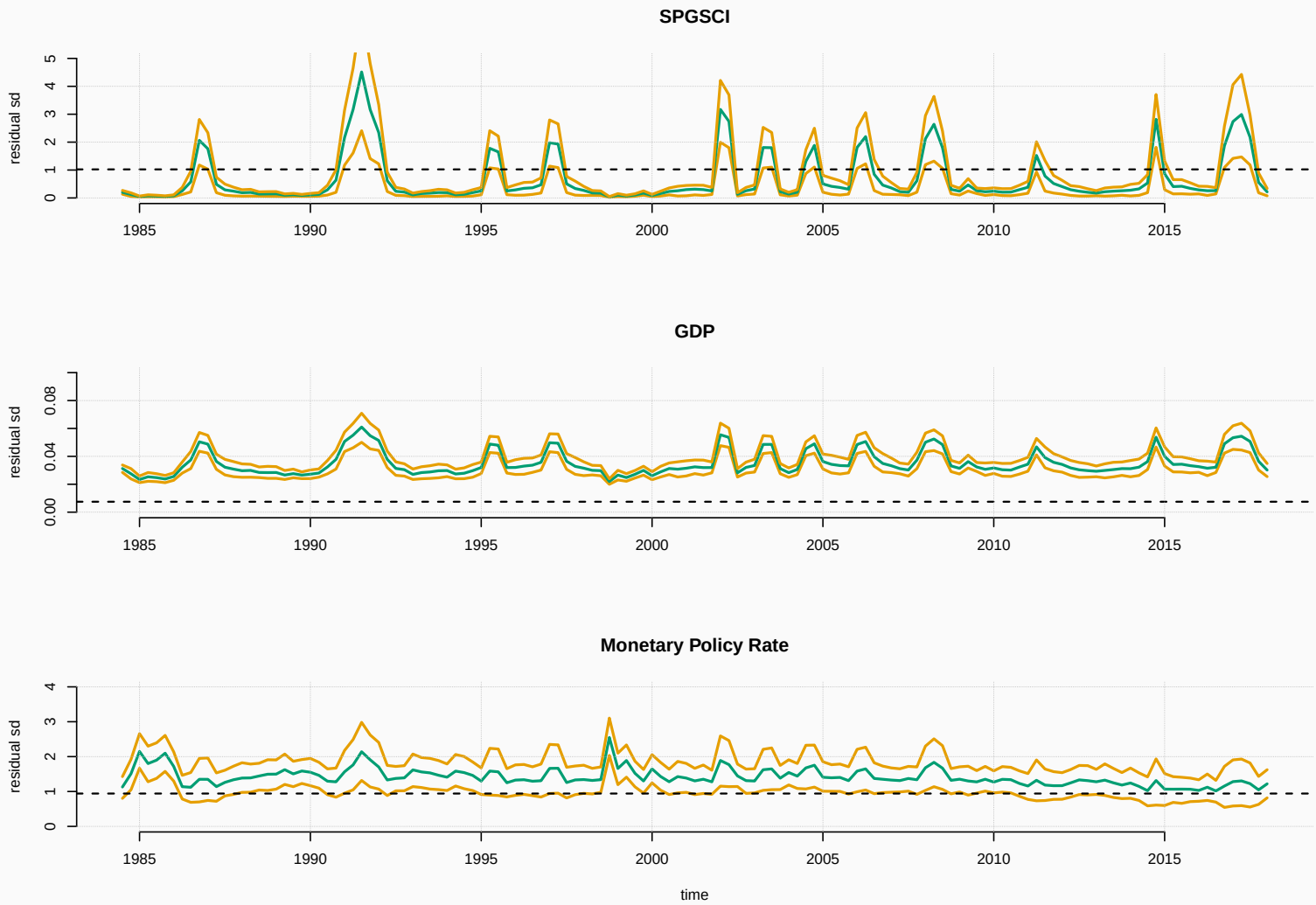
Data, Transformation

Work on data transformation:

- Quarterly frequency
  - Last Value
  - Quarterly Mean
- Achieving stationarity
  - Log-differences
  - Hodrick-Prescott Filter
- Testing
  - Augmented Dickey-Fuller Test
  - (P)ACF, etc.

Data, Observations

Residual standard deviations in a VAR for South Africa, that allows for time drift & and stochastic volatility, OLS as benchmark.



VAR, Order

Variables
Commodities
Output
Inflation
Unemployment
Trade
Money Supply
Monetary Policy Rate
10Y Government Bonds
Equity Prices

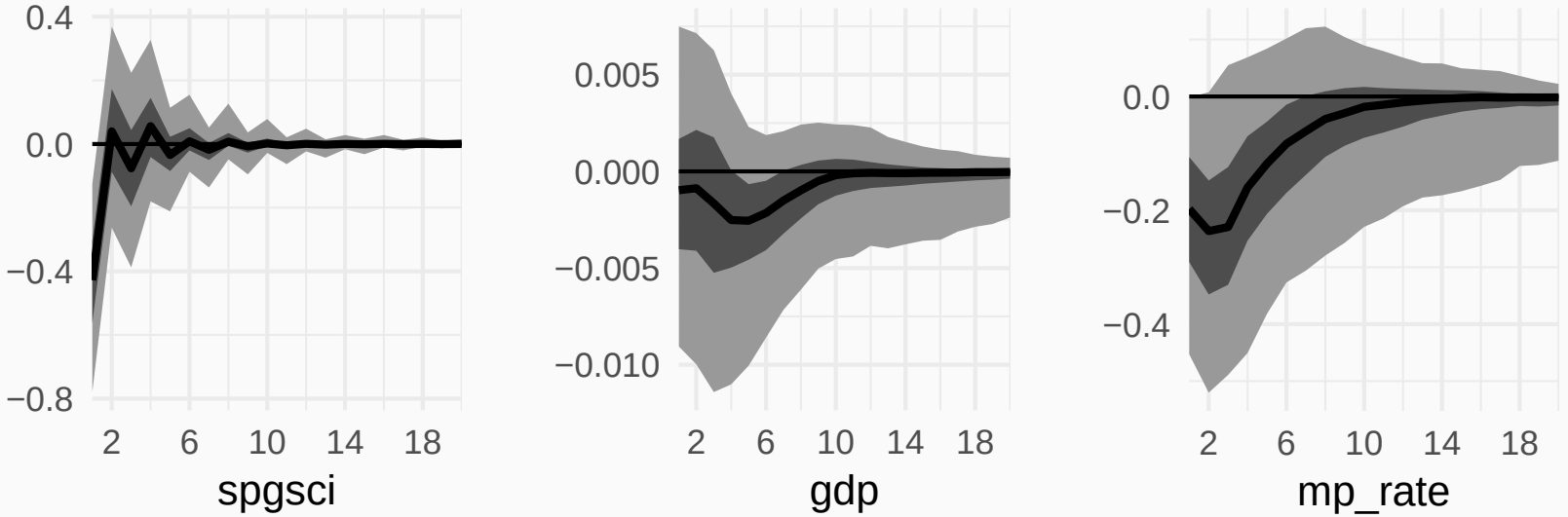
VAR, Modelling

1. First steps with `vars` package (Pfaff 2013)
2. Adapted a script from Econometrics with a Minnesota prior
    - Replaced sign- with short-run-restrictions.
3. Work on estimation from scratch, based on Kilian and Lütkepohl (2017)
    - Temporally intensive
4. Current results with `bvarsv` package (Krueger 2015)
    - Computationally intensive
    - Handles stochastic volatility

VAR, Impulse Responses i

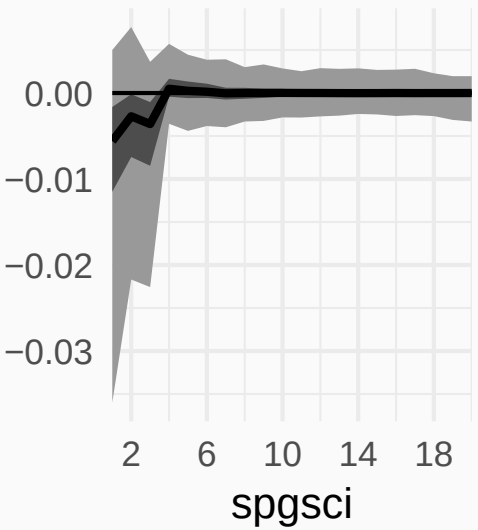
Impulse responses of a commodity price shock on three-dimensional VARs for Chile and South Africa.

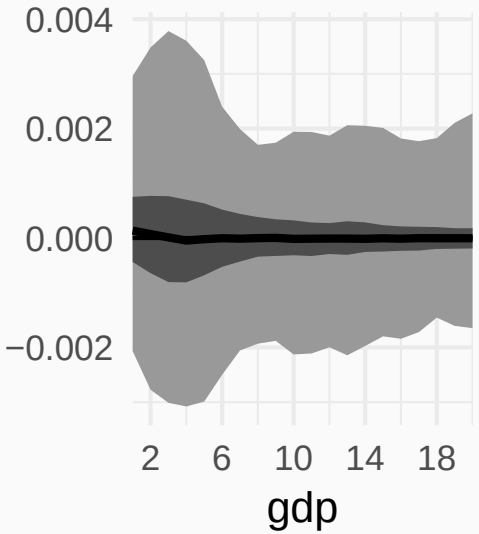
Chile

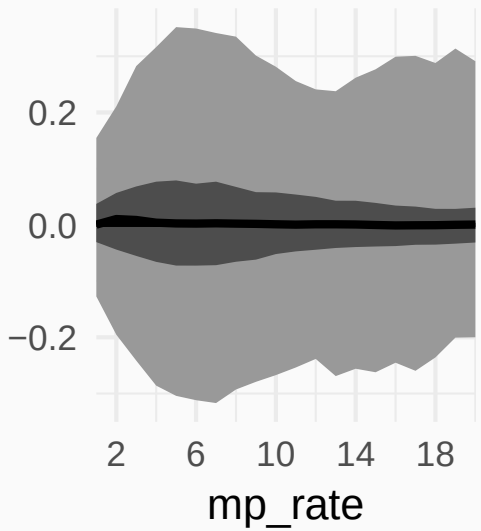


VAR, Impulse Responses ii

South Africa







VAR, Outlook

- Utilise the data for larger models
- Figure out model & variable selection
- More work on analysing the models
- **Focus on commodities**
  - Try different commodities per country
  - Utilise our results from PCA

PCA

Principal Componenent Analysis is

- an orthogonal transformation,
- that is used to reduce the amount of variables.

Whilst it is sensitive to scaling it can be useful for reducing dimensionality in VAR models.

We use it for our array of commodity data (40+ timeseries).

PCA, Commodities

We start with prices of single commodities and indices. They can generally be divided akin to:

Precious Metals	Industrial Metals	Energy	Other
Gold	Copper	Oil	Agriculture
Silver	Iron	Gas	Livestock
...	...	...	...

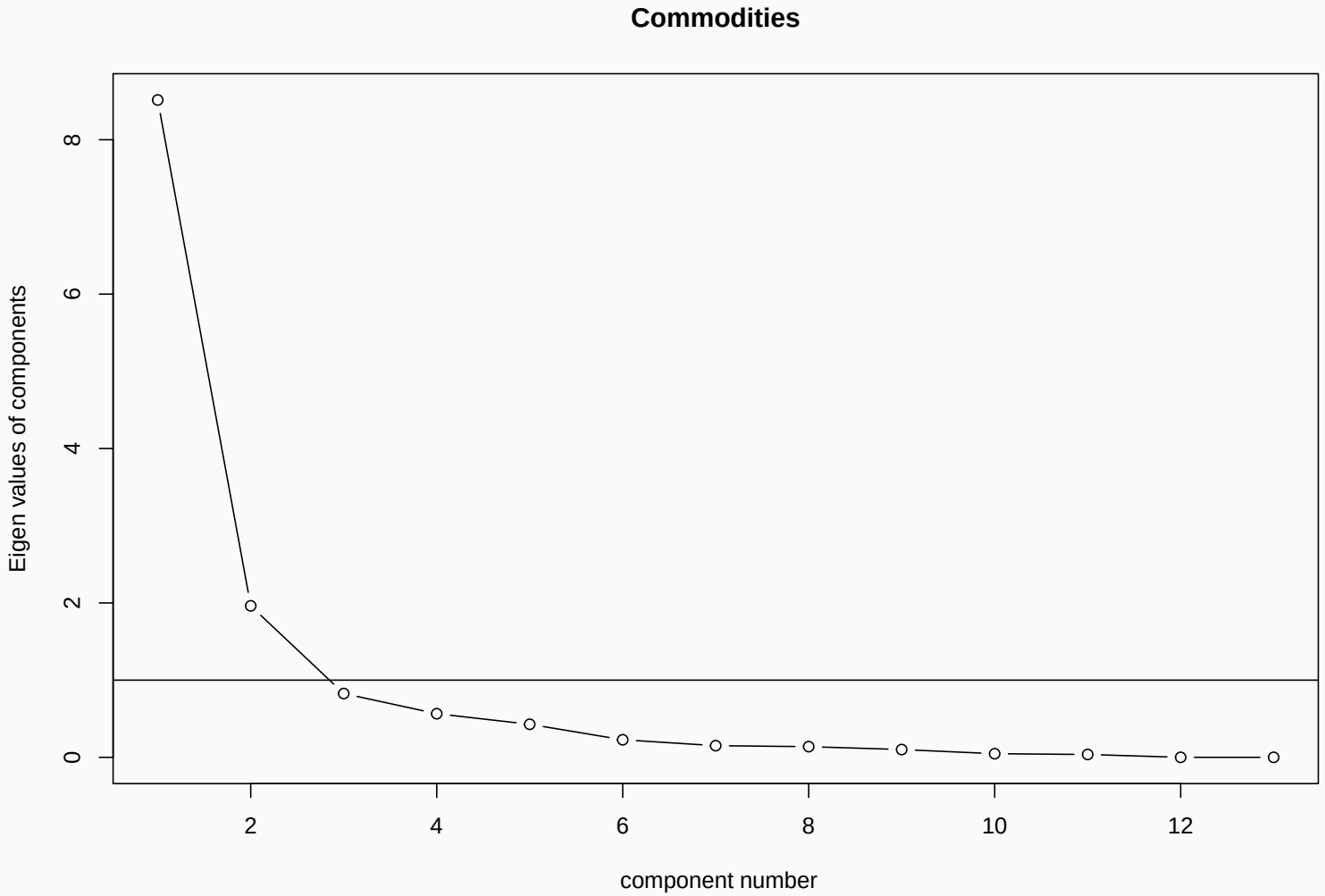
PCA, Process

1. Bartlett's test of sphericity
    - H0: variances are equal across variables
    - p-value > 0.05
2. KMO-Criterion
    - Sampling adequacy
    - Value < 0.8
3. PCA

PCA, Results

Start	# of Variables	Status	Bartlett's test p	KMO Criterion
1970	11	Rejected	$<$ 2.22e-16	0.77
1975	12	Rejected	$<$ 2.22e-16	0.75
1980	14	Accepted	$<$ 2.22e-16	0.80
1985	16	Rejected	$<$ 2.22e-16	0.78

PCA, 1980 i


Commodities
Eigen values of components
0
2
4
6
8
2
4
6
8
10
12
component number

PCA, 1980 ii

```
## Principal Components Analysis
## Call: principal(r = datCOM[, 2:14], nfactors = 2)
## Standardized loadings (pattern matrix) based upon correlation matrix
##                    item   RC1   RC2   h2    u2 com
## SP.Agri.LiveIndex     9  0.95       0.93 0.069 1.0
## SP.GoldIndex         10  0.95       0.95 0.052 1.1
## SilverPrice           6  0.95       0.95 0.052 1.1
## SPIndex               7  0.93       0.87 0.134 1.0
## SP.AgriIndex          8  0.91       0.84 0.162 1.0
## GoldPrice             3  0.90       0.83 0.170 1.0
## SPIndustrialIndex    11  0.87       0.75 0.249 1.0
## SP.LivestockIndex    12  0.86       0.78 0.219 1.1
## AluIndex              1  0.73  0.59 0.89 0.114 1.9
## NickelIndex           5  0.57       0.47 0.532 1.7
## LeadIndex             4        0.85 0.83 0.171 1.3
## ZincIndex            13        0.82 0.76 0.238 1.2
## CopperIndex           2        0.77 0.64 0.363 1.1
##
##                        RC1  RC2
## SS loadings           7.79 2.68
## Proportion Var        0.60 0.21
## Cumulative Var        0.60 0.81
## Proportion Explained  0.74 0.26
## Cumulative Proportion 0.74 1.00
##
## Mean item complexity =  1.2
## Test of the hypothesis that 2 components are sufficient.
##
## The root mean square of the residuals (RMSR) is  0.06
##  with the empirical chi square  91.12  with prob <  0.00088
##
## Fit based upon off diagonal values = 0.99
```

Fin

Thank you for your time!

References i

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