When does money become inflation?

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Motivation of the paper

We observe: Central banks increased money supply.

We know from theory: excess money might become inflation.

Research questions:

- When does money turn into inflation?
- How much excess liquidity can be revoked by the central bank?

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Prevalent Methodology:

- Cointegration analysis *á* la Johansen.

Possible pitfall:

- Misspecified velocity might lead to invalid inference.

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Our contribution:

- Verification that the correct specification of money velocity is indeed very important.
- Structural macroeconometric model which is able to determine money velocity endogenously.
- Simulation of different policy measures.

Outline

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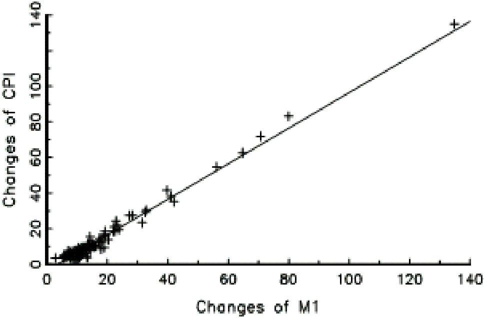
1. Introduction
2. Theoretical considerations
3. Error Correction Estimates
4. Consequences of Monetary Policy
5. Conclusions and Outlook

- Is money growth ineffective in explaining inflation?



Quantity theory literature:

- How to take care of velocity: Orphanides, Porter (2000, JEB)
- P* models: Herwatz, Reimers (2006, GER)

Money Demand Literature:

- Long run money demand: Dreger, Wolters (2009, Empirica)

Outline

Empirical Implementation

- Quarterly time series data for the US area.
- Sample period: 1951q1-2007q4.
- Baseline specification: p is CPI, m is M2, y is GDP.
- Robustness check with: core CPI and GDP deflator for p, M0 and M1 for money, trend GDP for GDP.

- Standard quantity theory:

$$m_t + v_t = y_t + p_t,$$

where we assume that

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- Error correction model:

$$\begin{bmatrix} \Delta p \\ \Delta m \\ \Delta y \end{bmatrix}_t = A_1 * v_{t-1}^* + A_2(L) \begin{bmatrix} \Delta p \\ \Delta m \\ \Delta y \end{bmatrix}_t + \varepsilon_t,$$

with

$$v_t^* = m_t - p_t - y_t - \tilde{v}_t.$$

Theoretical considerations
Conventionally detrended velocity

Linear trend:

- ${v_t}^* = m_t - p_t - y_t - \underbrace{\alpha_0 + \alpha_1 t}_{\tilde{v}_t}.$

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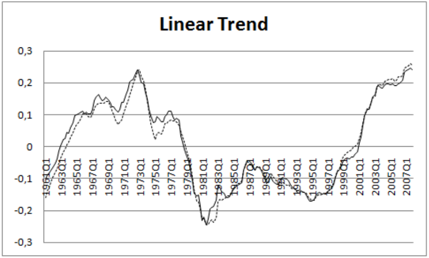
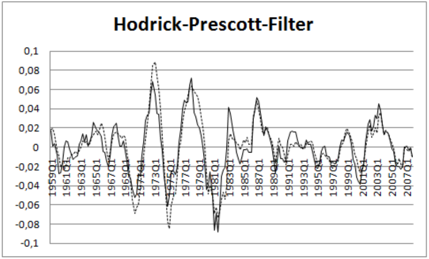
HP-filtered trend:

- Nonlinear institutional component.
- Decomposition of $v_t = m_t - p_t - y_t$ into a cyclical and a trend component, i.e. just running the HP-filter on $m_t - p_t - y_t$.

Results
Transitory velocity component





Univariate unobserved components decomposition:

$$v_t = \tilde{v}_t + v_t^*,$$

with

$$\tilde{v}_t = \tilde{v}_{t-1} + \alpha_1 + \varepsilon_{1t}$$

$$v_t^* = \phi(L) v_t^* + \varepsilon_{2t}.$$

- Decomposition of velocity into a random walk with drift and a stationary autoregressive process.
- State space model estimated with Kalman Filter.

Multivariate unobserved components decomposition:

$$\Delta x_t = v^*_{t-1} * A_1 + A_2(L)x_t + \varepsilon_t$$

$$v_t = \tilde{v}_t + v^*_t$$

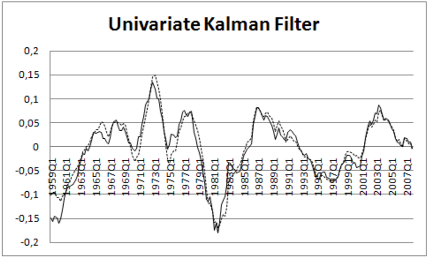
$$\tilde{v}_t = \tilde{v}_{t-1} + \alpha_1 + u_{1t}$$

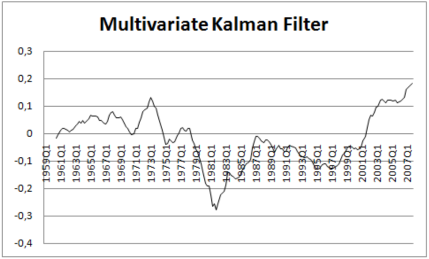
$$v^*_t = \phi(L)v^*_t + u_{2t}$$

- Embed the decomposition in a multiequation system.
- Estimated with an adapted version of the Kalman Filter.

Results

Transitory velocity component





Results

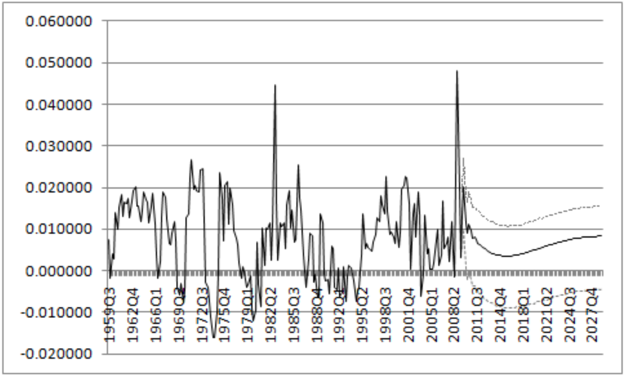
Error correction estimates for the US area

Trend Specification	Error Correction		
	Δ CPI	Δ M	Δ GDP
Business cycle neutral			
Linear trend	0.006771	-0.006078	-0.003057
	(3,20491)	(-1,59077)	(-0,72914)
HP trend	0.078366	-0.1355	0.04577
	(7,91131)	(-7,70098)	(2,02033)
Kalman filtered trend - univariate	0.021412	-0.033312	0.006462
	(4,73524)	(-4,11920)	(0,67704)
Not business cycle neutral			
Linear trend	0.006046	-0.004362	0.000069
	(2,85297)	(-1,14529)	(0,01529)
HP trend	0.070082	-0.115226	0.104126
	(6,28376)	(5,77365)	(4,47131)
Kalman filtered trend - univariate	0.017638	-0.026146	0.013801
	(3,92283)	(-3,25565)	(1,48719)
Kalman filtered trend - multivariate	0.0106	-0.0118	0.0006
	(3,4329)	(-2,1131)	(0,1025)

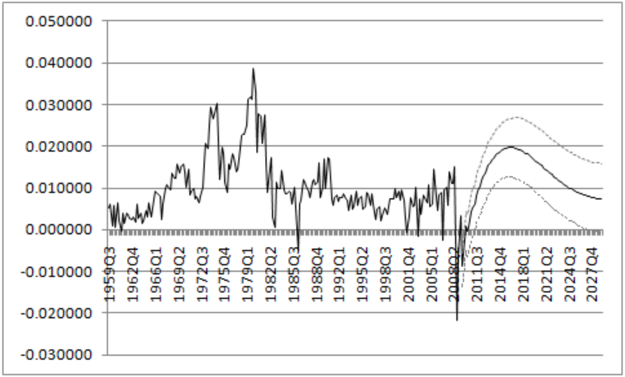
Notes: t-values in parentheses.

Outline

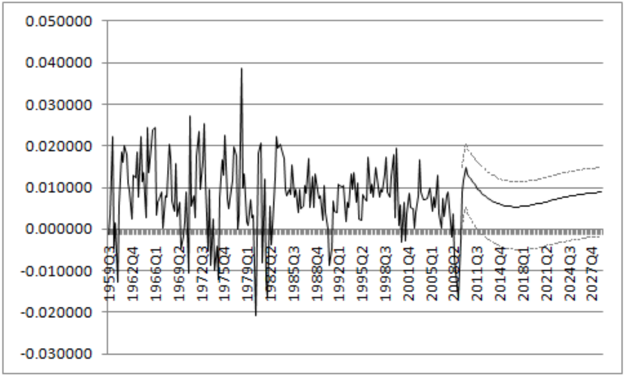
Simulated Monetary Policy



Reaction of Inflation



Consequences for Output



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Conclusions

What have we learned:

- The correct specification of velocity is one of the major problems of previous studies.
- We find clear and robust evidence that money overhang influence inflation, using our multivariate unobserved components model .
- We are able to simulate different monetary policy scenarios.

Outlook

What is left:

- Test if income elasticity is one.
- Incorporate prediction intervalls with parameter uncertanty.

Thanks a lot for your attention!