# WAVELET ANALYSIS OF LOANS IN GERMANY

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# Overview

- Motivation
- Survey of literature
  - theoretical
  - empirical
- Methodology
- Data
- Empirical results
- Conclusions

# Motivation

- renewed interest in credit growth after outbreak of financial crisis
- academics: inflation targeting without any role for monetary aggregates
- Goodhart: indicator of changes in expectations on future income
- ECB
  - two-pillar strategy
  - credit growth as indicator
- propagating role in transmission process

# Literature: theory

- procyclical
  - financing working capital requirements (Bernanke and Blinder (1988))
  - expectations of future growth

- counter-cyclical
  - smoothing the impact of business cycle (Bernanke and Gertler (1995))
  - demand for external financing depends on internal sources (Friedman et al. (1993))

- financial accelerator (Bernanke, Gertler and Gilchrist (1996))
  - asymmetric information
  - collateral
  - cannot explain excessive credit developments

# Literature: empirics (euro area)

- time domain
  - cointegration analysis a la money demand (Calza (2003,2006))
  - cointegration analysis for loan demand and supply (Sorensen et al. (2009))
  - correlation analysis (ECB (2009))
  - large BVAR (Giannone et al. (2010))
- frequency domain
  - Fourier analysis (Deutsche Bundesbank (2011))
- mixed (Aikman et al. (2010)): correlation of bandpass filtered series

# Frequency methods

- Fourier analysis
  - spectral density
  - coherency
- Wavelets
  - small waves
  - translation
  - dilation
- CWT
  - wavelet spectral density
  - wavelet coherency
  - phase difference (time lag)
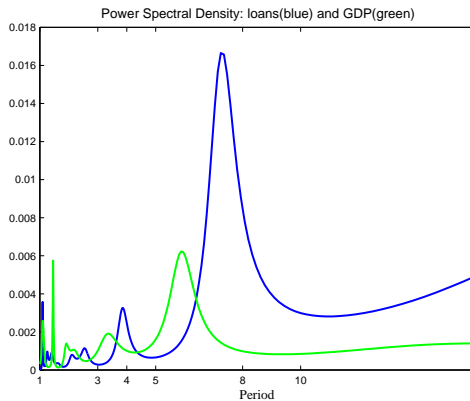  - partial wavelet coherency

# Data

- sectoral differentiation of loans
  - loans to non-financial corporations
  - loans to private households
  - mortgages
- national accounts data: GDP, investment, consumption
- calculation of real variables for loans using GDP deflator
- sample: 1971Q1 - 2011Q2
- quarterly growth rates

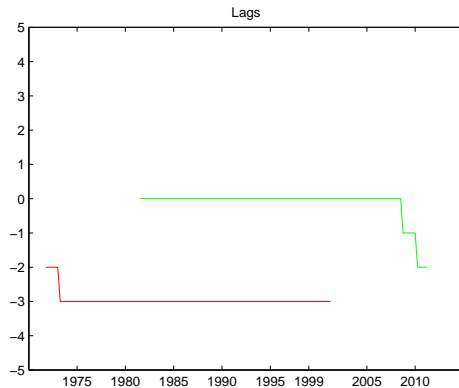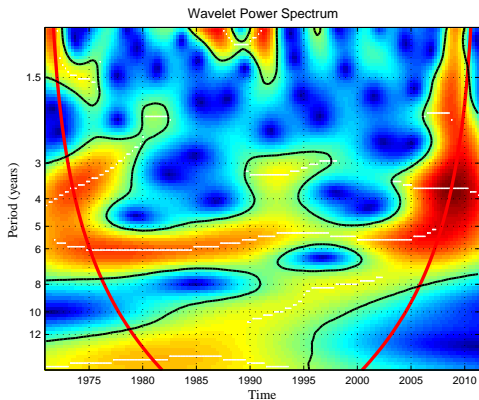# Loans to non-financial corporations and GDP



Loans to NFCs (blue) and GDP (green)

# Spectral densities



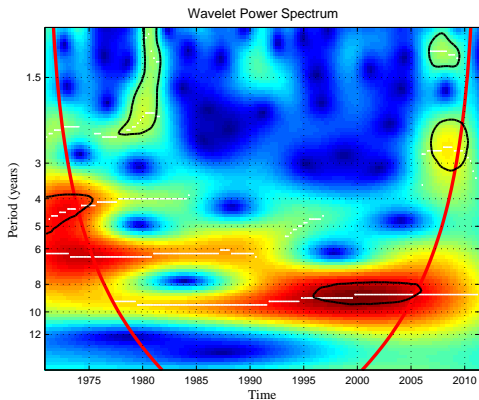Power Spectral Density: loans(blue) and GDP(green)
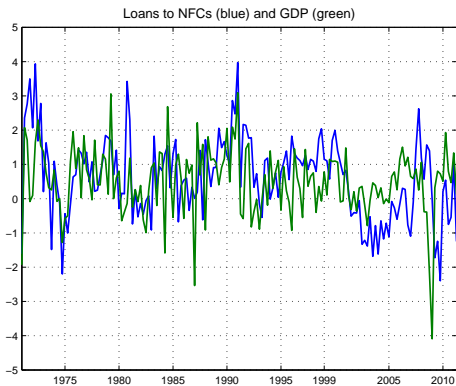
# Cross-correlation
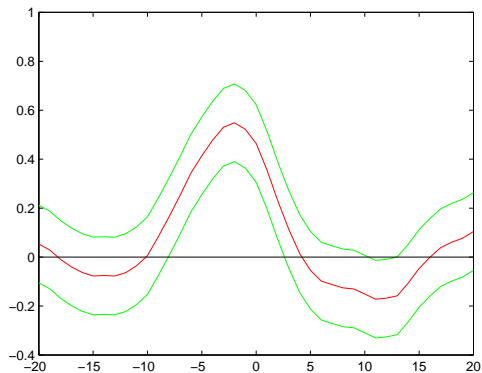
# Time-varying lead-lag structure

# Wavelet power spectrum of GDP



Wavelet Power Spectrum

# Wavelet power spectrum of loans to NFCs



Wavelet Power Spectrum

# Wavelet coherency: Loans to NFCs, GDP
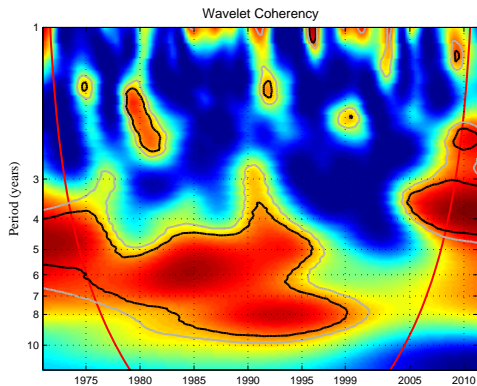


Wavelet Coherency

# Phase-difference



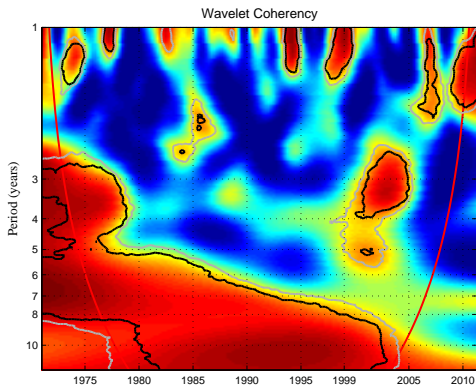Phases and Time−Lag: 7~10 frequency band
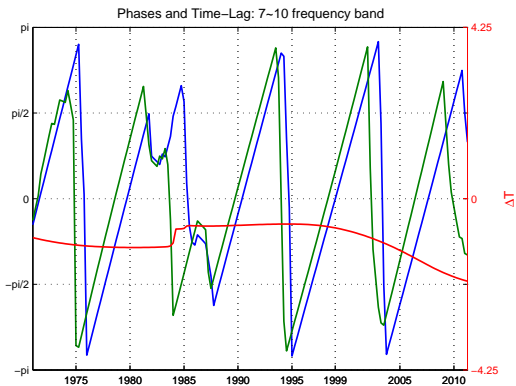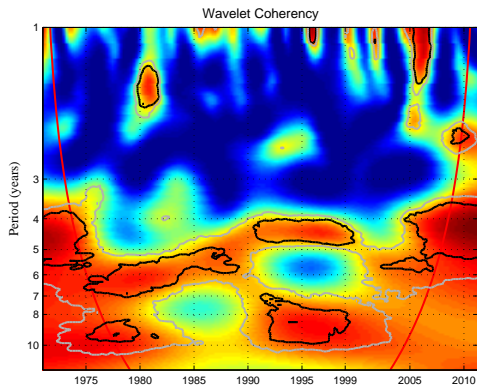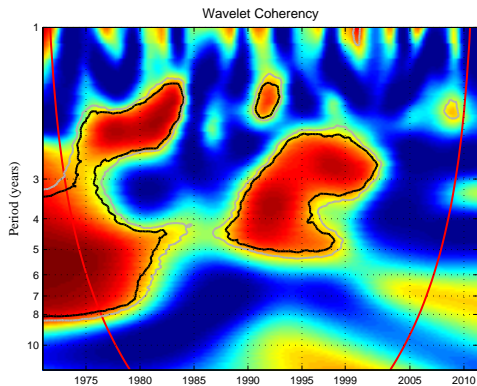
Wavelet Coherency

# Wavelet coherency: Loans to PHs, GDP
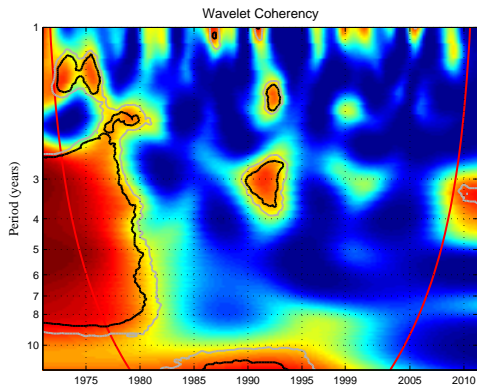


Wavelet Coherency

# Wavelet coherency: Loans to PHs, consumption

# Wavelet coherency: Mortgages, GDP



Wavelet Coherency

# Wavelet coherency: Mortgages, house prices
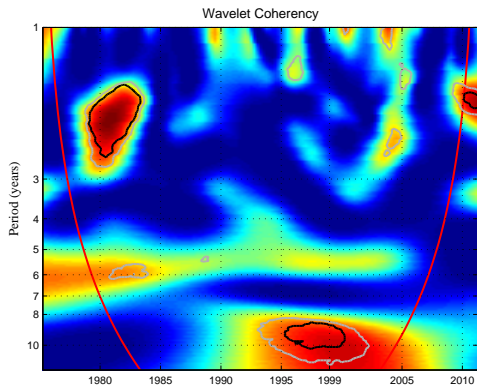
# Conclusions

- time-varying correlation of loans and GDP
- correlation of loans and specific scale variables more robust