On the low-frequency relationship between public deficits and inflation

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The rediscovery of fiscal policy

- fiscal policy as a stabilization tool has been rediscovered in recent times of crisis

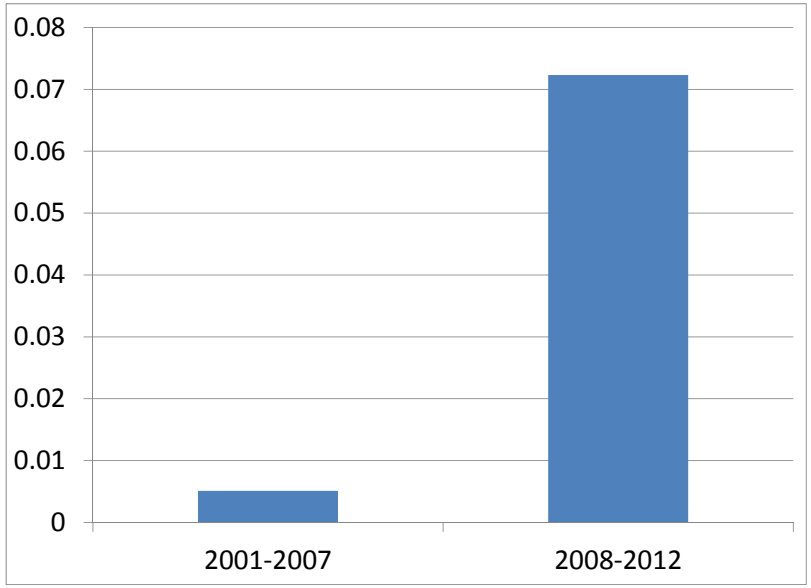


Figure: Average primary deficits over debt G7-countries.

$\Rightarrow$ increasing deficits are among the outcomes of recent fiscal policy

Are there implications of public deficits for inflation?

economic theory: it depends on the policy regime

- Sargent and Wallace: under **fiscal dominance** seignorage can be used to finance fiscal deficits and cause inflation
- Cochrane, Sims, Leeper: **active fiscal** policy is unresponsive to deficits, given **passive monetary** policy, prices adjust to revalue debt (Fiscal Theory of the Price level)
- no long lasting effects under **monetary dominance** or **active monetary** policy pared with **passive fiscal** policy

Are there implications of public deficits for inflation?

empirical evidence

- no conclusive evidence from fixed-coefficient time series models ▸ related literature
  - classic: King and Plosser (JME, 1985) find no significant relationship between deficits and seignorage in the US using data from 1953-1982
  - recent: Catão and Terrones (JME, 2005) as well as Lin and Chu (JIMF, 2013) find no relationship for advanced economies, but a significant positive relationship in the long run for developing countries
- Bianchi/Ilut (2012): regime-switching DSGE model, US data, 1955-2009, show that monetary/fiscal policy mix explains rise and fall of inflation in the US

Our paper

- we employ a long data set: U.S. data from 1875-2011
- we explicitly account for time-variation
  - theory suggests policy dependence
  - long data set calls for a flexible time series model
- we consider the low frequency domain:
  - theory stresses the long run
  - abstract from business cycle movements

Are fiscal deficits and inflation linked at low frequencies?

Outline

Measuring fiscal stance

- debt growth before interest payments (d)
- it measures the change of outstanding liabilities due to fiscal policy
- it is defined as primary deficits relative to debt (Sims (2011, EER))

▸ Zoom in: fiscal stance

First pass at the data

Following Lucas (1980):

1. filter the data

2. run a regression of filtered inflation $\tilde{\pi}$ on filtered deficits over debt $\tilde{d}$:

$$\tilde{\pi}_t = const + b_f \tilde{d}_t + error_t \tag{1}$$

Scatter plot

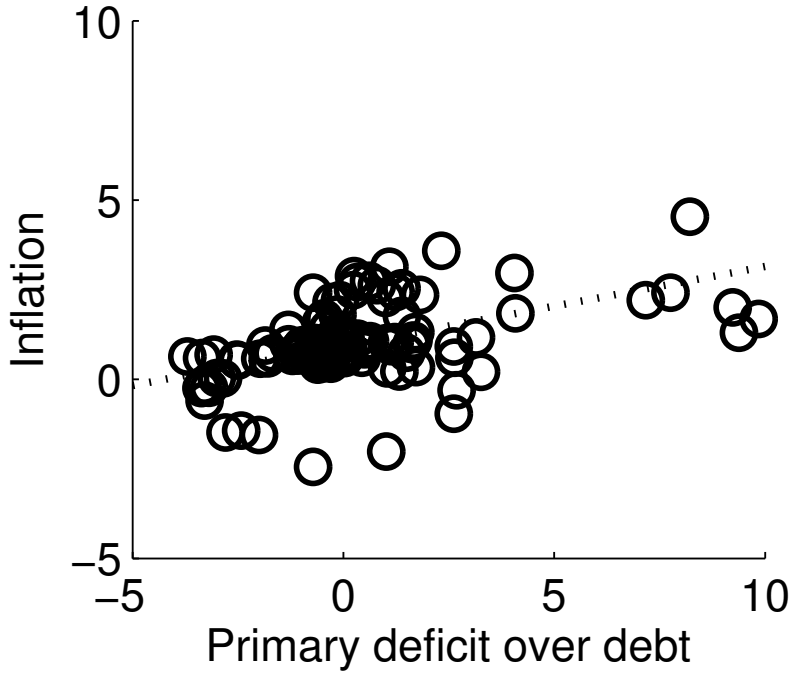
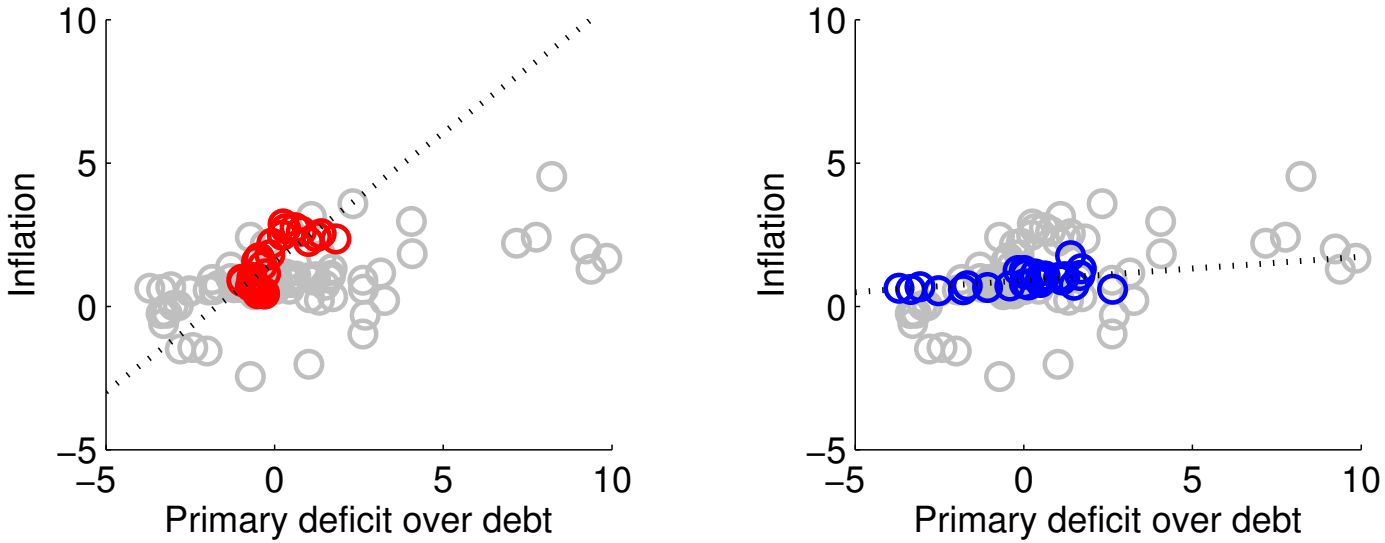


Figure: 1900 - 2009, dashed line $\tilde{\pi}$ on $\tilde{d}$

Subsample scatter plots



(a) 1952-1983 (red) (b) 1984-2009 (blue)

Figure: Dashed line $\tilde{\pi}$ on $\tilde{d}$

Observations from scatter plots

1. relationship is time-varying
2. positive relationship between 1952–1983
3. almost no relationship between 1984–2009

Challenges for the simple approach

1. potential endogeneities and omitted variables: estimate a dynamic system consisting of:
   - inflation (π_t)
   - money growth (Δm_t)
   - output growth (Δy_t)
   - nominal interest rates (R_t)
   - primary deficits over debt (d_t)
2. time variation

$\Rightarrow$ Bayesian time-varying parameter VAR model with stochastic volatility using **unfiltered** data.

From a VAR model with unfiltered data to b_f

1. Estimate the VAR model.

2. Compute the spectral density at frequency zero.

3. Whiteman (1984): Approximate the slope coefficient b_f as the cross-spectral density $S_{\pi d}$ and the spectral density S_d at frequency zero:

$$b_f \approx \frac{S_{\pi d}(0)}{S_d(0)} \tag{2}$$

Low-frequency relationship

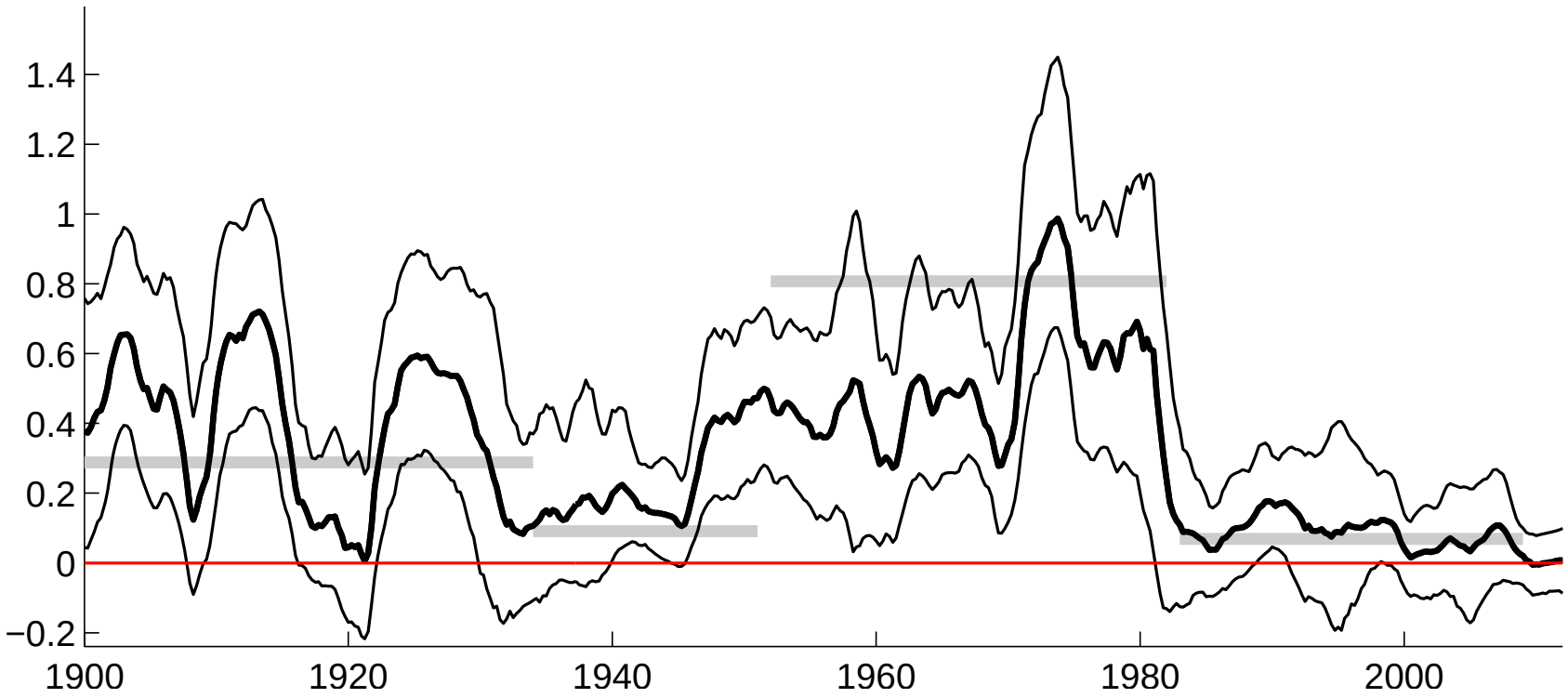


Figure: Long-run relationship between inflation and primary deficits over debt. 16% and 84% probability intervals. Grey bars correspond to b_f from OLS regressions.

Empirical results

- Positive and mostly significant low-frequency relationship up to 1980s.
- The relationship is time-varying.
- Remarkable:
  - Strongest relationship between 1970 and 1980 – neither in times of crisis nor of high deficits.
  - Sharp drop after Paul Volcker became chairman of the Federal reserve.

▸ Additional estimation results

▸ Robustness

Policy implications

Can the time-variation in the low-frequency relationship be attributed to a change in the monetary/fiscal policy regime?

- We identify a monetary policy shock using a recursive identification scheme.
- We compute the contribution of the monetary policy shock to the low-frequency relationship.

▸ Details on structural decomposition

Why a monetary policy shock?

Fiscal Theory of the Price level:

- Active monetary / passive fiscal policy: monetary policy shocks have no lasting effects
- Passive monetary / active fiscal policy: monetary policy shocks have persistent effects

Structural decomposition

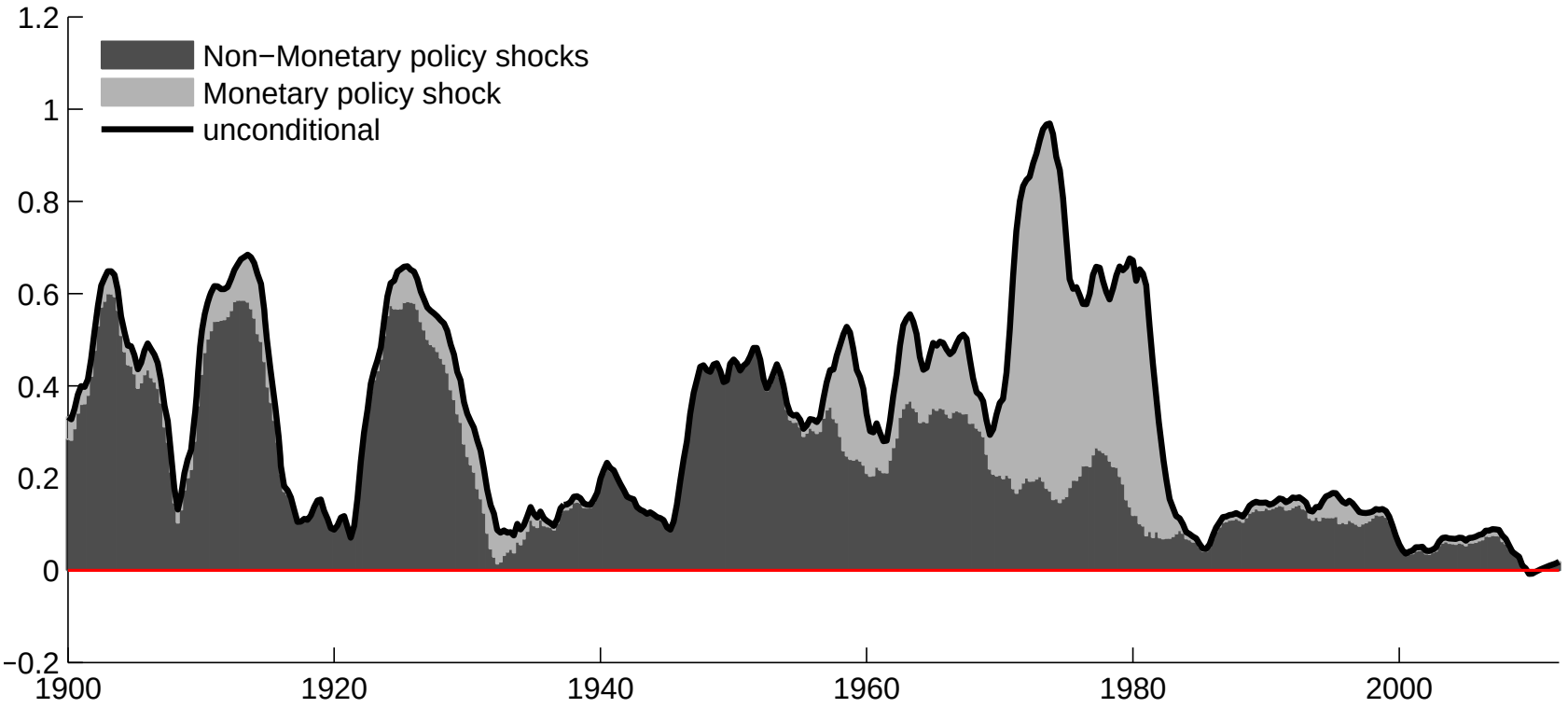


Figure: Structural decomposition of the low-frequency relationship.

Counterfactuals

Our VAR model consists of:

$$y_t = c_t + \sum_{j=1}^{p} A_{j,t} y_{t-j} + B_t \epsilon_t \quad \epsilon_t \sim \mathcal{N}(0, H_t) \tag{3}$$

- coefficient matrices A_t , B_t **(systematic response of the economy)**
- variances of the error term H_t

$\Rightarrow$ What would have been the estimate of the low-frequency relationship if the systematic response of the economy had been the same as in year XX in all years?

Structural decomposition: counterfactual I

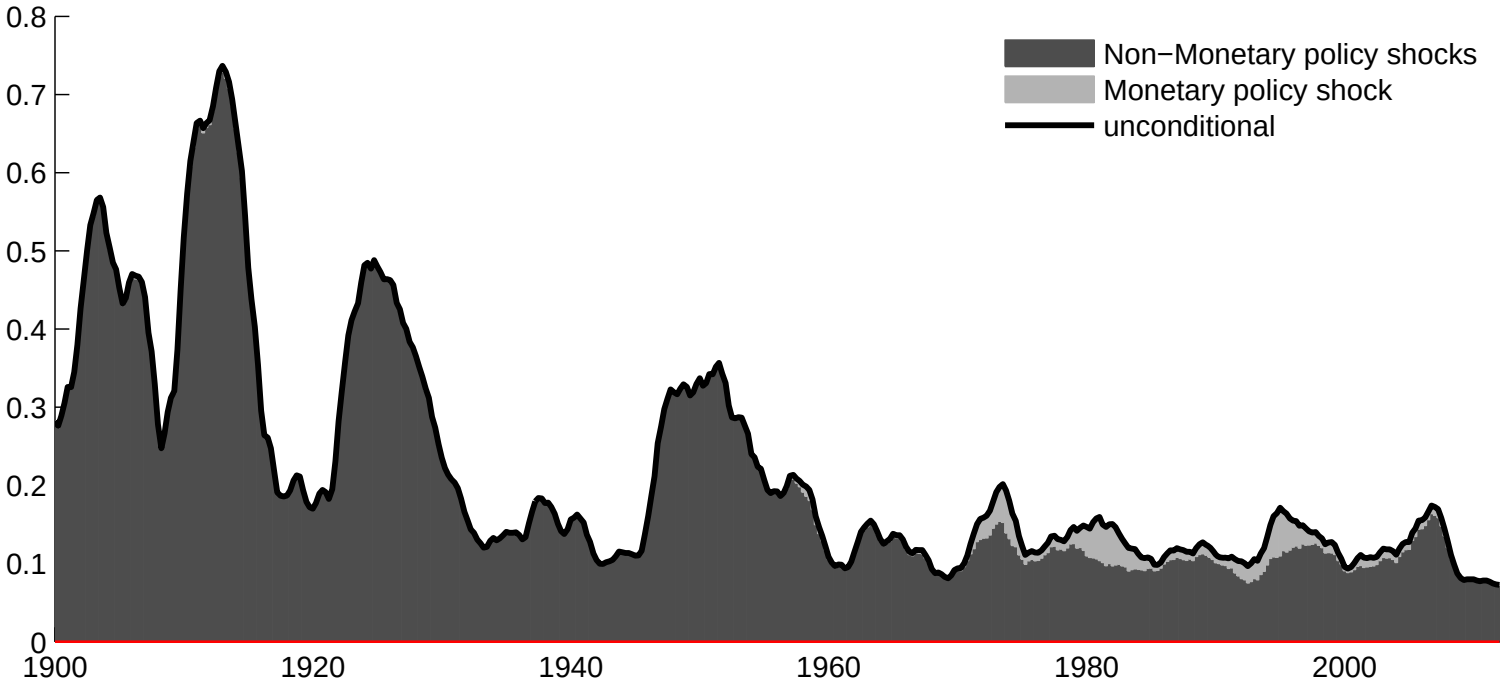


Figure: Structural decomposition of the low-frequency relationship. Counterfactual $A = A_{1995}, B = B_{1995}$.

Structural decomposition: counterfactual II

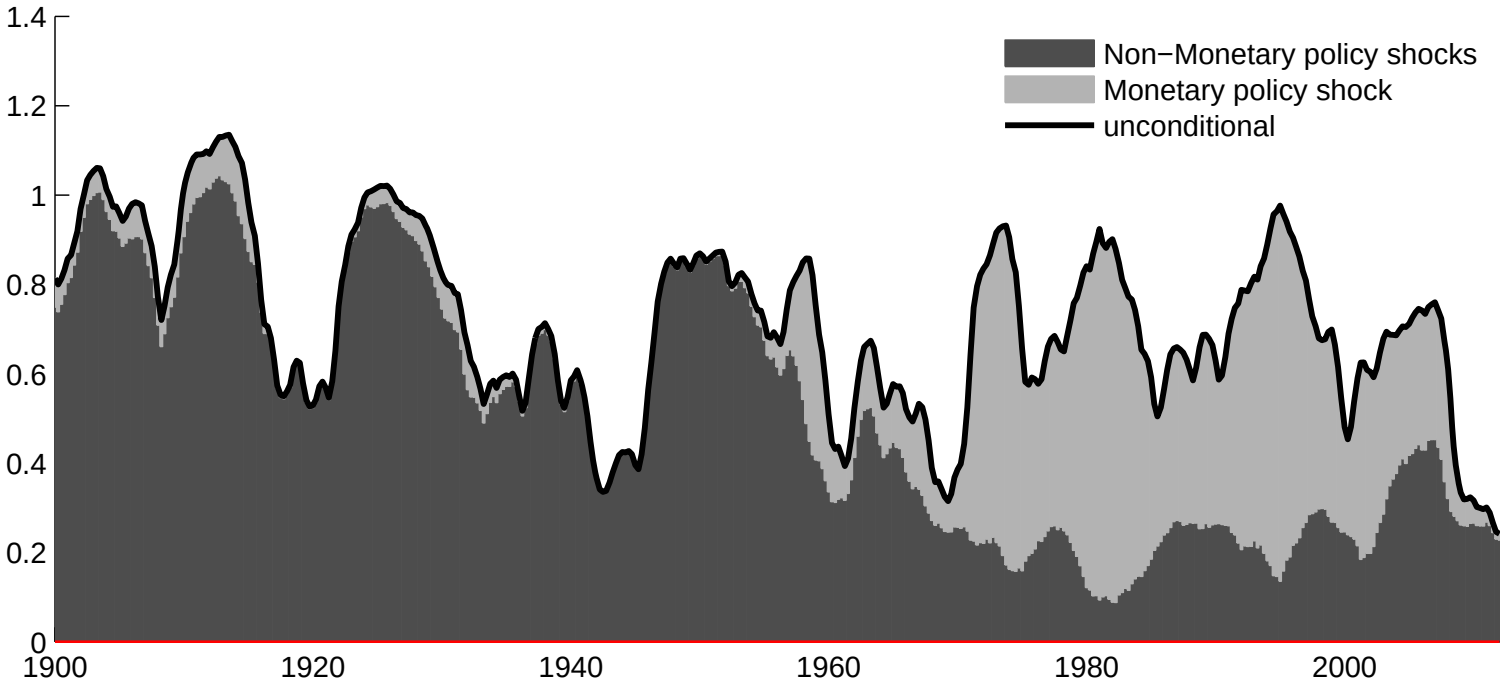


Figure: Structural decomposition of the low-frequency relationship. Counterfactual $A = A_{1976}, B = B_{1976}$.

Relation to other studies

- Clarida et.al. (QJE, 2000), Lubik and Schorfheide (AER, 2004), Davig and Leeper (NBER, 2006), Bianchi and Ilut (2012), estimate a change in policy regimes

- Bianchi and Ilut (2012), Bianchi and Melosi (2013) show that the interaction of monetary and fiscal policy explains key characteristic of the data after 1965

- Sims (2011) argues that the Fed could not control inflation in the 1970's

Anecdotal evidence I

Alan Meltzer's history of the Federal reserve system:

- In the 70's: Federal reserve bank acts as the 'junior partner' (Alan Meltzer) to the fiscal authority. The fiscal authority was not concerned with inflation.

- After Paul Volcker took office: central bank independence and the fiscal authority is concerned with high inflation rates.

Anecdotal evidence II

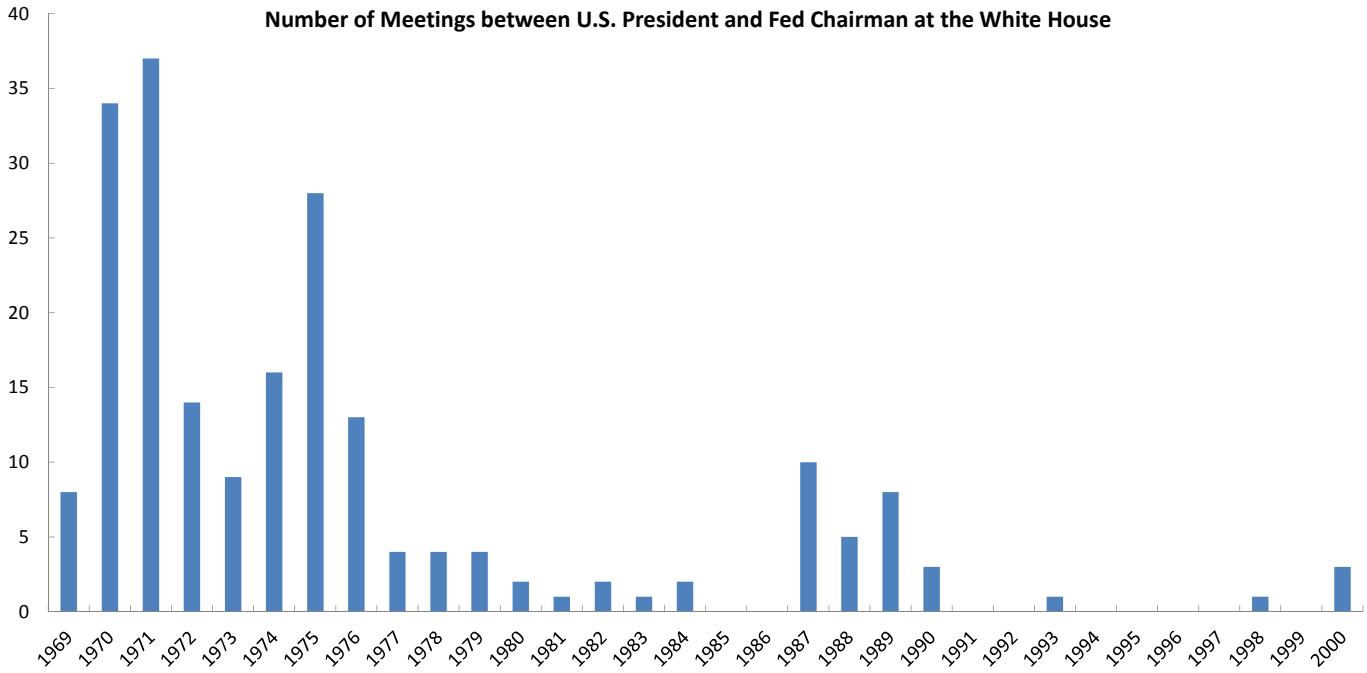


Figure: Number of meetings between US President and Federal Reserve chairman. Source: Martin (2012)

Summary of the analysis

- Counterfactual: change in the systematic part of the economy accounts for the time-variation in the low-frequency relationship
- Structural analysis: long lasting effects of the monetary policy shock in 1970s $\Rightarrow$ Bianchi and Ilut (2012) due to monetary/fiscal policy mix
- Theory: findings in line with fiscal theory of the price level (FTPL)

Conclusion

Are fiscal deficits and inflation linked at low frequencies?

- Yes, the relationship in the US is positive up to 1980 and it is time-varying.
- The interaction between monetary policy and fiscal policy is crucial for the behavior of the low-frequency relationship.

Robustness

We perform robustness exercises of the results w.r.t:

- choice of fiscal stance: debt growth ▸ Details
- choice of interpolation method: Chow and Lin (1971) and Litterman (1983) ▸ Details
- choice of interest rate measure: ▸ Details
- approximation of the spectrum: DOLS and rolling window estimation ▸ Details

▸ Back

Related literature: question of interest

- no conclusive evidence
- classic: King and Plosser (JME, 1985) find no significant relationship between deficits and seignorage in the US using data from 1953-1982
- recent: Catão and Terrones (JME, 2005) as well as Lin and Chu (JIMF, 2013) find no relationship for advanced economies, but a significant positive relationship in the long run for developing countries

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Fiscal stance

- Surplus over debt:

$$\frac{s_t}{b_{t-1}} = \left((1 + r_t) - \frac{b_t}{b_{t-1}} \right) \tag{4}$$

- Interpretation: net return on the investment due to interest and retirement of bonds.
- In steady state this is the real interest rate.
- A change measures reduction in future obligations.
- Deficits are the opposite, i.e. a increase in future obligations.

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Supplementary results: inflation and money

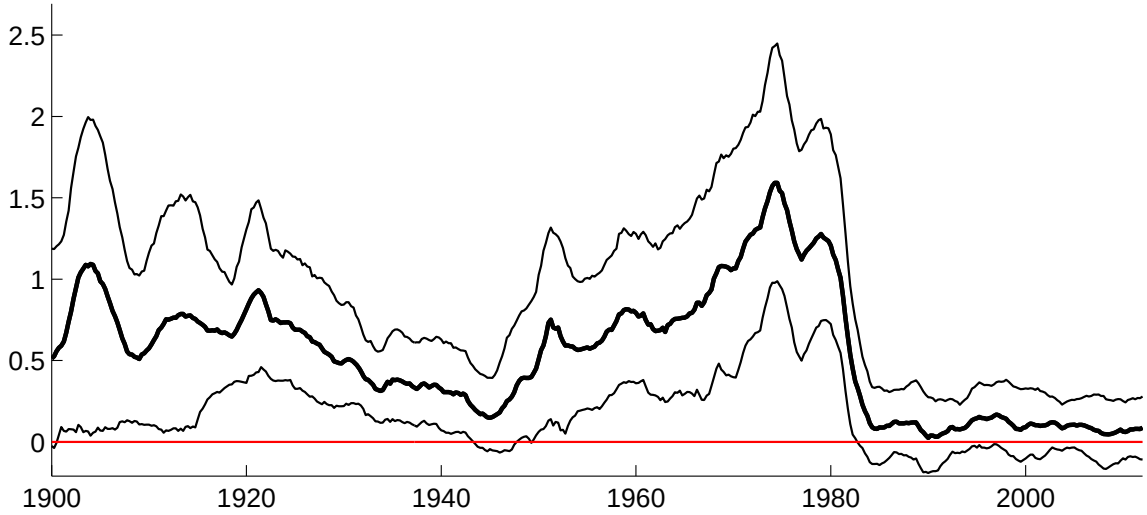

Figure: Long-run relationship between inflation and money growth. 16% and 84% probability intervals.

The low-frequency relationship between inflation and primary deficits over debt does not cancel the one between money and inflation.

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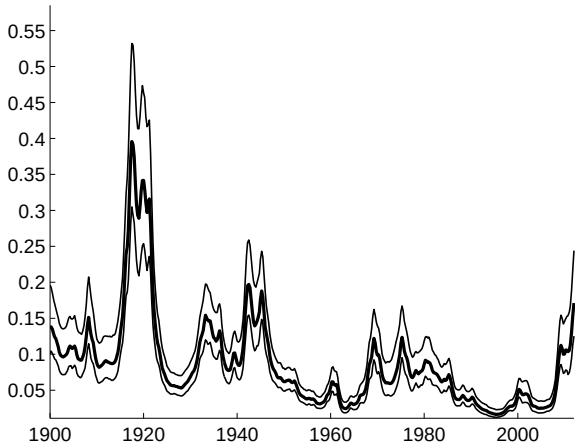
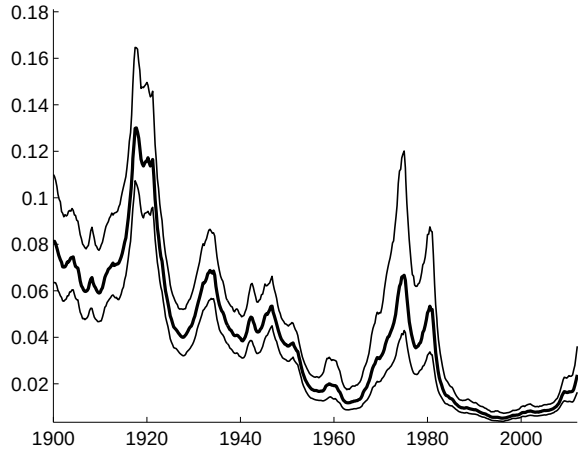
Implied Volatilities



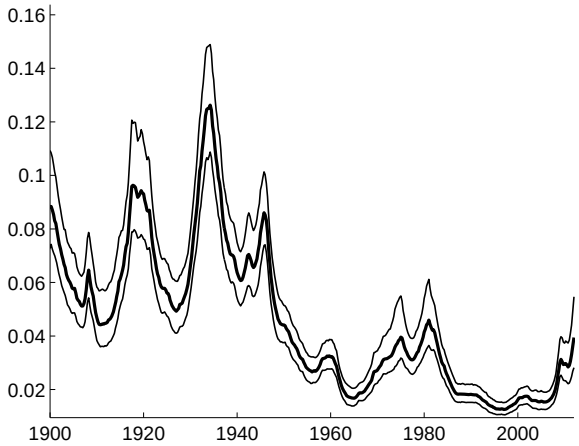
(a) Primary deficits over Debt



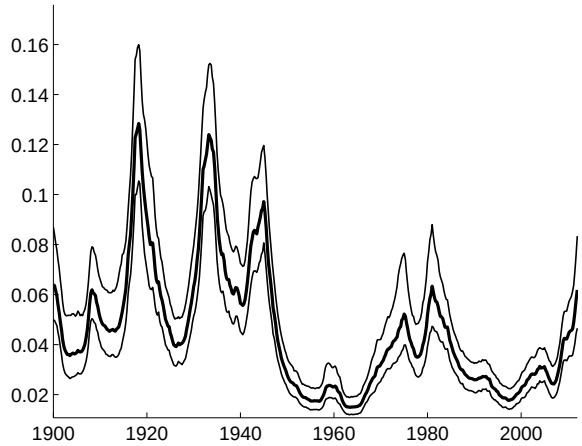
(b) Inflation

Figure: Standard deviations of the variables.

Implied volatilities



(a) Δ GDP



(b) Δ Money

Figure: Standard deviations of the variables.

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Convergence I

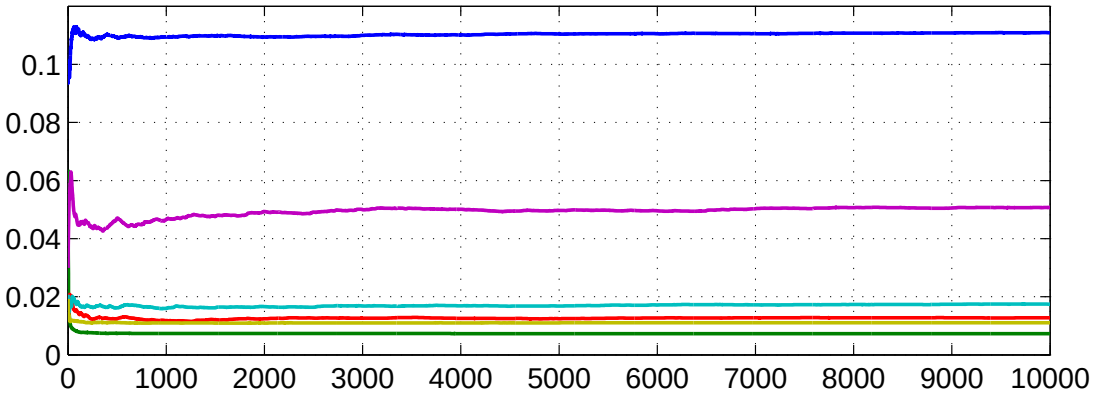

Figure: Running Mean Plot.

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Convergence II

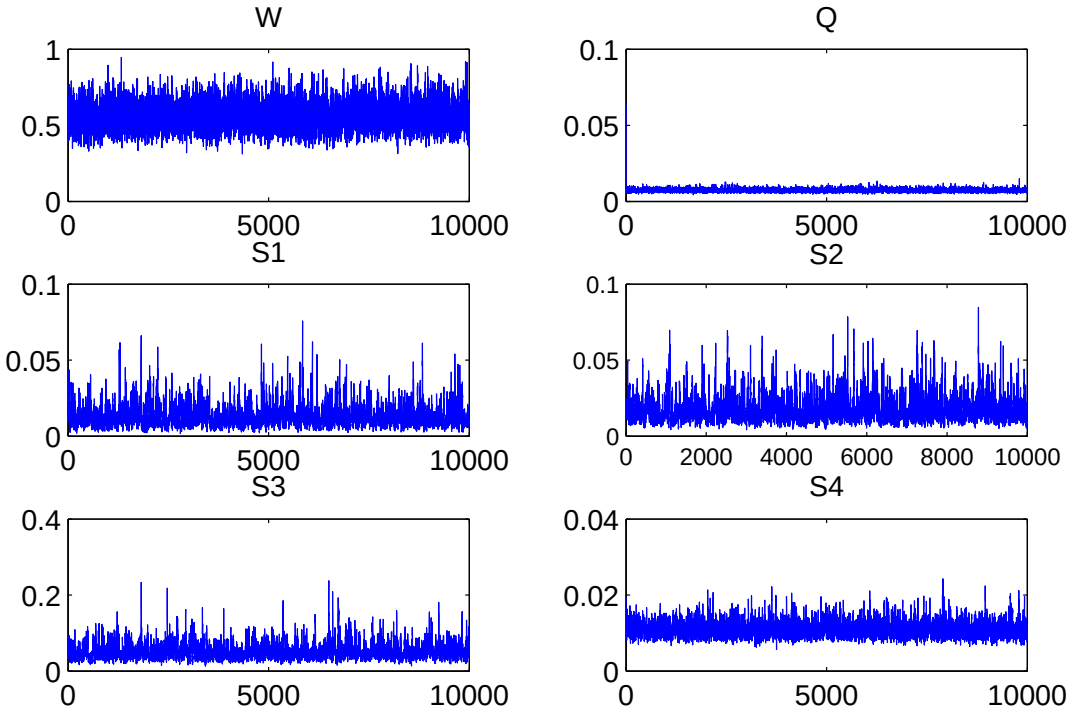

Figure: Trace Plot.

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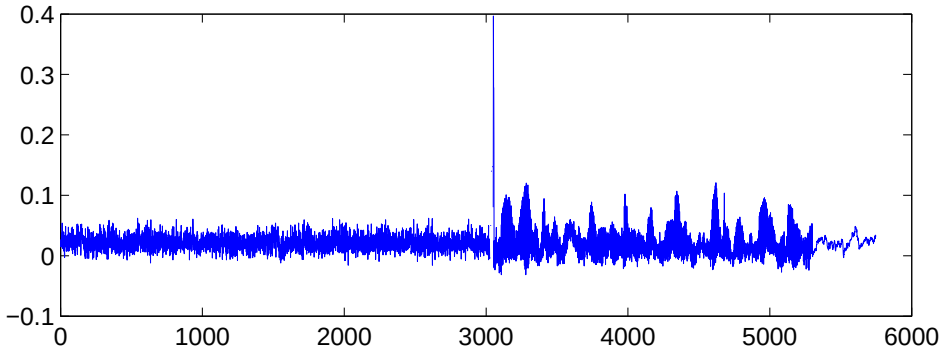
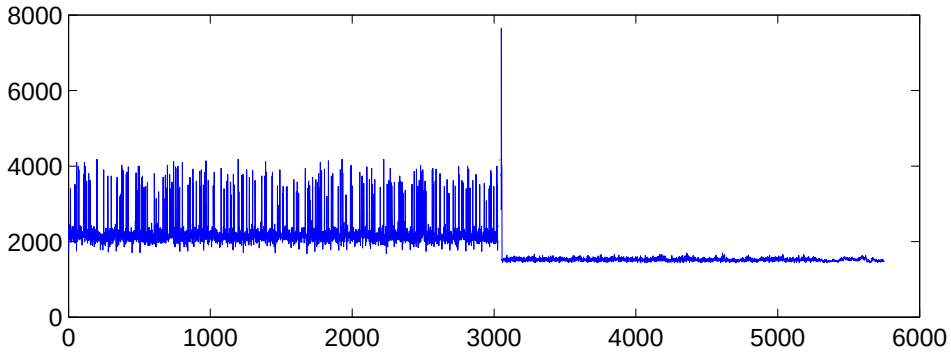
Convergence III



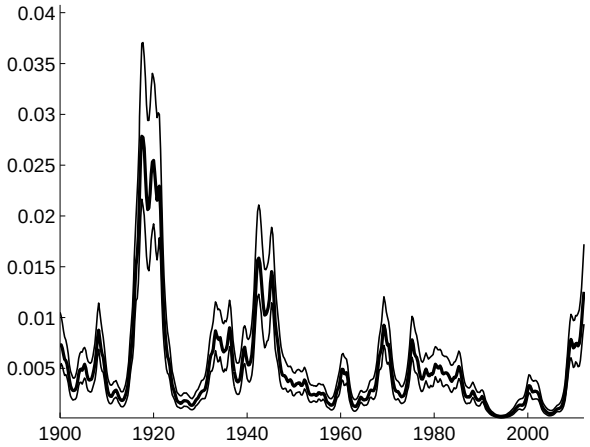
(a) Autocorrelation at 10th lag.



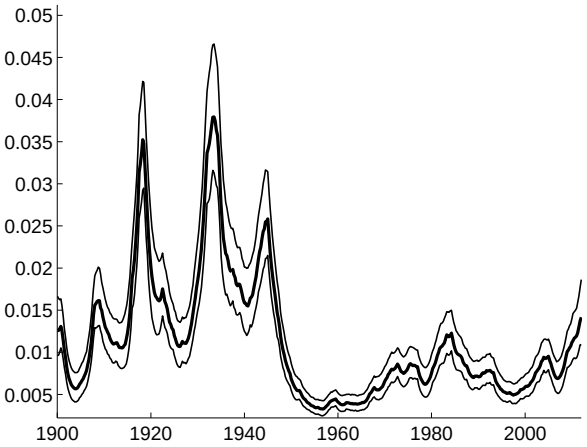
(b) Minimum Number of Draws.

Figure: Convergence diagnostics.

Stochastic volatilities I



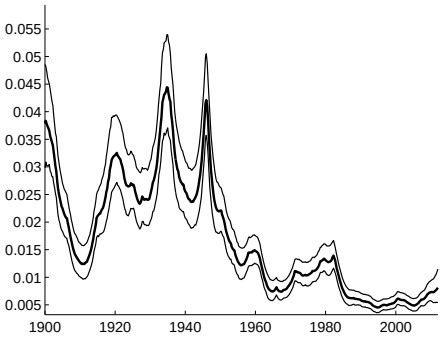
(a) Primary deficits over Debt



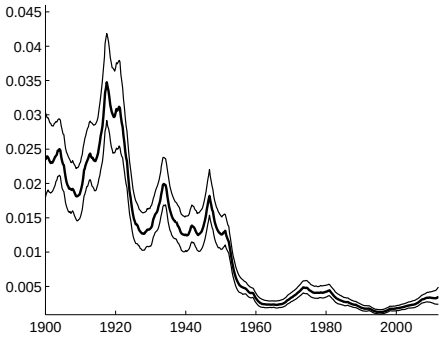
(b) Δ Money

Figure: Square roots of stochastic volatility.

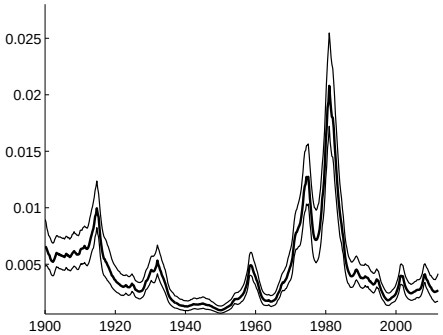
Stochastic volatilities II



(a) Δ GDP



(b) Inflation



(c) 6m Interest Rate

Figure: Square roots of stochastic volatility.

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Parameter Estimates I

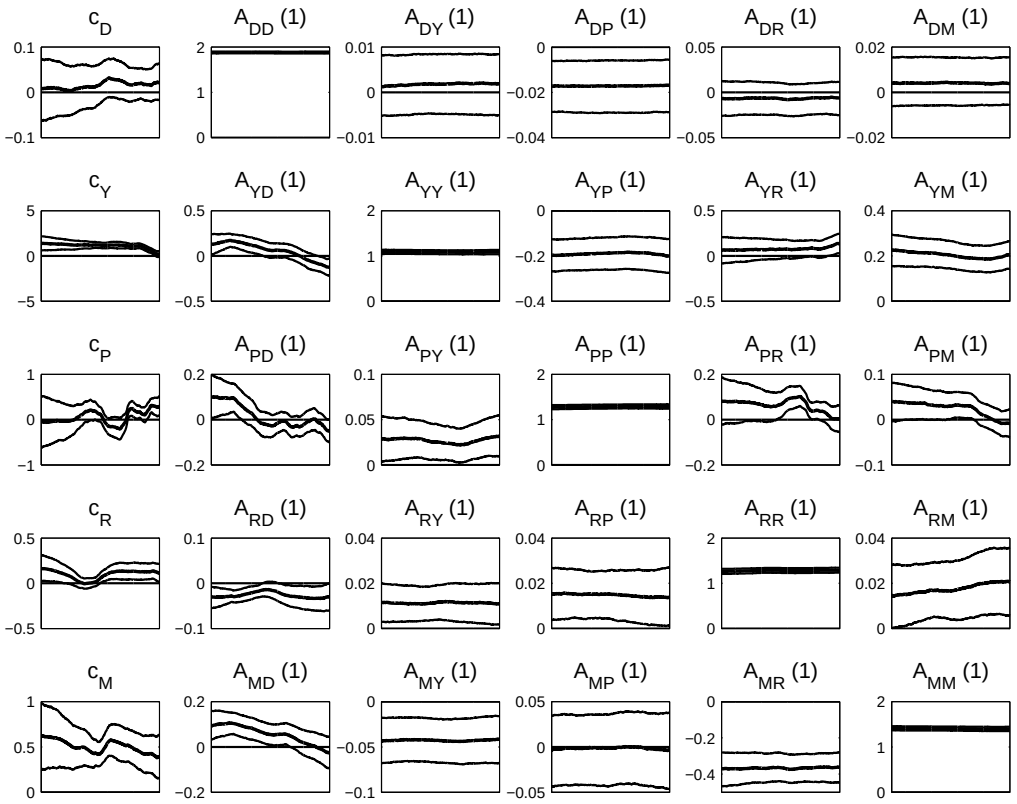

Figure: Time-varying parameter estimates: constants and AR(1) parameter

Parameter Estimates II

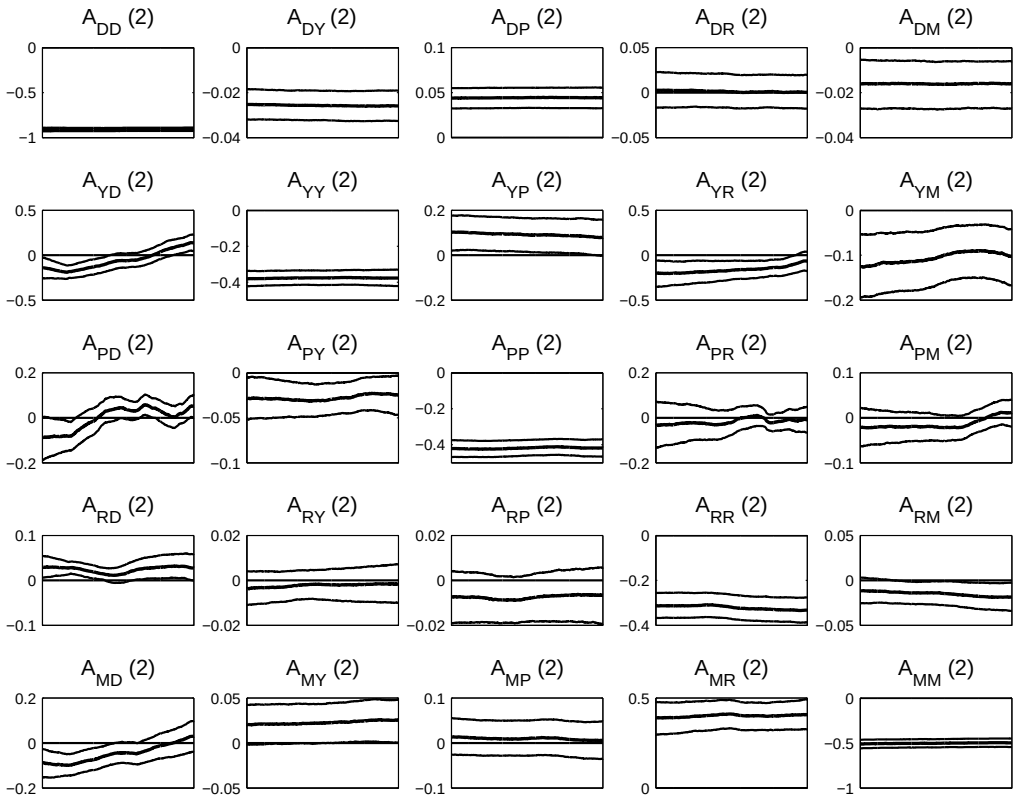

Figure: Time-varying parameter estimates: AR(2) parameter

Parameter Estimates III

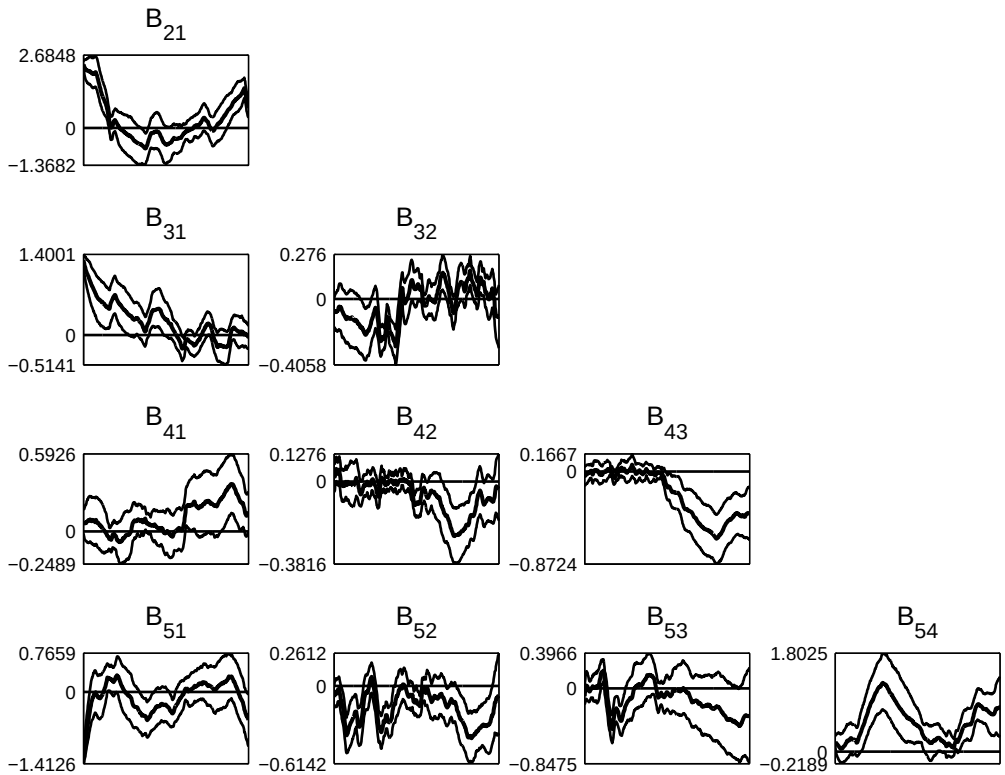

Figure: Time-varying parameter estimates B

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Debt growth as fiscal stance

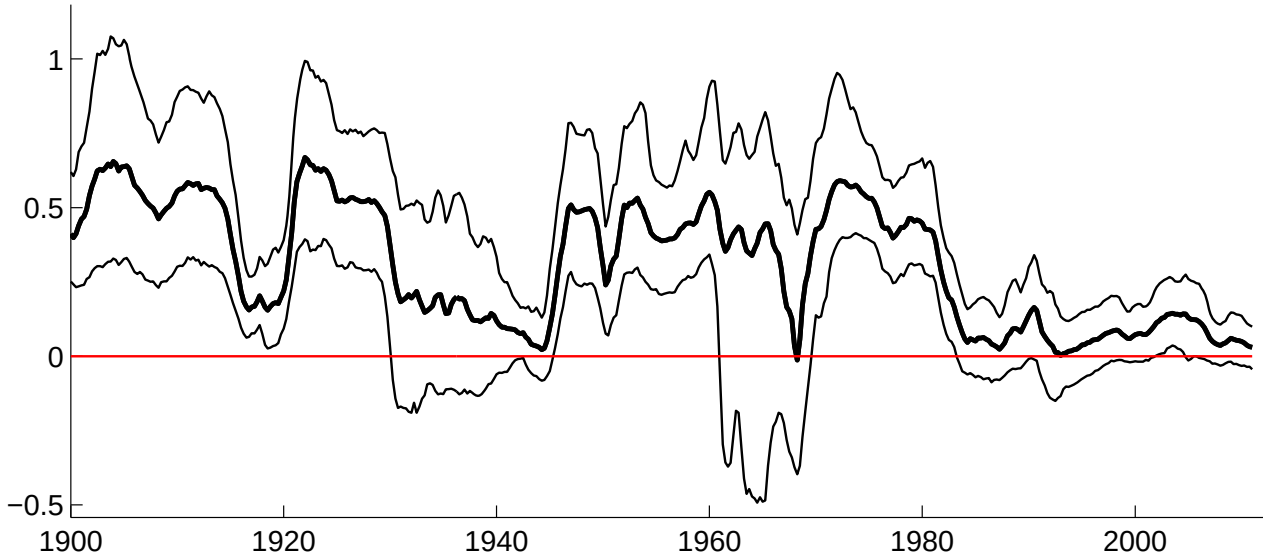

Figure: $\hat{b}_f$: Median and 68% central posterior bands for the time-varying regression coefficient inflation on debt growth. Robustness check with real debt growth instead of primary deficits over debt.

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Comparison interpolation methods

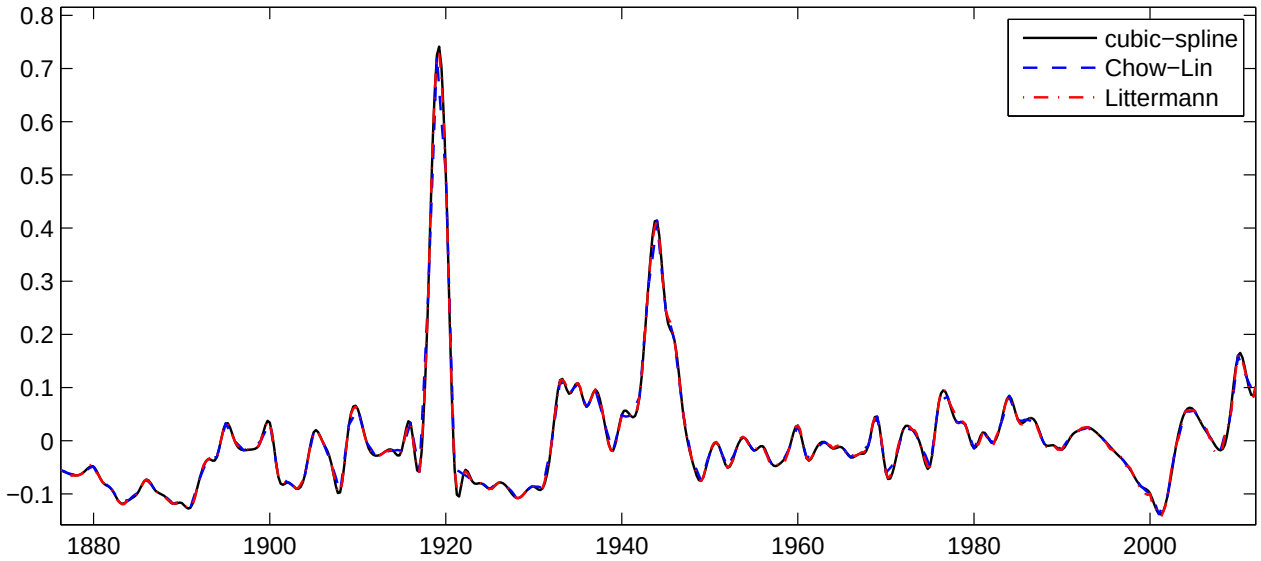

Figure: Interpolated time series for primary deficits over debt using different interpolation methods.

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Time-varying VAR and subsample OLS

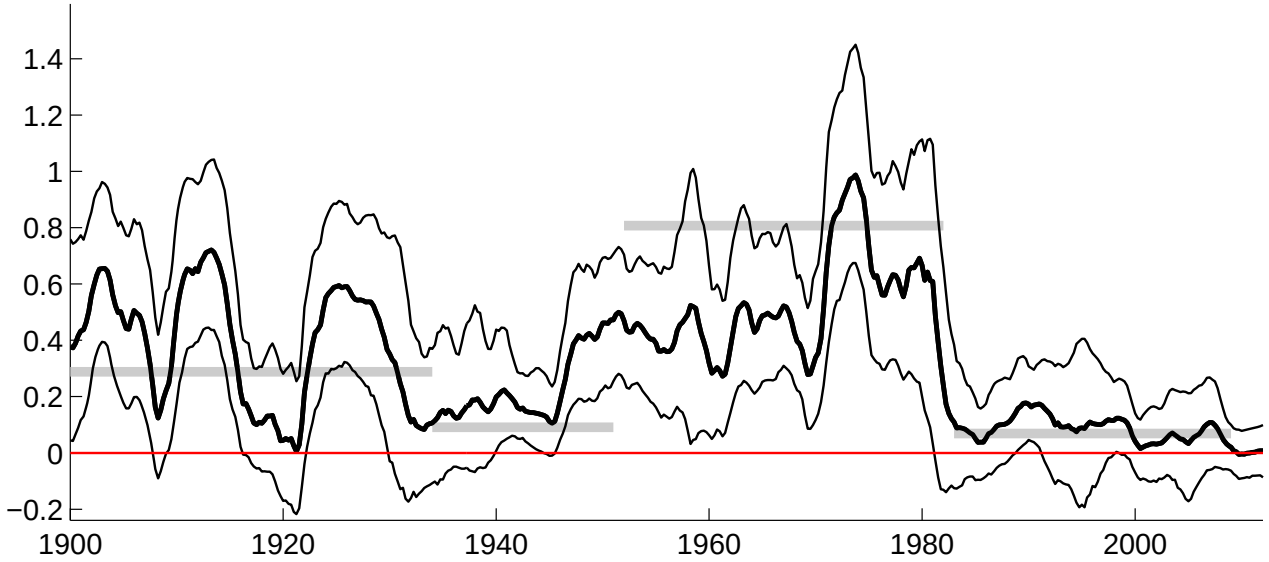

Figure: $\hat{b}_f$: Median and 68% central posterior bands for the time-varying regression coefficient inflation on primary deficits over debt. Grey lines correspond to the heteroscedastic-serial consistent OLS regression coefficient of the filtered data.

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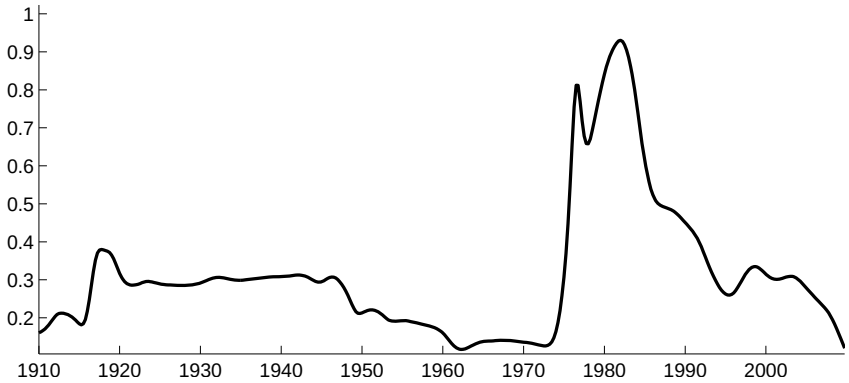
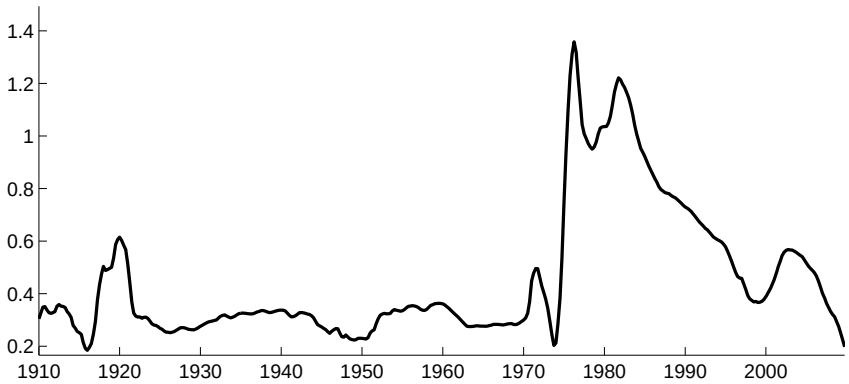
Rolling window OLS and DOLS



(a) OLS estimate



(b) DOLS estimate

Figure: Rolling sample (fixed window) regression coefficients.

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Nominal interest rates

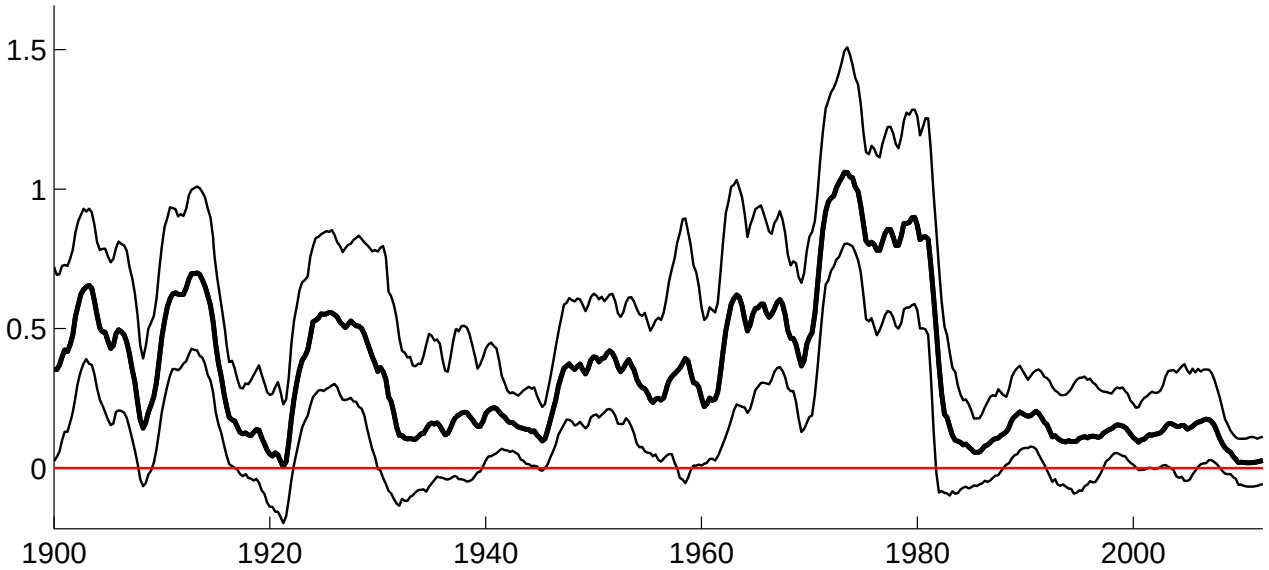

Figure: $\hat{b}_f$: Median and 68% central posterior bands for the time-varying regression coefficient inflation on primary deficits over debt. Robustness check with 3m nominal interest rates instead of 6m interest rates.

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3 month real interest rate

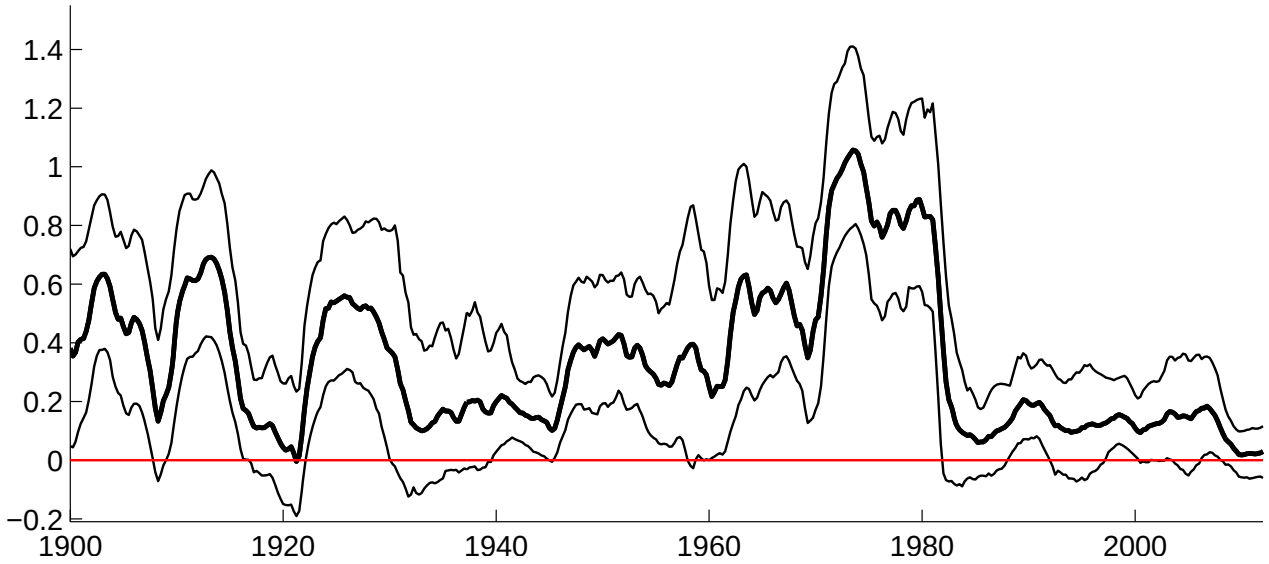

Figure: $\hat{b}_f$: Median and 68% central posterior bands for the time-varying regression coefficient inflation on primary deficits over debt. Robustness check with 3m real interest rates instead of 6m interest rates.

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Structural decomposition I

- Spectrum $S^i_{Y,t|T}(\omega)$ associated with $i-th$ column of the Cholesky decomposition $\tilde{B}^i_{t|T}$:

$$S^i_{Y,t|T}(\omega) = \hat{C}_{t|T}\left(I - \hat{A}_{t|T}e^{-i\omega}\right)^{-1}\tilde{B}^i_{t|T}(\tilde{B}^i)'_{t|T}\left(I - \hat{A}'_{t|T}e^{i\omega}\right)^{-1}\hat{C}'_{t|T}$$

- Spectrum is decomposed into spectra of structural shocks:

$$\hat{b}_{f,t|T} = \frac{S_{\pi d,t|T}(0)}{S_{d,t|T}(0)} = \frac{\sum_{i=1}^{5} S^i_{\pi d,t|T}(0)}{\sum_{i=1}^{5} S^i_{d,t|T}(0)} \tag{5}$$

Structural decomposition II

- Contribution of the monetary policy shock to the low-frequency relationship:

$$\hat{b}_{f,t|T} = \frac{S^m_{d,t|T}(0)}{S_{d,t|T}(0)} \hat{b}^m_{f,t|T} + \sum_{i=1}^{4} \frac{S^i_{d,t|T}(0)}{S_{d,t|T}(0)} \hat{b}^i_{f,t|T} \tag{6}$$

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