Optimal Monetary Policy Under Financial Sector Risk

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[1] The views presented here are solely those of the authors and should not be interperted as representing the views of the Federal Reserve Bank of Dallas or the Federal Reserve System.

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    - How does optimal policy change when financial conditions matter?

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- Sticky prices and wages allow monetary policy to have a role in smoothing output fluctuations.
- How should the central bank respond to changes in home and foreign interbank lending spreads?

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- These financial frictions drive a countercyclical wedge between the rate at which entrepreneurs borrow, r_t^e, and the banks cost of capital, r_t^b.

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- This model also incorporates financial frictions in the banking sector itself.

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- Where $\omega_t^b(j)$ is lognormally distributed with mean 1 and standard deviation σ_t^b. If banks held fully diversified loan portfolios and there was no heterogeneity across banks $\sigma_t^b = 0$

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- The bank is insolvent if the end of period value of their assets is less than the end of period value of their liabilities:

$$\left(1 - \omega_t^b (j)\, \xi_t^e\right)(1 + r_t^e)\, B_t^e < \left(1 + r_t^b\right) b_t^s (j)$$

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- Thus the number of banks that are insolvent is $1-G\left(\bar{\omega}_t^b;\sigma_t^b\right)$, where G is the c.d.f. of the lognormal distribution of $\omega_t^b(j)$.

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- The risk free rate is determined by the central bank according to a Taylor rule:

$$i_t = i_{ss} + \theta_i \left(i_{t-1} - i_{ss}\right) + \left(1 - \theta_i\right) \begin{pmatrix} \theta_p \pi_t + \theta_y \hat{y}_t + \theta_s s_t + \\ \theta_r \left(r\hat{p}_t\right) + \theta_{rf} \left(r\hat{p}_t^*\right) \end{pmatrix}$$

where $s_t = \frac{S_t}{S_{t-1}} - 1$, $r\hat{p}_t = \left(r_t^b - i_t\right) - \left(r_{ss}^b - i_{ss}\right)$ and $r\hat{p}_t^* = \left(r_t^{b*} - i_t^*\right) - \left(r_{ss}^{b*} - i_{ss}^*\right)$

Optimal Monetary Policy

- The central bank will minimize a loss function consisting of the variance of inflation, the output gap, and the difference in the nominal risk free rate.

$$\mathcal{L} = var\left(\pi_t\right) + 0.5 \times var\left(\hat{y}_t\right) + 0.1 \times var\left(i_t - i_{t-1}\right)$$

where π_t is the quarterly inflation rate and $\hat{y}_t$ is the output gap

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  - $g_1 \left(\frac{\bar{\omega}_t^b - \bar{\omega}_{ss}^b}{\bar{\omega}_{ss}^b}\right)$ are changes in the spread that occur because of changes in $\bar{\omega}_t^b$.

Results

- Endogenous vs. Exogenous changes in the spread:

$$r_t^b - i_t \approx \left(r_{ss}^b - i_{ss}\right) + g_1\left(\frac{\bar{\omega}_t^b - \bar{\omega}_{ss}^b}{\bar{\omega}_{ss}^b}\right) + g_2\left(\frac{\sigma_t^b - \sigma_{ss}^b}{\sigma_{ss}^b}\right)$$

  - $g_1\left(\frac{\bar{\omega}_t^b - \bar{\omega}_{ss}^b}{\bar{\omega}_{ss}^b}\right)$ are changes in the spread that occur because of changes in $\bar{\omega}_t^b$.
    - $\bar{\omega}_t^b$ is determined by endogenous variables like debt ratios, interest rates, and bankruptcy rates

Results

- Endogenous vs. Exogenous changes in the spread:

$$r_t^b - i_t \approx \left(r_{ss}^b - i_{ss}\right) + g_1 \left(\frac{\bar{\omega}_t^b - \bar{\omega}_{ss}^b}{\bar{\omega}_{ss}^b}\right) + g_2 \left(\frac{\sigma_t^b - \sigma_{ss}^b}{\sigma_{ss}^b}\right)$$

- $g_1 \left(\frac{\bar{\omega}_t^b - \bar{\omega}_{ss}^b}{\bar{\omega}_{ss}^b}\right)$ are changes in the spread that occur because of changes in $\bar{\omega}_t^b$.
  - $\bar{\omega}_t^b$ is determined by endogenous variables like debt ratios, interest rates, and bankruptcy rates
- $g_2 \left(\frac{\sigma_t^b - \sigma_{ss}^b}{\sigma_{ss}^b}\right)$ are changes in the spread that occur because of σ_t^b

Results

- Endogenous vs. Exogenous changes in the spread:

$$r_t^b - i_t \approx \left(r_{ss}^b - i_{ss}\right) + g_1\left(\frac{\bar{\omega}_t^b - \bar{\omega}_{ss}^b}{\bar{\omega}_{ss}^b}\right) + g_2\left(\frac{\sigma_t^b - \sigma_{ss}^b}{\sigma_{ss}^b}\right)$$

  - $g_1\left(\frac{\bar{\omega}_t^b - \bar{\omega}_{ss}^b}{\bar{\omega}_{ss}^b}\right)$ are changes in the spread that occur because of changes in $\bar{\omega}_t^b$.
    - $\bar{\omega}_t^b$ is determined by endogenous variables like debt ratios, interest rates, and bankruptcy rates
  - $g_2\left(\frac{\sigma_t^b - \sigma_{ss}^b}{\sigma_{ss}^b}\right)$ are changes in the spread that occur because of σ_t^b
    - σ_t^b is an exogenous stochastic variable that describes the amount of ex-ante uncertainty in the banking sector.

Results

The optimal weight on the interbank lending spread

- Define Σ as the ratio of the standard deviation of the financial sector shock to the standard deviation of the TFP shock.

Results

The optimal weight on the interbank lending spread

- Define Σ as the ratio of the standard deviation of the financial sector shock to the standard deviation of the TFP shock.
  - As Σ increases, financial sector shocks are more important for driving fluctuations in the business cycle.

Optimal Taylor Rule Parameters

Conventional Taylor Rule

	θ_p	θ_y	θ_i	θ_s	$\sqrt{\frac{var(rp_t^b)}{var(GDP_t)}}$	Rel. Loss
$\theta_s = 0:$						
$\Sigma = 0$	1.709	0.417	0.746	–	0.0124	12.61%
$\Sigma = 0.025$	1.713	0.417	0.746	–	0.0345	12.71%
$\Sigma = 0.050$	1.726	0.429	0.748	–	0.0655	12.98%
$\Sigma = 0.075$	1.733	0.434	0.749	–	0.0966	13.44%
$\Sigma = 0.100$	1.762	0.452	0.752	–	0.1271	14.05%
$\Sigma = 0.125$	1.788	0.469	0.755	–	0.1569	14.81%
$\Sigma = 0.150$	1.822	0.494	0.759	–	0.1859	15.67%
$\Sigma = 0.175$	1.951	0.544	0.774	–	0.2099	16.54%

Optimal Taylor Rule Parameters

Conventional Taylor Rule

	θ_p	θ_y	θ_i	θ_s	$\sqrt{\frac{var\left(rp_t^b\right)}{var(GDP_t)}}$	Rel. Loss
$\theta_s \neq 0:$						
$\Sigma = 0$	1.641	0.375	0.741	0.154	0.0126	12.26%
$\Sigma = 0.025$	1.650	0.385	0.743	0.156	0.0347	12.36%
$\Sigma = 0.050$	1.667	0.396	0.745	0.153	0.0656	12.65%
$\Sigma = 0.075$	1.681	0.406	0.746	0.146	0.0967	13.13%
$\Sigma = 0.100$	1.719	0.434	0.751	0.145	0.1274	13.75%
$\Sigma = 0.125$	1.751	0.457	0.755	0.139	0.1573	14.51%
$\Sigma = 0.150$	1.785	0.480	0.754	0.134	0.1864	15.47%
$\Sigma = 0.175$	1.838	0.513	0.760	0.129	0.2138	16.43%

Results

- Step 2: Now do the same grid search, but allow θ_r and θ_{rf} to vary

Optimal Taylor Rule Parameters

Include spreads in the Taylor Rule

	θ_p	θ_y	θ_i	θ_s	θ_r	θ_{rf}	Rel. Loss
$\theta_s = 0:$							
$\Sigma = 0$	1.709	0.417	0.746	–	0.000	0.000	12.61%
$\Sigma = 0.025$	1.713	0.417	0.746	–	0.000	0.000	12.71%
$\Sigma = 0.050$	1.726	0.429	0.748	–	0.000	0.000	12.98%
$\Sigma = 0.075$	1.737	0.430	0.749	–	−0.343	0.000	13.29%
$\Sigma = 0.100$	1.754	0.439	0.756	–	−0.484	−0.049	13.49%
$\Sigma = 0.125$	1.768	0.440	0.759	–	−0.548	−0.112	13.71%
$\Sigma = 0.150$	1.777	0.441	0.762	–	−0.584	−0.147	13.93%
$\Sigma = 0.175$	1.797	0.444	0.768	–	−0.612	−0.172	14.15%

Optimal Taylor Rule Parameters

Include spreads in the Taylor Rule

	θ_p	θ_y	θ_i	θ_s	θ_r	θ_{rf}	Rel. Loss
$\theta_s \neq 0:$							
$\Sigma = 0$	1.641	0.375	0.741	0.154	0.000	0.000	12.26%
$\Sigma = 0.025$	1.650	0.385	0.743	0.156	0.000	0.000	12.36%
$\Sigma = 0.050$	1.667	0.396	0.745	0.153	0.000	0.000	12.65%
$\Sigma = 0.075$	1.665	0.394	0.746	0.154	−0.370	0.000	12.94%
$\Sigma = 0.100$	1.673	0.394	0.749	0.159	−0.526	0.000	13.13%
$\Sigma = 0.125$	1.677	0.391	0.752	0.165	−0.597	−0.028	13.31%
$\Sigma = 0.150$	1.693	0.398	0.756	0.176	−0.643	−0.049	13.48%
$\Sigma = 0.175$	1.704	0.400	0.760	0.183	−0.671	−0.067	13.66%

Results

The optimal weight on the home and foreign interbank lending spreads

- Endogenous fluctuations in the spread contain no new information that is not already contained in the output gap and the inflation rate.

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Results

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  - If the coefficients on the output gap and the inflation rate are optimally chosen, putting weight on the endogenous component of the spread is suboptimal.
  - When $\Sigma = 0$, the optimal coefficients θ_r and θ_{rf} are zero.

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  - If the coefficients on the output gap and the inflation rate are optimally chosen, putting weight on the endogenous component of the spread is suboptimal.
  - When $\Sigma = 0$, the optimal coefficients θ_r and θ_{rf} are zero.
- Exogenous fluctuations in the spread may contain information not already found in the output gap and inflation.

Results

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  - If the coefficients on the output gap and the inflation rate are optimally chosen, putting weight on the endogenous component of the spread is suboptimal.
  - When $\Sigma = 0$, the optimal coefficients θ_r and θ_{rf} are zero.
- Exogenous fluctuations in the spread may contain information not already found in the output gap and inflation.
  - There is a benefit to putting weight on exogenous component of the home and foreign interbank spreads.

Results

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- Endogenous fluctuations in the spread contain no new information that is not already contained in the output gap and the inflation rate.
  - If the coefficients on the output gap and the inflation rate are optimally chosen, putting weight on the endogenous component of the spread is suboptimal.
  - When $\Sigma = 0$, the optimal coefficients θ_r and θ_{rf} are zero.
- Exogenous fluctuations in the spread may contain information not already found in the output gap and inflation.
  - There is a benefit to putting weight on exogenous component of the home and foreign interbank spreads.
- When $\Sigma > 0$, optimal policy balances the cost of putting weight on the endogenous component of the spread against the benefit of putting weight on the exogenous component of the spread.

Results

The optimal weight on the home and foreign interbank lending spreads

- If $\Sigma > 0$ and the central bank is putting weight on the home and foreign interbank lending spread, putting weight on the nominal exchange rate will make the central bank want to reduce the weight it places on the foreign spread and increase the weight it places on the home spread.

Results

The optimal weight on the home and foreign interbank lending spreads

- Following a foreign financial shock, the foreign country will start to go into recession and the home nominal exchange rate will appreciate. If the home central bank is targeting the nominal exchange rate, it will cut the risk free rate.

Results

The optimal weight on the home and foreign interbank lending spreads

- Following a foreign financial shock, the foreign country will start to go into recession and the home nominal exchange rate will appreciate. If the home central bank is targeting the nominal exchange rate, it will cut the risk free rate.
  - This is exactly what it would have done if reacting to the foreign financial shock.

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  - This is exactly what it would have done if reacting to the foreign financial shock.
  - Following a foreign financial shock, there is no trade-off between financial stability and exchange rate stability.
- Following a home financial shock, the home country will start to go into recession and the home nominal exchange rate will depreciate. If the home central bank is targeting the nominal exchange rate, it will raise the risk free rate.

Results

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- Following a foreign financial shock, the foreign country will start to go into recession and the home nominal exchange rate will appreciate. If the home central bank is targeting the nominal exchange rate, it will cut the risk free rate.
  - This is exactly what it would have done if reacting to the foreign financial shock.
  - Following a foreign financial shock, there is no trade-off between financial stability and exchange rate stability.
- Following a home financial shock, the home country will start to go into recession and the home nominal exchange rate will depreciate. If the home central bank is targeting the nominal exchange rate, it will raise the risk free rate.
  - This is the exact opposite of what it would have done if reacting to the home financial shock.

Results

The optimal weight on the home and foreign interbank lending spreads

- Following a foreign financial shock, the foreign country will start to go into recession and the home nominal exchange rate will appreciate. If the home central bank is targeting the nominal exchange rate, it will cut the risk free rate.
  - This is exactly what it would have done if reacting to the foreign financial shock.
  - Following a foreign financial shock, there is no trade-off between financial stability and exchange rate stability.
- Following a home financial shock, the home country will start to go into recession and the home nominal exchange rate will depreciate. If the home central bank is targeting the nominal exchange rate, it will raise the risk free rate.
  - This is the exact opposite of what it would have done if reacting to the home financial shock.
  - Following a home financial shock, there is a trade-off between financial stability and exchange rate stability.

Results

- Suppose that the central bank can distinguish between the endogenous and exogenous movements in the spread and the two components enter the Taylor rule separately:

$$i_t = i_{ss} + \theta_i \left(i_{t-1} - i_{ss} \right) + (1 - \theta_i) \left(\begin{array}{c} \theta_p \pi_t + \theta_y \hat{y}_t + \theta_s s_t \\ \theta_r^{endo} r\hat{p}_t^{endo} + \theta_r^{exo} r\hat{p}_t^{exo} + \\ \theta_{rf}^{endo} r\hat{p}_t^{*endo} + \theta_{rf}^{exo} r\hat{p}_t^{*exo} \end{array} \right)$$

where $r\hat{p}_t^{endo} = g_1 \left(\frac{\bar{\omega}_t^b - \bar{\omega}_{ss}^b}{\bar{\omega}_{ss}^b} \right)$ and $r\hat{p}_t^{exo} = g_2 \left(\frac{\sigma_t^b - \sigma_{ss}^b}{\sigma_{ss}^b} \right)$

Optimal Taylor Rule Parameters

Include exogenous and endogenous spreads in the Taylor Rule

	θ_p	θ_y	θ_i	θ_s
$\theta_s = 0:$				
$\Sigma = 0$	1.709	0.417	0.746	–
$\Sigma = 0.025$	1.788	0.467	0.760	–
$\Sigma = 0.050$	1.736	0.432	0.750	–
$\Sigma = 0.075$	1.737	0.430	0.749	–
$\Sigma = 0.100$	1.746	0.432	0.752	–
$\Sigma = 0.125$	1.785	0.455	0.758	–
$\Sigma = 0.150$	1.816	0.469	0.761	–
$\Sigma = 0.175$	1.888	0.506	0.767	–

Optimal Taylor Rule Parameters

Include exogenous and endogenous spreads in the Taylor Rule

	θ_r^{endo}	θ_{rf}^{endo}	θ_r^{exo}	θ_{rf}^{exo}	$\sqrt{\frac{var(rp_t^b)}{var(GDP_t)}}$	Rel. Loss
$\theta_s = 0:$						
$\Sigma = 0$	0.000	0.000	*na*	*na*	1.24%	12.61%
$\Sigma = 0.025$	0.000	0.000	-0.696	-0.246	3.33%	12.56%
$\Sigma = 0.050$	0.000	0.000	-0.816	-0.340	6.23%	12.70%
$\Sigma = 0.075$	0.000	0.000	-0.813	-0.351	9.20%	12.86%
$\Sigma = 0.100$	0.000	0.000	-0.811	-0.359	12.11%	13.03%
$\Sigma = 0.125$	0.000	0.000	-0.826	-0.388	14.99%	13.25%
$\Sigma = 0.150$	0.000	0.000	-0.858	-0.406	17.76%	13.57%
$\Sigma = 0.175$	0.000	0.000	-0.944	-0.434	20.39%	14.03%

Optimal Taylor Rule Parameters

Include exogenous and endogenous spreads in the Taylor Rule

	θ_p	θ_y	θ_i	θ_s
$\theta_s \neq 0:$				
$\Sigma = 0$	1.641	0.375	0.741	0.154
$\Sigma = 0.025$	1.641	0.375	0.741	0.154
$\Sigma = 0.050$	1.659	0.384	0.745	0.157
$\Sigma = 0.075$	1.665	0.390	0.746	0.161
$\Sigma = 0.100$	1.679	0.393	0.748	0.163
$\Sigma = 0.125$	1.689	0.398	0.749	0.171
$\Sigma = 0.150$	1.706	0.403	0.752	0.177
$\Sigma = 0.175$	1.749	0.428	0.757	0.189

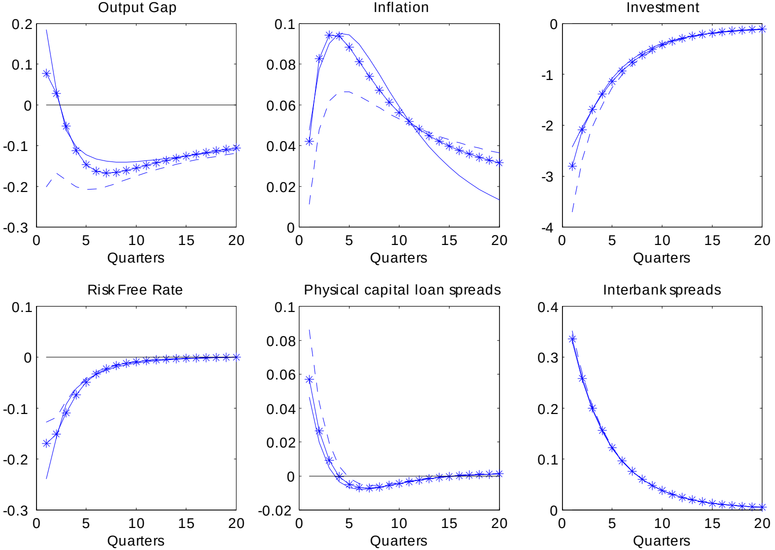
Optimal Taylor Rule Parameters

Include exogenous and endogenous spreads in the Taylor Rule

	θ_r^{endo}	θ_{rf}^{endo}	θ_r^{exo}	θ_{rf}^{exo}	$\sqrt{\frac{var(rp_t^b)}{var(GDP_t)}}$	Rel. Loss
$\theta_s \neq 0$:						
$\Sigma = 0$	0.000	0.000	*na*	*na*	1.26%	12.26%
$\Sigma = 0.025$	0.000	0.000	-0.726	-0.124	3.32%	12.28%
$\Sigma = 0.050$	0.000	0.000	-0.828	-0.216	6.21%	12.34%
$\Sigma = 0.075$	0.000	0.000	-0.850	-0.201	9.17%	12.44%
$\Sigma = 0.100$	0.000	0.000	-0.837	-0.226	12.08%	12.58%
$\Sigma = 0.125$	0.000	0.000	-0.865	-0.211	14.94%	12.75%
$\Sigma = 0.150$	0.000	0.000	-0.883	-0.214	17.68%	12.97%
$\Sigma = 0.175$	0.000	0.000	-0.922	-0.231	20.38%	13.25%

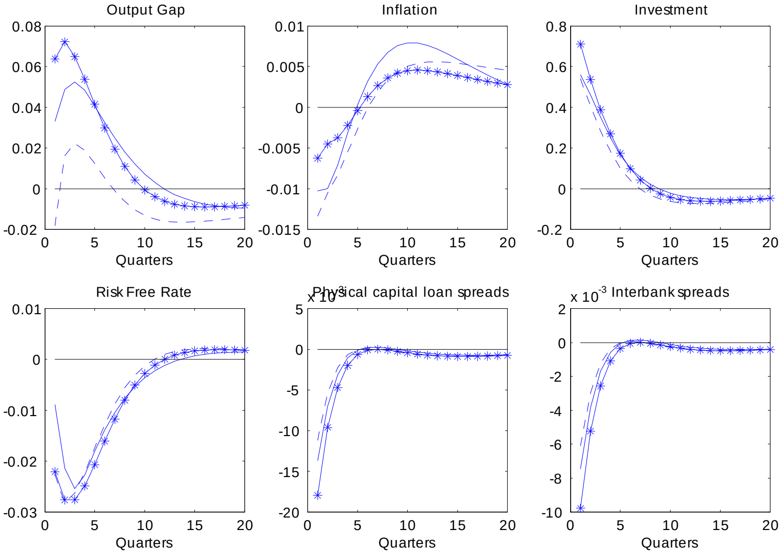
Responses to a home financial shock

Solid line - Ramsey, Dashed line - Taylor w/o spreads, Line with stars - Taylor w/ spreads



Responses to a foreign financial shock

Solid line - Ramsey, Dashed line - Taylor w/o spreads, Line with stars - Taylor w/ spreads



Summary

- Optimal monetary policy under financial sector risk:

Summary

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Summary

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Summary

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- Does the central bank want to include the interbank lending spread in its Taylor rule?
    - Maybe
        - React to fluctuations in the interbank lend spread that are due to exogenous financial shocks.

Summary

- Optimal monetary policy under financial sector risk:
- Does the central bank want to include the interbank lending spread in its Taylor rule?
    - Maybe
        - React to fluctuations in the interbank lend spread that are due to exogenous financial shocks.
        - Ignore fluctuations in the spread that are due to movements in balance sheet ratios, loan losses, etc.

Summary

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Summary

- Optimal monetary policy under financial sector risk:
- How will the optimal Taylor rule weights change when the central bank also targets the nominal exchange rate?

Summary

- Optimal monetary policy under financial sector risk:
- How will the optimal Taylor rule weights change when the central bank also targets the nominal exchange rate?
    - In response to a foreign financial shock, there is no trade-off between targeting the exchange rate and targeting the foreign interbank spread.

Summary

- Optimal monetary policy under financial sector risk:
- How will the optimal Taylor rule weights change when the central bank also targets the nominal exchange rate?
  - In response to a foreign financial shock, there is no trade-off between targeting the exchange rate and targeting the foreign interbank spread.
    - When also targeting the exchange rate, the central bank can reduce the weight it places on the foreign interbank spread.

Summary

- Optimal monetary policy under financial sector risk:
- How will the optimal Taylor rule weights change when the central bank also targets the nominal exchange rate?
  - In response to a foreign financial shock, there is no trade-off between targeting the exchange rate and targeting the foreign interbank spread.
    - When also targeting the exchange rate, the central bank can reduce the weight it places on the foreign interbank spread.
  - In response to a home financial shock, there is a trade-off between targeting the exchange rate and targeting the home interbank spread.

Summary

- Optimal monetary policy under financial sector risk:
- How will the optimal Taylor rule weights change when the central bank also targets the nominal exchange rate?
  - In response to a foreign financial shock, there is no trade-off between targeting the exchange rate and targeting the foreign interbank spread.
    - When also targeting the exchange rate, the central bank can reduce the weight it places on the foreign interbank spread.
  - In response to a home financial shock, there is a trade-off between targeting the exchange rate and targeting the home interbank spread.
    - If the central bank is targeting the exchange rate, it needs to increase the weight it places on the home interbank spread.

Optimal Taylor Rule Parameters - High Trade

Conventional Taylor Rule

	θ_p	θ_y	θ_i	θ_s	$\sqrt{\frac{var\left(rp_t^b\right)}{var(GDP_t)}}$	Rel. Loss
$\theta_s = 0:$						
$\Sigma = 0$	1.579	0.332	0.741	–	0.0132	12.18%
$\Sigma = 0.025$	1.579	0.332	0.741	–	0.0364	12.27%
$\Sigma = 0.050$	1.589	0.337	0.742	–	0.0689	12.54%
$\Sigma = 0.075$	1.606	0.352	0.744	–	0.102	12.97%
$\Sigma = 0.100$	1.629	0.368	0.747	–	0.1345	13.55%
$\Sigma = 0.125$	1.645	0.379	0.749	–	0.1662	14.27%
$\Sigma = 0.150$	1.687	0.407	0.754	–	0.1972	15.08%
$\Sigma = 0.175$	1.719	0.430	0.758	–	0.2274	16.00%

Optimal Taylor Rule Parameters - High Trade

Conventional Taylor Rule

	θ_p	θ_y	θ_i	θ_s	$\sqrt{\frac{var\left(rp_t^b\right)}{var(GDP_t)}}$	Rel. Loss
$\theta_s \neq 0:$						
$\Sigma = 0$	1.548	0.309	0.741	0.599	0.0135	11.86%
$\Sigma = 0.025$	1.552	0.309	0.741	0.591	0.0364	11.96%
$\Sigma = 0.050$	1.558	0.318	0.742	0.585	0.0691	12.23%
$\Sigma = 0.075$	1.580	0.333	0.745	0.561	0.102	12.66%
$\Sigma = 0.100$	1.607	0.353	0.748	0.536	0.1347	13.24%
$\Sigma = 0.125$	1.640	0.377	0.753	0.510	0.1667	13.92%
$\Sigma = 0.150$	1.678	0.405	0.758	0.496	0.198	14.71%
$\Sigma = 0.175$	1.717	0.430	0.763	0.485	0.2279	15.58%

Optimal Taylor Rule Parameters - High Trade

Include spreads in the Taylor Rule

	θ_p	θ_y	θ_i	θ_s	θ_r	θ_{rf}	Rel. Loss
$\theta_s = 0:$							
$\Sigma = 0$	1.579	0.332	0.741	–	0.000	0.000	12.18%
$\Sigma = 0.025$	1.579	0.332	0.741	–	0.000	0.000	12.27%
$\Sigma = 0.050$	1.589	0.337	0.742	–	0.000	0.000	12.54%
$\Sigma = 0.075$	1.594	0.340	0.744	–	−0.160	−0.121	12.87%
$\Sigma = 0.100$	1.616	0.352	0.750	–	−0.260	−0.232	13.05%
$\Sigma = 0.125$	1.621	0.351	0.752	–	−0.315	−0.286	13.23%
$\Sigma = 0.150$	1.638	0.358	0.757	–	−0.346	−0.321	13.38%
$\Sigma = 0.175$	1.653	0.364	0.761	–	−0.364	−0.343	13.55%

Optimal Taylor Rule Parameters - High Trade

Include spreads in the Taylor Rule

	θ_p	θ_y	θ_i	θ_s	θ_r	θ_{rf}	Rel. Loss
$\theta_s \neq 0:$							
$\Sigma = 0$	1.548	0.309	0.741	0.599	0.000	0.000	11.86%
$\Sigma = 0.025$	1.552	0.309	0.741	0.591	0.000	0.000	11.96%
$\Sigma = 0.050$	1.558	0.318	0.742	0.585	0.000	0.000	12.23%
$\Sigma = 0.075$	1.563	0.320	0.744	0.578	-0.258	-0.031	12.54%
$\Sigma = 0.100$	1.567	0.323	0.746	0.563	-0.339	-0.146	12.74%
$\Sigma = 0.125$	1.578	0.327	0.749	0.562	-0.383	-0.215	12.89%
$\Sigma = 0.150$	1.598	0.336	0.756	0.603	-0.434	-0.213	13.00%
$\Sigma = 0.175$	1.609	0.337	0.757	0.576	-0.457	-0.231	13.15%

Optimal Taylor Rule Parameters - High Trade

Include exogenous and endogenous spreads in the Taylor Rule

	θ_p	θ_y	θ_i	θ_s
$\theta_s = 0:$				
$\Sigma = 0$	1.579	0.332	0.741	–
$\Sigma = 0.025$	1.594	0.340	0.744	–
$\Sigma = 0.050$	1.895	0.543	0.801	–
$\Sigma = 0.075$	1.648	0.373	0.756	–
$\Sigma = 0.100$	1.614	0.351	0.749	–
$\Sigma = 0.125$	1.642	0.366	0.754	–
$\Sigma = 0.150$	1.660	0.373	0.756	–
$\Sigma = 0.175$	1.688	0.388	0.760	–

Optimal Taylor Rule Parameters - High Trade

Include exogenous and endogenous spreads in the Taylor Rule

	θ_r^{endo}	θ_{rf}^{endo}	θ_r^{exo}	θ_{rf}^{exo}	$\sqrt{\frac{var\left(rp_t^b\right)}{var(GDP_t)}}$	Rel. Loss
$\theta_s = 0:$						
$\Sigma = 0$	0.000	0.000	*na*	*na*	1.32%	12.18%
$\Sigma = 0.025$	0.000	0.000	-0.418	-0.395	3.54%	12.18%
$\Sigma = 0.050$	0.000	0.000	-0.251	-1.030	6.82%	11.92%
$\Sigma = 0.075$	0.000	0.000	-0.516	-0.471	9.83%	12.25%
$\Sigma = 0.100$	0.000	0.000	-0.502	-0.454	12.99%	12.43%
$\Sigma = 0.125$	0.000	0.000	-0.520	-0.468	16.08%	12.57%
$\Sigma = 0.150$	0.000	0.000	-0.516	-0.492	19.11%	12.78%
$\Sigma = 0.175$	0.000	0.000	-0.533	-0.504	22.06%	13.01%

Optimal Taylor Rule Parameters - High Trade

Include exogenous and endogenous spreads in the Taylor Rule

	θ_p	θ_y	θ_i	θ_s
$\theta_s \neq 0:$				
$\Sigma = 0$	1.548	0.309	0.741	0.599
$\Sigma = 0.025$	1.548	0.305	0.741	0.599
$\Sigma = 0.050$	1.546	0.304	0.740	0.596
$\Sigma = 0.075$	1.560	0.311	0.743	0.595
$\Sigma = 0.100$	1.579	0.321	0.748	0.786
$\Sigma = 0.125$	1.579	0.321	0.748	0.556
$\Sigma = 0.150$	1.607	0.336	0.753	0.595
$\Sigma = 0.175$	1.614	0.337	0.754	0.618

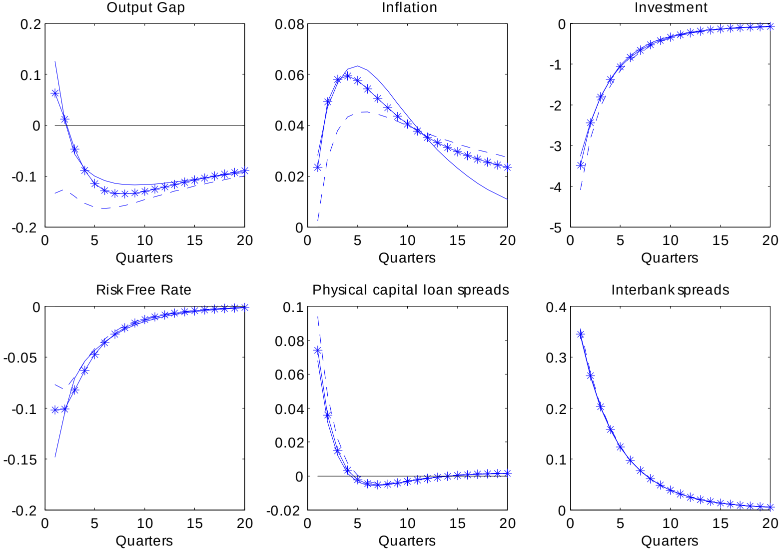
Optimal Taylor Rule Parameters - High Trade

Include exogenous and endogenous spreads in the Taylor Rule

	θ_r^{endo}	θ_{rf}^{endo}	θ_r^{exo}	θ_{rf}^{exo}	$\sqrt{\frac{var(rp_t^b)}{var(GDP_t)}}$	Rel. Loss
$\theta_s \neq 0$:						
$\Sigma = 0$	0.000	0.000	*na*	*na*	1.35%	11.86%
$\Sigma = 0.025$	0.000	0.000	-0.460	-0.321	3.54%	11.88%
$\Sigma = 0.050$	0.000	0.000	-0.573	-0.315	6.63%	11.92%
$\Sigma = 0.075$	0.000	0.000	-0.588	-0.315	9.78%	11.99%
$\Sigma = 0.100$	0.000	0.000	-0.762	-0.151	12.84%	12.11%
$\Sigma = 0.125$	0.000	0.000	-0.516	-0.401	16.05%	12.21%
$\Sigma = 0.150$	0.000	0.000	-0.595	-0.344	19.02%	12.34%
$\Sigma = 0.175$	0.000	0.000	-0.610	-0.342	21.95%	12.52%

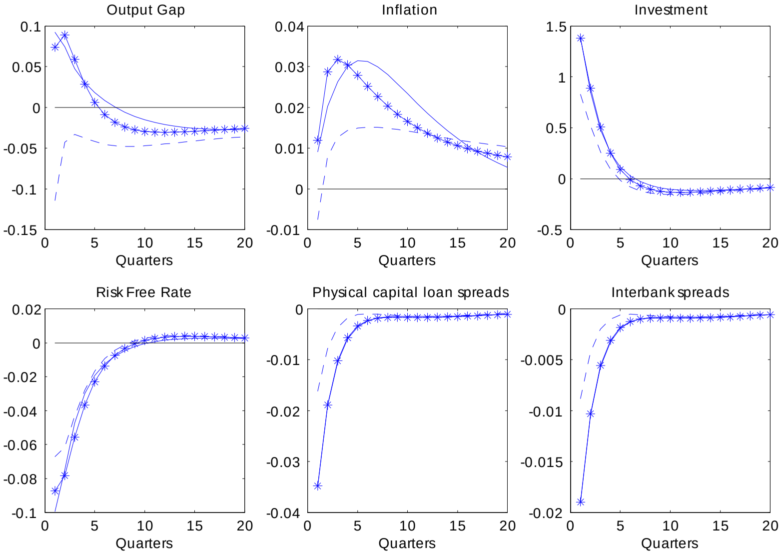
Responses to a home financial shock - High Trade

Solid line - Ramsey, Dashed line - Taylor w/o spreads, Line with stars - Taylor w/ spreads



Responses to a foreign financial shock - High Trade

Solid line - Ramsey, Dashed line - Taylor w/o spreads, Line with stars - Taylor w/ spreads



Optimal Taylor Rule Parameters - Foreign Borrowing

Conventional Taylor Rule

	θ_p	θ_y	θ_i	θ_s	$\sqrt{\frac{var\left(rp_t^b\right)}{var(GDP_t)}}$	Rel. Loss
$\theta_s = 0:$						
$\Sigma = 0$	1.659	0.377	0.745	–	0.0128	11.04%
$\Sigma = 0.025$	1.665	0.382	0.746	–	0.033	11.13%
$\Sigma = 0.050$	1.676	0.387	0.747	–	0.0618	11.38%
$\Sigma = 0.075$	1.693	0.398	0.749	–	0.0912	11.79%
$\Sigma = 0.100$	1.715	0.414	0.751	–	0.1205	12.35%
$\Sigma = 0.125$	1.733	0.425	0.753	–	0.1492	13.06%
$\Sigma = 0.150$	1.780	0.456	0.759	–	0.1773	13.83%
$\Sigma = 0.175$	1.814	0.481	0.763	–	0.2049	14.74%

Optimal Taylor Rule Parameters - Foreign Borrowing

Conventional Taylor Rule

	θ_p	θ_y	θ_i	θ_s	$\sqrt{\frac{var\left(rp_t^b\right)}{var(GDP_t)}}$	Rel. Loss
$\theta_s \neq 0:$						
$\Sigma = 0$	1.594	0.341	0.739	0.149	0.0132	10.58%
$\Sigma = 0.025$	1.600	0.346	0.740	0.154	0.033	10.67%
$\Sigma = 0.050$	1.610	0.351	0.741	0.151	0.0616	10.93%
$\Sigma = 0.075$	1.625	0.367	0.744	0.156	0.0912	11.35%
$\Sigma = 0.100$	1.648	0.383	0.747	0.162	0.1203	11.91%
$\Sigma = 0.125$	1.683	0.406	0.751	0.165	0.1489	12.60%
$\Sigma = 0.150$	1.713	0.426	0.756	0.168	0.1768	13.40%
$\Sigma = 0.175$	1.761	0.458	0.762	0.172	0.2041	14.29%

Optimal Taylor Rule Parameters - Foreign Borrowing

Include spreads in the Taylor Rule

	θ_p	θ_y	θ_i	θ_s	θ_r	θ_{rf}	Rel. Loss
$\theta_s = 0:$							
$\Sigma = 0$	1.659	0.377	0.745	–	0.000	0.000	11.04%
$\Sigma = 0.025$	1.665	0.382	0.746	–	0.000	0.000	11.13%
$\Sigma = 0.050$	1.676	0.387	0.747	–	0.000	0.000	11.38%
$\Sigma = 0.075$	1.693	0.398	0.749	–	−0.143	−0.139	11.72%
$\Sigma = 0.100$	1.695	0.394	0.751	–	−0.261	−0.253	11.99%
$\Sigma = 0.125$	1.717	0.406	0.756	–	−0.320	−0.320	12.22%
$\Sigma = 0.150$	1.748	0.420	0.762	–	−0.361	−0.357	12.46%
$\Sigma = 0.175$	1.769	0.427	0.766	–	−0.385	−0.385	12.73%

Optimal Taylor Rule Parameters - Foreign Borrowing

Include spreads in the Taylor Rule

	θ_p	θ_y	θ_i	θ_s	θ_r	θ_{rf}	Rel. Loss
$\theta_s \neq 0:$							
$\Sigma = 0$	1.594	0.341	0.739	0.149	0.000	0.000	10.58%
$\Sigma = 0.025$	1.600	0.346	0.740	0.154	0.000	0.000	10.67%
$\Sigma = 0.050$	1.610	0.351	0.741	0.151	0.000	0.000	10.93%
$\Sigma = 0.075$	1.621	0.359	0.744	0.156	−0.133	−0.145	11.27%
$\Sigma = 0.100$	1.624	0.361	0.745	0.157	−0.235	−0.259	11.53%
$\Sigma = 0.125$	1.635	0.361	0.748	0.159	−0.286	−0.321	11.77%
$\Sigma = 0.150$	1.656	0.373	0.753	0.162	−0.316	−0.360	12.01%
$\Sigma = 0.175$	1.675	0.379	0.757	0.165	−0.337	−0.387	12.28%

Optimal Taylor Rule Parameters - Foreign Borrowing

Include exogenous and endogenous spreads in the Taylor Rule

	θ_p	θ_y	θ_i	θ_s
$\theta_s = 0:$				
$\Sigma = 0$	1.659	0.377	0.745	–
$\Sigma = 0.025$	1.709	0.410	0.756	–
$\Sigma = 0.050$	1.733	0.425	0.760	–
$\Sigma = 0.075$	1.707	0.407	0.754	–
$\Sigma = 0.100$	1.699	0.398	0.751	–
$\Sigma = 0.125$	1.734	0.418	0.756	–
$\Sigma = 0.150$	1.764	0.427	0.759	–
$\Sigma = 0.175$	1.802	0.452	0.763	–

Optimal Taylor Rule Parameters - Foreign Borrowing

Include exogenous and endogenous spreads in the Taylor Rule

	θ_r^{endo}	θ_{rf}^{endo}	θ_r^{exo}	θ_{rf}^{exo}	$\sqrt{\frac{var(rp_t^b)}{var(GDP_t)}}$	Rel. Loss
$\theta_s = 0$:						
$\Sigma = 0$	0.000	0.000	*na*	*na*	1.28%	11.04%
$\Sigma = 0.025$	0.000	0.000	−0.447	−0.443	3.21%	11.02%
$\Sigma = 0.050$	0.000	0.000	−0.550	−0.563	5.96%	11.10%
$\Sigma = 0.075$	0.000	0.000	−0.545	−0.545	8.80%	11.27%
$\Sigma = 0.100$	0.000	0.000	−0.538	−0.550	11.62%	11.48%
$\Sigma = 0.125$	0.000	0.000	−0.553	−0.574	14.42%	11.72%
$\Sigma = 0.150$	0.000	0.000	−0.589	−0.581	17.08%	12.04%
$\Sigma = 0.175$	0.000	0.000	−0.616	−0.608	19.79%	12.43%

Optimal Taylor Rule Parameters - Foreign Borrowing

Include exogenous and endogenous spreads in the Taylor Rule

	θ_p	θ_y	θ_i	θ_s
$\theta_s \neq 0:$				
$\Sigma = 0$	1.594	0.341	0.739	0.149
$\Sigma = 0.025$	1.600	0.346	0.740	0.154
$\Sigma = 0.050$	1.612	0.353	0.742	0.151
$\Sigma = 0.075$	1.625	0.359	0.744	0.152
$\Sigma = 0.100$	1.621	0.356	0.744	0.156
$\Sigma = 0.125$	1.625	0.356	0.744	0.156
$\Sigma = 0.150$	1.663	0.378	0.751	0.161
$\Sigma = 0.175$	1.694	0.392	0.755	0.163

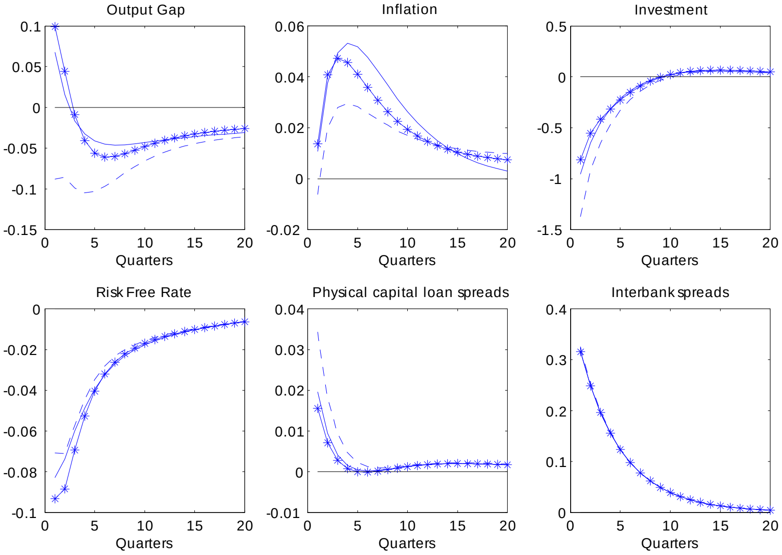
Optimal Taylor Rule Parameters - Foreign Borrowing

Include exogenous and endogenous spreads in the Taylor Rule

	θ_r^{endo}	θ_{rf}^{endo}	θ_r^{exo}	θ_{rf}^{exo}	$\sqrt{\frac{var(rp_t^b)}{var(GDP_t)}}$	Rel. Loss
$\theta_s \neq 0$:						
$\Sigma = 0$	0.000	0.000	*na*	*na*	1.32%	10.58%
$\Sigma = 0.025$	0.000	0.000	-0.381	-0.427	3.21%	10.60%
$\Sigma = 0.050$	0.000	0.000	-0.457	-0.519	5.95%	10.68%
$\Sigma = 0.075$	0.000	0.000	-0.469	-0.523	8.78%	10.81%
$\Sigma = 0.100$	0.000	0.000	-0.473	-0.512	11.58%	10.98%
$\Sigma = 0.125$	0.000	0.000	-0.461	-0.531	14.36%	11.20%
$\Sigma = 0.150$	0.000	0.000	-0.482	-0.546	17.09%	11.47%
$\Sigma = 0.175$	0.000	0.000	-0.490	-0.576	19.73%	11.80%

Responses to a home financial shock - Foreign Borrowing

Solid line - Ramsey, Dashed line - Taylor w/o spreads, Line with stars - Taylor w/ spreads



Responses to a foreign financial shock - Foreign Borrowing

Solid line - Ramsey, Dashed line - Taylor w/o spreads, Line with stars - Taylor w/ spreads