Financial Integration and Monetary Policy Coordination

Javier Bianchi\textsuperscript{1}    Louphou Coulibaly\textsuperscript{2}

Bank of Canada, Annual Conference 2023

\textsuperscript{1}Federal Reserve Bank of Minneapolis

\textsuperscript{2}University of Wisconsin-Madison and NBER

The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis, the Federal Reserve System.
Motivation

- Surge in inflation followed by synchronized tightening of monetary policy
Concerns about synchronized tightening leading to global recession

Central banks nearly everywhere feel accused of being on the back foot. The present danger, however, is [...] they collectively go too far and drive the world economy into an unnecessarily harsh contraction... By simultaneously all going in the same direction, they risk reinforcing each other’s policy impacts without taking that feedback loop into account.

Maury Obstfeld, Peterson Institute blog post, 09/12/2022
Motivation (ctd)

Concerns about synchronized tightening leading to global recession

Central banks nearly everywhere feel accused of being on the back foot. The present danger, however, is [...] they collectively go too far and drive the world economy into an unnecessarily harsh contraction... By simultaneously all going in the same direction, they risk reinforcing each other’s policy impacts without taking that feedback loop into account.

Maury Obstfeld, Peterson Institute blog post, 09/12/2022

Questions:

- What are the benefits from monetary policy cooperation?
- Does cooperation necessarily call for less tightening?
Focus of the literature: terms-of-trade manipulation
Monetary Policy Coordination

- Focus of the literature: terms-of-trade manipulation
  - Appreciate to improve terms of trade (Obstfeld-Rogoff 1995; Corsetti-Pesenti 2001)
Monetary Policy Coordination

- Focus of the literature: terms-of-trade manipulation
  - Appreciate to improve terms of trade (Obstfeld-Rogoff 1995; Corsetti-Pesenti 2001)
  - Benefits from coordination even in the absence of financial flows
Monetary Policy Coordination

- Focus of the literature: terms-of-trade manipulation
  - Appreciate to improve terms of trade (Obstfeld-Rogoff 1995; Corsetti-Pesenti 2001)
  - Benefits from coordination even in the absence of financial flows

- Today: benefit from cooperation from an intertemporal perspective
  - Monetary policy affects capital flows and $R^* \Rightarrow$ macro spillovers abroad
Monetary Policy Coordination

• Focus of the literature: terms-of-trade manipulation
  • Appreciate to improve terms of trade (Obstfeld-Rogoff 1995; Corsett-Pesenti 2001)
  • Benefits from coordination even in the absence of financial flows

• Today: benefit from cooperation from an intertemporal perspective
  • Monetary policy affects capital flows and $R^*$ ⇒ macro spillovers abroad

• Bianchi and Coulibally (2021):
  • Countries use monetary policy to ↑ NFA and prevent ZLB
  • In general eqm. ↓ $R^*$ ⇒ incentives to ↑ borrow ⇒ countries deviate from efficient $Y$
Monetary Policy Coordination

- Focus of the literature: terms-of-trade manipulation
  - Appreciate to improve terms of trade (Obstfeld-Rogoff 1995; Corsett-Pesenti 2001)
  - Benefits from coordination even in the absence of financial flows

- **Today**: benefit from cooperation from an *intertemporal perspective*
  - Monetary policy affects capital flows and $R^* \Rightarrow$ macro spillovers abroad

- Bianchi and Coulibally (2021):
  - Countries use monetary policy to ↑ NFA and prevent ZLB
  - In general eqm. ↓ $R^* \Rightarrow$ incentives to ↑ borrow ⇒ countries deviate from efficient $Y$

- Fornaro and Romei (2022):
  - Cooperative monetary policy under inflation-output tradeoff
  - Under-tightening in response to reallocation shock
• **Cooperation may call for lower or higher nominal rates**

• **Three sufficient statistics:** (i) output gap; (ii) sectoral differences in labor intensity for tradables (T) and non-tradables (N); (iii) the trade balance response to changes in nominal rates
• **Cooperation may call for lower or higher nominal rates**

• **Three sufficient statistics**: (i) output gap; (ii) sectoral differences in labor intensity for tradables (T) and non-tradables (N); (iii) the trade balance response to changes in nominal rates

• Examples w/ under-tightening in Nash-eqm:
  - Overheating, N are more labor intensive & $dTB/dR<0$
  - Recession, N are more labor intensive & $dTB/dR>0$
• **Cooperation may call for lower or higher nominal rates**

• **Three sufficient statistics**: (i) output gap; (ii) sectoral differences in labor intensity for tradables (T) and non-tradables (N); (iii) the trade balance response to changes in nominal rates

• Examples w/ **under-tightening** in Nash-eqm:
  - Overheating, N are more labor intensive & \(\frac{dT_B}{dR} < 0\)
  - Recession, N are more labor intensive & \(\frac{dT_B}{dR} > 0\)

• Examples w/ **over-tightening** in Nash-eqm:
  - Overheating, N are more labor intensive & \(\frac{dT_B}{dR} > 0\)
  - Recession, N are more labor intensive & \(\frac{dT_B}{dR} < 0\)
General logic:

- Countries do not internalize how managing trade balance affects $R^*$ and welfare abroad.
- Depending on output gap & labor intensities, countries benefits from ↓ $R^*$ or ↑ $R^*$. 
General logic:

- Countries do not internalize how managing trade balance affects $R^*$ and welfare abroad.
- Depending on output gap & labor intensities, countries benefits from $\downarrow R^*$ or $\uparrow R^*$.

Planner’s optimality:

$$\frac{\partial U_0(R, R^*)}{\partial R} + \frac{dR^*}{dR} \frac{\partial U}{\partial R^*} = 0$$
General logic:

- Countries do not internalize how managing trade balance affects $R^*$ and welfare abroad.
- Depending on output gap & labor intensities, countries benefit from ↓ $R^*$ or ↑ $R^*$.

Planner's optimality:

$$\frac{\partial U_0(R, R^*)}{\partial R} + \frac{dR^*}{dR} \frac{\partial U}{\partial R^*} = 0$$

- If recession and N are more labor intensive: $\frac{\partial U}{\partial R^*} < 0$
  - Central bank wants to shift employment towards high-labor intensive sector (N).
  - ↓ $R^*$ leads to more inflows and more demand (and more employment) for N.
General logic:

- Countries do not internalize how managing trade balance affects $R^*$ and welfare abroad.
- Depending on output gap & labor intensities, countries benefits from $\downarrow R^*$ or $\uparrow R^*$.

Planner’s optimality:

$$\frac{\partial U_0(R, R^*)}{\partial R} + \frac{dR^*}{dR} \frac{\partial U}{\partial R^*} = 0$$

- If recession and N are more labor intensive: $\frac{\partial U}{\partial R^*} < 0$
  - Central bank wants to shift employment towards high-labor intensive sector (N).
  - $\downarrow R^*$ leads to more inflows and more demand (and more employment) for N.
General logic:

- Countries do not internalize how managing trade balance affects $R^*$ and welfare abroad
- Depending on output gap & labor intensities, countries benefit from $\downarrow R^*$ or $\uparrow R^*$

Planner’s optimality:

$$\frac{\partial U_0(R, R^*)}{\partial R} + \frac{dR^*}{dR} \frac{\partial U}{\partial R^*} = 0$$

- If recession and N are more labor intensive: $\frac{\partial U}{\partial R^*} < 0$

- If $dTB/dR < 0$, lower R induces higher supply of assets $\frac{dR^*}{dR} > 0$
General logic:

- Countries do not internalize how managing trade balance affects $R^*$ and welfare abroad.
- Depending on output gap & labor intensities, countries benefit from $\downarrow R^*$ or $\uparrow R^*$.

Planner’s optimality:

$$\frac{\partial U_0(R, R^*)}{\partial R} + \frac{dR^*}{dR} \frac{\partial U}{\partial R^*} = 0$$

- If recession and N are more labor intensive: $\frac{\partial U}{\partial R^*} < 0$
- If $dTBR < 0$, lower R induces higher supply of assets $\frac{dR^*}{dR} > 0$

$\Rightarrow$ Planner perceives higher benefits from cutting interest rates $\Rightarrow$ over-tightening.
Preview of Results (ctd)

**General logic:**
- Countries do not internalize how managing trade balance affects $R^*$ and welfare abroad.
- Depending on output gap & labor intensities, countries benefit from $\downarrow R^*$ or $\uparrow R^*$.

Planner's optimality:

$$\frac{\partial U_0(R, R^*)}{\partial R} + \frac{dR^*}{dR} \frac{\partial U}{\partial R^*} = 0$$

- If recession and $N$ are more labor intensive: $\frac{\partial U}{\partial R^*} < 0$
- If $dTB/dR < 0$, lower $R$ induces higher supply of assets $\frac{dR^*}{dR} > 0$
  \[\Rightarrow \text{Planner perceives higher benefits from cutting interest rates} \Rightarrow \text{over-tightening}\]

Signs revert when $dTB/dR > 0$ (or $T$ are more labor intensive) $\Rightarrow$ under-tightening.
Main Elements of the Model

- Deterministic, infinite horizon
- Continuum of identical small open economies
  - Each country populated by continuum of households
- Two goods: tradable (T) and non-tradable (N)
  - Law of one price for tradables
- Sticky wages in period 0
  - Flexible wages for $t > 0$
- Perfect capital mobility
  - Global asset pays $R^*$ in units of T
Households

\[ \sum_{t=0}^{\infty} \beta^t \left[ U(c_t) - \kappa_t h_t - \frac{\chi}{2} (\hat{\pi}_t)^2 \right] \]

\[ c_t = \left[ \phi^T (c_t^T)^{\gamma-1} + \phi^N (c_t^N)^{\gamma-1} \right]^{\gamma-1} \frac{\gamma}{\gamma-1}, \quad h_t = h_t^T + h_t^N, \quad \hat{\pi}_t \text{ deviation from CPI target} \]

- Budget constraint:
  \[ P_t^T c_t^T + P_t^N c_t^N + \frac{b_{t+1}}{R_t} + P_t^T \frac{b_{t+1}^*}{R_t^*} = W_t (h_t^T + h_t^N) + \Psi_t + b_t + P_t^T b_t \]

- Off labor supply at \( t = 0 \)
Households

\[
\sum_{t=0}^{\infty} \beta^t \left[ U(c_t) - \kappa_t h_t - \frac{\chi}{2} (\hat{\pi}_t)^2 \right] \]

\[
c_t = \left[ \phi^T (c_t^T)^{\frac{\gamma-1}{\gamma}} + \phi^N (c_t^N)^{\frac{\gamma-1}{\gamma}} \right]^{\frac{\gamma}{\gamma-1}}, \quad h_t = h_t^T + h_t^N, \quad \hat{\pi}_t \text{ deviation from CPI target} \]

- Budget constraint:
  \[
P_T^T c_t^T + P_T^N c_t^N + \frac{b_{t+1}}{R_t} + P_T^T b_{t+1}^* = W_t (h_t^T + h_t^N) + \psi_t + b_t + P_T^T b_t \]

- Off labor supply at \( t = 0 \)

- For baseline, assume \( \gamma = 1 \). General IES \( 1/\sigma \)
• Production for tradables (T) and non-tradables (N)

\[ F^T(h^T_t, A^T_t) = A^T_t(h^T_t)^{\alpha^T}, \quad F^N(h^N_t, A^N_t) = A^N_t(h^N_t)^{\alpha^N} \]

• Optimality

\[ P^T_t \alpha^T A^T_t (h^T_t)^{\alpha^T-1} = P^N_t \alpha^N A^N_t (h^N_t)^{\alpha^N-1} = W_t. \]
• For $t > 0$, assume central bank stabilizes price level
• For $t = 0$, optimal choice of $\{R_0\}$
Competitive Equilibrium in the Global Economy

Given $b_0^*$, a sticky wage $W$, and a sequence of policies $\{R_t\}$ in each country $k$, an equilibrium is a sequence of world real rates $\{R_t^*\}$, prices $\{P^T_t, P^N_t, W_t, e^j_{k,t}\}$ and allocations $\{c^T_t, c^N_t, h^T_t, h^N_t, b_{t+1}, b^*_{t+1}\}$ in each country $k$ such that:

- In each country:
  1. Households and firms optimize
  2. (iii) Market clears for non-tradables $F^N(h^N_t, A^N_t) = c^N_t$, local currency bonds $b_{t+1} = 0$. and labor for $t \geq 1$

- Law of one price holds for tradables: $P^T_{kt} = e^j_{kt} P^T_{jt}$ for any country-pair $k, j$

- Market for real assets clear globally: $\int b^*_{kt+1} dk = 0$ for $t \geq 0$. 
Competitive Equilibrium in the Global Economy

Given $b_0^*$, a sticky wage $W$, and a sequence of policies $\{R_t\}$ in each country $k$, an equilibrium is a sequence of world real rates $\{R_t^*\}$, prices $\{P_T^k, P_N^k, W_t, e_{k,t}^j\}$ and allocations $\{c_t^T, c_t^N, h_t^T, h_t^N, b_{t+1}, b_{t+1}^*\}$ in each country $k$ such that:

- In each country:
  (i) Households and firms optimize
  (iii) Market clears for non-tradables $F^N(h_t^N, A_t^N) = c_t^N$, local currency bonds $b_{t+1} = 0$, and labor for $t \geq 1$

- Law of one price holds for tradables: $P_T^{k,t} = e_{kt}^i P_T^{j,t}$ for any country-pair $k, j$

- Market for real assets clear globally: $\int b_{kt+1}^* dk = 0$ for $t \geq 0$.

In a symmetric equilibrium: $b_{t+1}^* = 0$ for all $k, t$ and $e_{kt}^i = 1$
Individual central bank problem

\[
\max_{h_T^0, h_N^0, b_1^*} \left( F^T(h_0^T, A_0^T) - \frac{b_1^*}{R_0^*}, F^N(h_0^N, A_0^N) \right) - \kappa_0(h_0^T + h_0^N) - \frac{\chi}{2}(\hat{\pi}_0)^2 + \beta V_1(b_1^*)
\]

s.t.

\[
\frac{\hat{\pi}_0}{1 + \pi} = \frac{W}{W_0^n} \left( \frac{h_0^T}{h_0^T} \right)^{(1-\alpha^T) \phi^T} \left( \frac{h_0^N}{h_0^N} \right)^{(1-\alpha^N) \phi^N} - 1
\]

\[
h_T^0 h_N^0 = \frac{b_1^*}{R_0^* F(h_0^T, A_0^T)}
\]

\[
u_T \left( F^T(h_0^T, A_0^T) - \frac{b_1^*}{R_0^*}, F^N(h_0^N, A_0^N) \right) = \beta R_0^* u_T(C^T(b_1^*), C^N(b_1^*))
\]
Individual central bank problem

\[
\max_{h_T^0, h_N^0, b_1^*} u \left( F^T(h_T^0, A_T^0) - \frac{b_1^*}{R_0^*}, F^N(h_N^0, A_N^0) \right) - \kappa_0(h_T^0 + h_N^0) - \frac{\chi}{2}(\hat{\pi}_0)^2 + \beta V_1(b_1^*)
\]

\[
\text{s.t.} \quad \frac{\hat{\pi}_0}{1 + \pi} = \frac{W}{W_0^n} \left( \frac{h_T^0}{\bar{h}_T^0} \right)^{(1 - \alpha_T)\phi_T} \left( \frac{h_N^0}{\bar{h}_N^0} \right)^{(1 - \alpha_N)\phi_N} - 1
\]

\[
\frac{h_N^0}{h_T^0} = \frac{\bar{h}_N^0}{\bar{h}_T^0} \left( 1 - \frac{b_1^*}{R_0^* F(h_T^0, A_T^0)} \right)
\]

\[
u_T \left( F^T(h_T^0, A_T^0) - \frac{b_1^*}{R_0^*}, F^N(h_N^0, A_N^0) \right) = \beta R_0^* u_T(C^T(b_1^*), C^N(b_1^*))
\]

- Absent inflation costs, first-best \(\bar{h}_T^0, \bar{h}_N^0\) can be implemented for any natural wage \(W_0^n\)
- Align real wage consistent that implements \(\bar{h}_T^0, \bar{h}_N^0\)
Individual central bank problem

\[
\max_{h_T^0, h_N^0, b_1^*} \ u \left( F^T(h_T^0, A_T^0) - \frac{b_1^*}{R_0^*}, F^N(h_N^0, A_N^0) \right) - \kappa_0(h_T^0 + h_N^0) - \frac{\chi}{2}(\pi_0)^2 + \beta V_1(b_1^*)
\]

s.t.

\[
\frac{\pi_0}{1 + \pi} = \frac{W}{W_0} \left( \frac{h_T^0}{h_T^0} \right)^{(1-\alpha_T)\phi_T} \left( \frac{h_N^0}{h_N^0} \right)^{(1-\alpha_N)\phi_N} - 1
\]

\[
u_T \left( F^T(h_T^0, A_T^0) - \frac{b_1^*}{R_0^*}, F^N(h_N^0, A_N^0) \right) = \beta R_0^* u_T(C^T(b_1^*), C^N(b_1^*))
\]

Suppose \( \pi_0 > 0 \) and \( h_0^T < 0 \):

• By \( b_1^* \downarrow \), country can raise demand for T and N goods
  \[ \Rightarrow \text{Higher borrowing reallocate employment toward N} \]

• If \( \alpha^N > \alpha^T \), this helps \( \pi_0 \downarrow \)
  \[ \Rightarrow \text{Higher intensity means that to achieve } h \uparrow, \text{ less increase in prices needed} \]
Individual central bank problem

\[
\max_{h_T^0, h_N^0, b_1^*} u \left( F^T(h_T^0, A_T^0) - \frac{b_1^*}{R_0^*}, F^N(h_N^0, A_N^0) \right) - \kappa_0(h_T^0 + h_N^0) - \frac{\chi}{2}(\hat{\pi}_0)^2 + \beta V_1(b_1^*)
\]

\[
\text{s.t.} \quad \frac{\hat{\pi}_0}{1 + \pi} = \frac{W}{W_0^n} \left( \frac{h_T^0}{h_0^T} \right)^{(1 - \alpha_T)\phi_T^T} \left( \frac{h_N^0}{h_0^N} \right)^{(1 - \alpha_N)\phi_N^N} - 1
\]

\[
u_T \left( F^T(h_T^0, A_T^0) - \frac{b_1^*}{R_0^*}, F^N(h_N^0, A_N^0) \right) = \beta R_0^* u_T(C^T(b_1^*), C^N(b_1^*))
\]

Suppose \( \hat{\pi}_0 > 0 \) and \( \hat{h}_0 < 0 \):

- By \( \downarrow b_1^* \), country can raise demand for T and N goods
  \Rightarrow Higher borrowing reallocate employment toward N

- If \( \alpha_N > \alpha_T \), this helps \( \downarrow \hat{\pi}_0 \)
  - Higher intensity means that to achieve \( \uparrow h \), less increase in prices needed
Why Nash ≠ Cooperative Equilibrium?

- Individual countries manage trade balance to improve macro stabilization.
Why Nash ≠ Cooperative Equilibrium?

- Individual countries manage trade balance to improve macro stabilization
- But in equilibrium trade balance must add up to zero
  - $R_0^*$ adjusts so that $b_1^* = 0$
Why Nash ≠ Cooperative Equilibrium?

• Individual countries manage trade balance to improve macro stabilization
• But in equilibrium trade balance must add up to zero
  • \(R_0^*\) adjusts so that \(b_1^* = 0\)
• Using monetary policy to try to alter trade balance ends up backfiring
  • Distorts output and inflation without any benefits
Why Nash ≠ Cooperative Equilibrium?

- Individual countries manage trade balance to improve macro stabilization
- But in equilibrium trade balance must add up to zero
  - \( R_0^* \) adjusts so that \( b_1^* = 0 \)
- Using monetary policy to try to alter trade balance ends up backfiring
  - Distorts output and inflation without any benefits

Does cooperative monetary policy call for higher or lower nominal rates?
Individual central bank problem

\[
\max_{h_T^0, h_N^0, b_1^*} u \left( F^T(h_T^0, A_T^0) - \frac{b_1^*}{R_0^*}, F^N(h_N^0, A_N^0) \right) - \kappa_0(h_T^0 + h_N^0) - \frac{\chi}{2} (\hat{\pi}_0)^2 + \beta V_1(b_1^*)
\]

\[
\text{s.t.} \quad \frac{\hat{\pi}_0}{1 + \overline{\pi}} = \frac{W}{W_0^m} \left( \frac{h_T^0}{h_T^0} \right)^{(1 - \alpha^T) \phi^T} \left( \frac{h_N^0}{h_N^0} \right)^{(1 - \alpha^N) \phi^N} - 1
\]

\[
h_N^0 h_T^0 = \frac{\bar{h}_N^0}{\bar{h}_T^0} \left( 1 - \frac{b_1^*}{R_0^* F(h_T^0, A_T^0)} \right)
\]

\[
u_T \left( F^T(h_T^0, A_T^0) - \frac{b_1^*}{R_0^*}, F^N(h_N^0, A_N^0) \right) = \beta R_0^* u_T \left( C^T(b_1^*), C^N(b_1^*) \right)
\]

All spillovers through \( R_0^* \):

- No terms of trade (single tradable good)
- Inflationary pressures through exchange rates can be offset by monetary policy
Individual central bank problem

\[
\max_{h_T^0, h_N^0, b_1^*} u \left( F^T(h_T^0, A_T^0) - \frac{b_1^*}{R_0^*}, F^N(h_N^0, A_N^0) \right) - \kappa_0(h_T^0 + h_N^0) - \frac{\chi}{2}(\hat{\pi}_0)^2 + \beta V_1(b_1^*)
\]

s.t. \[
\frac{\widehat{\pi}_0}{1 + \overline{\pi}} = \frac{W}{W_0^n} \left( \frac{h_T^0}{h_T^0} \right)^{(1-\alpha_T)\phi_T} \left( \frac{h_N^0}{h_N^0} \right)^{(1-\alpha_N)\phi_N} - 1
\]

\[
u_T \left( F^T(h_T^0, A_T^0) - \frac{b_1^*}{R_0^*}, F^N(h_N^0, A_N^0) \right) = \beta R_0^* u_T \left( C^T(b_1^*), C^N(b_1^*) \right)
\]

All spillovers through \( R_0^* \):

- No terms of trade (single tradable good)
- Inflationary pressures through exchange rates can be offset by monetary policy
- With capital controls, no spillovers (Bianchi and Coulibaly, 2021)
Denote $R^*$ the real rate as a function of nominal rates $R_0$

$$\max_{R_0} U_0(R_0, R^*(R_0)) \Rightarrow \frac{\partial U_0(R, R^*)}{\partial R} + \frac{dR^*}{dR} \frac{\partial U}{\partial R^*} = 0$$
Denote $R^*$ the real rate as a function of nominal rates $R_0$

$$\max_{R_0} U_0(R_0, R^*(R_0)) \Rightarrow \frac{\partial U_0(R, R^*)}{\partial R} + \frac{dR^*}{dR} \frac{\partial U}{\partial R^*} = 0$$

$$\left. \frac{\partial U_0}{\partial R^*} \right|_{R^*_0 = R^*_{0,NE}} = \frac{1}{R^*_0 \psi_\eta} \left[ \phi^T \phi^N \right] \frac{\alpha^N - \alpha^T}{\psi_{NE}} \tilde{h}^N_0$$

Suppose $\alpha^N > \alpha^T$ and $\tilde{h}^N_0 < 0$: a country benefits from low $R^*$

- $\downarrow R^*$ higher domestic demand $\Rightarrow \uparrow h^N$ (modest effects on $\pi$)
Denote $R^*$ the real rate as a function of nominal rates $R_0$

$$\max_{R_0} \mathcal{U}_0(R_0, R^*(R_0)) \Rightarrow \frac{\partial \mathcal{U}_0(R, R^*)}{\partial R} + \frac{dR^*}{dR} \frac{\partial \mathcal{U}}{\partial R^*} = 0$$

$$\left. \frac{\partial \mathcal{U}_0}{\partial R^*} \right|_{R^*_0 = R^*_{0,NE}} = \left. \frac{1}{R^*_0 \psi_\eta} \left[ \frac{\phi^T \phi^N}{\delta_0 - \phi^T + \sigma \phi^T} \right] \frac{\alpha^N - \alpha^T}{\psi^{NE}} \tilde{h}^N \right.$$

Suppose $\alpha^N > \alpha^T$ and $\tilde{h}^N < 0$: a country benefits from low $R^*$

- $\downarrow R^*$ higher domestic demand $\Rightarrow \uparrow h^N$ (modest effects on $\pi$)

$$\frac{dR^*}{dR} > 0 \iff \sigma > \bar{\sigma} \equiv 1 - \frac{\alpha^T}{\alpha^T \phi^T + \alpha^N \phi^N}$$

$\Rightarrow$ Generalized Marshall Lerner: $dTB/dR < 0$ for relatively low IES $1/\sigma$ or high $\alpha^T$: 
**Proposition.** Denote $h^N_0$ the output gap in the Nash equilibrium. Then, the Nash equilibrium displays under-tightening $R^N_0 < R^G_0$ if and only if $(\alpha^N - \alpha^T)(\sigma - \overline{\sigma})h^N_0 > 0$.
Proposition. Denote $h_0^N$ the output gap in the Nash equilibrium. Then, the Nash equilibrium displays under-tightening $R_{0}^{NE} < R_{0}^{GP}$ if and only if $(\alpha^N - \alpha^T)(\sigma - \overline{\sigma})h_0^N > 0$.

- Examples w/ under-tightening in Nash-eqm:
  - Overheating, N are more labor intensive & $dT_B/dR < 0$
  - Recession, N are more labor intensive & $dT_B/dR > 0$
- Examples w/ over-tightening in Nash-eqm:
  - Overheating, N are more labor intensive & $dT_B/dR > 0$
  - Recession, N are more labor intensive & $dT_B/dR < 0$

Fornaro and Romei (2022): $\alpha^N = 1, \sigma = 1, \kappa = 0, \Rightarrow b_1/dR < 0, \hat{h} < 0$
Inflation-Output Tradeoff

Under-tightening for $\sigma < \bar{\sigma}$ and $\alpha^N > \alpha^T$

![Diagram showing the inflation-output tradeoff with an ideal point marked.](image-url)
Inflation-Output Tradeoff

Under-tightening for $\sigma < \bar{\sigma}$ and $\alpha^N > \alpha^T$

\[ \hat{\pi}_0, GP \quad \hat{h}_0, GP \]

ideal point

\[ (AS) \]
Under-tightening for $\sigma < \bar{\sigma}$ and $\alpha^N > \alpha^T$

Lower nominal interest rates for a SOE expand output and lower inflation
Inflation-Output Tradeoff

Under-tightening for $\sigma < \bar{\sigma}$ and $\alpha^N > \alpha^T$

Low nominal rates raise $R^*$ and generate even higher inflation
Quantitative Gains from Coordination

Output gap

Inflation gap

Welfare
Extensions/Other considerations

- Anticipated shocks can generate inflation and overheating
  - Under cooperation, $\hat{\pi} = \hat{h} = 0$ (Bianchi and Coulibaly, 2021)

- Sufficient statistics generalize with CES aggregator and imperfect labor mobility

- Other factors of production (e.g. oil)
  - Intensity of other factors of production irrelevant as long as their price is flexible
Extensions/Other considerations

- Anticipated shocks can generate inflation and overheating
  - Under cooperation, $\hat{\pi} = \hat{h} = 0$ (Bianchi and Coulibaly, 2021)

- Sufficient statistics generalize with CES aggregator and imperfect labor mobility

- Other factors of production (e.g. oil)
  - Intensity of other factors of production irrelevant as long as their price is flexible
  - Role of labor intensity for inflation
Conclusion

- Theory of monetary policy coordination under financial integration
- Nash equilibrium features over- or under-tightening depending on
  - the sign of output gap
  - differences in labor intensity
  - response of trade balance to exchange rate depreciations
- Quantitative gains can be significant for large shocks