Instruments, Targets and Trade-offs in a World of High Capital Mobility

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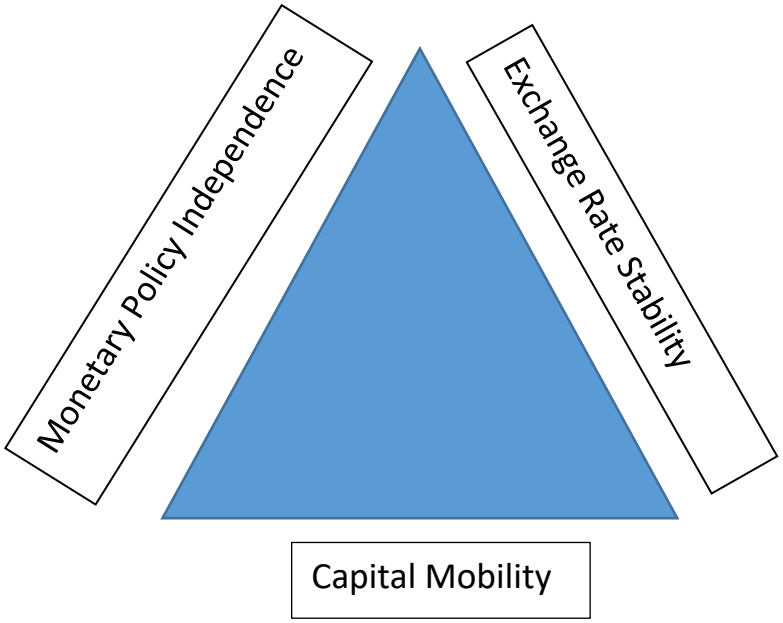
The Mundellian Trilemma



- The trilemma was first investigated in a world where the central bank has one instrument and one objective when deciding between a flexible and fixed exchange rate regime.
- In the 1960s the Mundellian Trilemma highlighted the **limitations of monetary policy under a fixed exchange rate.**

- Rey (2013, 2016) challenges the validity of the trilemma. The trilemma has morphed into a dilemma because of the emergence of a US-led world financial cycle. An independent monetary policy is now impossible, even under a flexible exchange rate.
- Her point is that US monetary policy drives a global financial cycle. This cycle is so powerful that even a flexible exchange rate does not permit a small open economy to chart an independent course for its monetary policy **→ a system of flexible exchange rates has its limitations.**

This paper presents a few theoretical insights pivotal to an understanding of the trilemma.

Our analysis

- Reaffirms the validity of the Mundellian Trilemma.
- Emphasizes the distinction between monetary policy independence and insulation from foreign policy shocks and global risk shocks.
- Suggests that the acute shortage of policy instruments in the new financial architecture limits a central bank's scope for stabilization policy because central banks need to consider more tradeoffs between policy objectives.
- To alleviate the shortage of policy instruments against the backdrop of a growing global financial cycle, a central bank needs additional potent policy instruments.
- Hence the need to consider capital controls and foreign exchange market intervention.

Definitions:

Monetary Policy Independence under flexible exchange rate: central bank has unimpeded control over its instruments and proximate targets.

Insulation: Primary domestic target variables (output, inflation) are not affected by **foreign** policy shocks (US policy rate change) and financial shocks (VIX), etc.

Outline of Paper:

2. Optimal Policy in the Simple Mundell-Fleming Model
3. Optimal Policy in the New Keynesian Model
4. Extensions
5. Optimal Policy in an Expanded New Keynesian Model with a Financial Market

Optimal Monetary Policy in the Simple Mundell-Fleming Model

$$y_t = a_0 - a_1 r_t + a_2 q_t + a_3 g_t + a_4 y_t^f + v_t \qquad (0.1)$$

$$r_t = r_t^f + E_t q_{t+1} - q_t + \varepsilon_t + VIX_t \qquad (0.2)$$

y is output; r is the domestic interest rate; r^f is the foreign (U.S. or other center country) interest rate; g is a measure of fiscal policy; y^f is foreign income; v is a white noise shock to output demand; q is the nominal exchange rate expressed as units of the domestic currency per unit of the foreign currency: Eq_{+1} is the expectation of *q* one period ahead: *VIX* is a world risk shock and ε is a white noise shock reflecting domestic disturbances to *UIP.*
The central bank's policy objective is limited to ensuring output stability:

$$Min\ L_t = \frac{1}{2} y_t^2 \qquad (0.3)$$

The central bank uses r_t as its sole instrument and uses discretion in setting policy.

Q: How does the central bank respond to a policy change abroad?

The optimal policy response is:

$$\frac{dr_t^*}{dr_t^f} = \frac{a_2}{a_1 + a_2} > 0 \qquad (0.4)$$

- Having control over its policy instrument and seeking to minimize its loss function the central bank adjusts its policy stance **in the same direction,** albeit by less than the change in the foreign policy rate. Thus if the Fed lowers its policy rate so does RBNZ.
- The central bank does so out of self-interest to protect domestic output from the effect of the foreign shock. In this simple example, the central bank completely **insulates** the domestic economy: $\Delta y_t = 0$.
- What's special about the optimal reaction of the central bank?
- In the literature, "monetary independence or autonomy" is often measured by examining the co-movement between a short-term interest rate in a small open or emerging economy and the policy rate in a center country (US, Euro-area, Japan, etc.)
- Extreme cases: fixed exchange rate: $\frac{dr_t^*}{dr_t^f} = 1$; flexible exchange rate (with "monetary independence" and monetary policy on hold): $\frac{dr_t^*}{dr_t^f} = 0$.
- Rey ((2013), (2016)), Davis and Presno (2017), and Klein and Shambaugh (2015): a positive response of the policy rate in the small country to the U.S. policy rate, for example, is inconsistent with the Mundellian trilemma.

A Modern Incarnation of the MT in an Open-Economy New Keynesian Model

$$y_t = E_t y_{t+1} - a_1 r_t + a_2 q_t + v_t \qquad (0.5)$$
$$\pi_t = \beta E_t \pi_{t+1} + \kappa y_t + b q_t + u_t \qquad (0.6)$$
$$r_t = r_t^f + E_t q_{t+1} - q_t + \varepsilon_t + VIX_t \qquad (0.7)$$
$$L_t = \frac{1}{2}(y_t^2 + \mu \pi_t^2) \qquad (0.8)$$

- Nominal rates are replaced with real rates.
- Dual mandate for central bank: 'flexible inflation targeting"
- Real exchange rate channel in the Phillips Curve if *b > 0*.
- Target rule for an optimizing central bank: $\theta y_t = -\pi_t$ (0.9)

$$\theta^* = \frac{a_1 + a_2}{\mu(\kappa(a_1 + a_2) + b)} \qquad (0.10)$$

Optimal policy response:

$$\frac{dr_t^*}{dr_t^f} = \frac{a_2(a_1 + a_2) + \mu(b + a_2\kappa)(b + \kappa(a_1 + a_2))}{(a_1 + a_2)^2 + \mu(b + \kappa(a_1 + a_2))^2} < 1$$

Thus it is the case that

$$\frac{dr_t^*}{dr_{t,b>0}^f} > \frac{dr_t^*}{dr_{t,b=0}^f} = \frac{dr_t^*}{dr_t^f} = \frac{a_2}{a_1 + a_2}$$

- Under flexible inflation targeting and with a real exchange rate channel the co-movement between the domestic policy rate and the foreign policy rate increases.
- Broadening the central bank's mandate to include real exchange rate stability as a secondary goal increases the optimal response further.

Measuring the Gains from Exchange Rate Flexibility: An Example

Flexible Exchange Rate			
Narrow Mandate			
$Var(y_t)$	$Var(\pi_t)$	$Var(r_t)$	$Var(q_t)$
0.062	0.95	3.66	7.78
Narrow Mandate $Loss = Var(y_t) + \mu Var(\pi_t)$ = 1.02 $\mu = 1$			
Broad Mandate			
$Var(y_t)$	$Var(\pi_t)$	$Var(r_t)$	$Var(q_t)$
0.20	0.94	4.03	5.18
Broad Mandate $Loss = \mu Var(y_t) + \mu Var(\pi_t) + \delta Var(q_t) = 1.57$ $\mu = 0.9524$, $\delta = 0.1\mu$			
Fixed Exchange Rate			
$Var(y_t)$	$Var(\pi_t)$	$Var(r_t)$	$Var(q_t)$
3.42	1.03	11.98	0
$Loss = Var(y_t) + \mu Var(\pi_t)$ = 4.46 $\mu = 1$			

All demand shock variances are four times the size of variance of cost-push shock.

- Marked output gap instability under a fixed exchange rate regime.
- Welfare loss from fixed exchange rate regime can be huge.

An Extension of the New Keynesian Model

Additional Goals

- Further expansion of mandate:
  $L_t = \frac{1}{2}(y_t^2 + \mu\pi_t^2 + \delta((LF_t - LF^*)^2 + q_t^2))$ (0.11)
- Financial stability is a secondary goal: $\delta = 0.1\mu$.
- Financial stability is defined in terms of stability of undesirable capital flows and the real exchange rate.

Model Refinements

- Domestic credit market to allow for distinction between *policy rate* and domestic *market interest rate*.
- Market interest rate drives aggregate demand.

Policy Instruments

- Interest rate, capital equalization tax

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The Expanded Model (with all forward expectations = 0 ⟺ shocks are white noise)

$$\pi_t = \kappa y_t + bq_t + u_t \quad (0.12)$$

$$y_t = -a_1\rho_t + a_2 q_t + v_t \quad (0.13)$$

$$C^D = d(\rho_t - r_t) + z_t^d \quad (0.14)$$

$$C^S = -s\rho_t + z_t^s \quad (0.15)$$

$$LF_t = LF^* + l_1\left(\rho_t - \tau_t - \rho_t^f\right) - l_2 VIX_t \quad (0.16)$$

$$CAP_t = c_1(\rho_t - (\rho_t^f + \varepsilon_t - q_t)) \quad (0.17)$$

$$CAP_t + LF_t + FXI_t + TB_t = 0 \quad (0.18)$$

$$LF_t + C_t^D + C_t^{CB} = C_t^S \quad (0.19)$$

τ_t= interest equalization tax instrument (additional tool) to help stabilize undesirable capital flows.

ρ_t = market interest rate.

$C_t^{CB} = TB_t = 0.$

An Analysis of Three Cases

Case 1: Target rule when only r_t is used:

$$\frac{\delta}{a_1+a_2}(l_1(LF_t - LF^*) - q_t) = \left(\frac{b}{a_1+a_2} + \kappa\right)\mu\pi_t + y_t \quad (0.20)$$

Clear trade-off between financial and key target variables

Case 2: Target rule when both r_t and τ_t are used:

$$\frac{\delta}{a_1+a_2}(-q_t) = \left(\frac{b}{a_1+a_2} + \kappa\right)\mu\pi_t + y_t \quad (0.21)$$

Limited trade-off between financial and key target variables

Case 3: $\tau_t = \rho_t - \rho_t^f$ applies to all capital flows and central bank sets r_t . This implies greater stability of the real exchange rate as $q_t = \varepsilon_t$. The underlying target rule is:

$$\frac{1}{\mu\kappa}y_t = -\pi_t. \quad (0.22)$$

No trade-off between financial and key target variables in target rule.

Linkage between policy instrument and real exchange rate is cut.

Results

Table 4: Responses, Variances, and Losses under a Flexible Rate: One Policy Instrument (r_t)

	y_t	π_t	ρ_t	q_t	LF_t	r_t	$Var(y_t)$	$Var(\pi_t)$	$Var(\rho_t)$	$Var(q_t)$	$Var(LF_t)$	$Var(r_t)$
u_t	-0.05	0.99	0.08	-0.08	0.31	0.77	0.79	0.99	0.86	0.91	2.15	19.8
v_t	0.80	0.05	0.31	-0.31	1.23	3.09	$Loss = Var(y_t) + \mu Var(\pi_t) + \delta(Var(q_t) + Var(LF_t))$ =					
ρ_t^f	-0.36	-0.02	0.86	0.14	-0.56	0.61	1.90 $\mu = 0.909091;\ \delta = .1\mu$					
ε_t	0.12	0.10	0.11	0.89	0.46	1.15						
VIX_t	-0.06	-0.015	0.09	-0.09	-0.13	-0.07						
z_t^d	-					2.0						
z_t^s	-					-2.0						

- Highlights the acute shortage of policy instruments
- Substantial output gap variability
- Close co-movement between domestic and foreign interest rates.

Table 5: Responses, Variances, and Losses under a Flexible Rate: Two Instruments (r_t, τ_t)

	y_t	π_t	ρ_t	q_t	LF_t	r_t	τ_t	$Var(y_t)$	$Var(\pi_t)$	$Var(\rho_t)$	$Var(q_t)$	$Var(LF_t)$	$Var(r_t)$	$Var(\tau_t)$
u_t	-0.20	0.95	0.30	-0.30	-	0.61	0.30	0.10	0.92	1.98	2.18	0	15.9	2.10
v_t	0.21	-0.10	1.22	-1.22	-	2.44	1.22	$Loss = Var(y_t) + \mu Var(\pi_t) + \delta(Var(q_t) + Var(LF_t))$ = 1.12						
ρ_t^f	-0.10	0.04	0.45	0.55	-	0.90	-0.55	$\mu = 0.909091;\ \delta = .1\mu$						
ε_t	-0.10	0.04	0.45	0.55	-	0.90	0.45							
VIX_t	-	-	-	-	-	-	-0.125							
z_t^d	-	-	-	-	-	2.0	-							
z_t^s	-	-	-	-	-	-2.0	-							

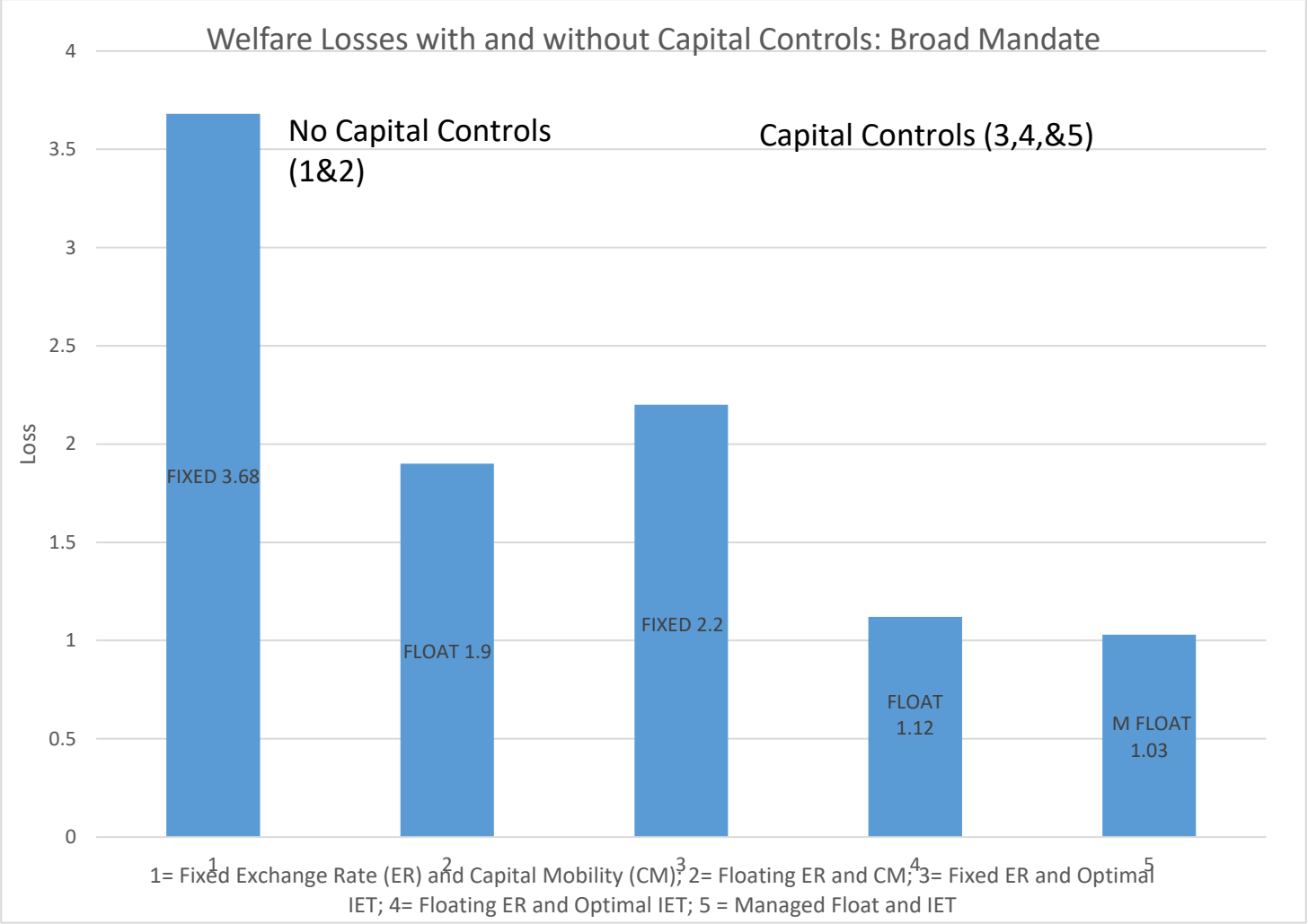
- Complete stabilization of undesirable capital flows.
- Better stabilization of output gap.
- Smaller response of market interest rate to foreign rate.
- Larger response of policy rate to foreign rate.

Table 6: Responses, Variances, and Losses under a Flexible Rate: Two Instruments ($\tau_t = \rho_t - \rho_t^f$)

	y_t	π_t	ρ_t	q_t	LF_t	r_t	τ_t	$Var(y_t)$	$Var(\pi_t)$	$Var(\rho_t)$	$Var(q_t)$	$Var(LF_t)$	$Var(r_t)$	$Var(\tau_t)$
u_t	-0.099	0.99	0.22	-	-	0.44	0.22	0.01	0.99	5.19	1	0.25	29.78	6.19
v_t	-	-	2.22	-	-	4.44	2.22	$Loss = Var(y_t) + \mu Var(\pi_t) + \delta(Var(q_t) + Var(LF_t))$ =						
ρ_t^f	-	-	-	-	-	-	-1.0	1.03 $\mu = 0.909091;\ \delta = .1\mu$						
ε_t	-0.01	0.099	0.46	1.0	-	0.91	0.46							
VIX_t	-	-	-	-	-0.50	-1.0	-							
z_t^d	-	-	-	-	-	2.0	-							
z_t^s	-	-	-	-	-	-2.0	-							

- Domestic economy and inflation are insulated from foreign policy shock and global risk premium shocks.
- Domestic market interest rate is immune to foreign policy change.
- Effective stabilization of output gap.
- Limited real exchange rate variability but high variability of instruments.
- Lowest overall loss score.

Which is More Important? Choice of Exchange Rate System or Capital Controls?



Conclusion

- A flexible exchange rate permits an independent monetary policy provided the central bank controls its policy instrument even in the presence of a world financial cycle. The Mundellian Trilemma is valid.
- The extent to which domestic and center countries' interest rate movements are correlated under a flexible exchange rate regime depends on multiple factors such as the mandate of the central bank and an exchange rate channel in the Phillips curve.
- Simple checks of interest correlations in empirical specifications of UIP and/or Taylor rules do not reveal the true extent of monetary policy independence under flexible exchange rates.
- With only one policy instrument there is no insulation from foreign disturbances in a highly stylized New Keynesian model with undesirable capital flows. There is a clear trade-off between primary and secondary policy objectives due to the acute shortage of policy instruments.
- An interest equalization tax – a macroprudential policy tool – to curb undesirable capital flows proves effective in stabilizing output.

- In this model complete insulation of domestic policy objectives from foreign policy changes and global risk shocks can be achieved if the interest equalization tax aims at stabilizing the real exchange rate.
- Choice of exchange rate system remains a first-order priority, much more so than capital controls.