A Theory of Capital Controls As Dynamic Terms of Trade Manipulation

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Tariffs and capital controls

- Tariffs: *Intratemporal* trade restriction
- Capital controls: *Intertemporal* trade restriction

- Trade approach: large literature on optimal tariffs as terms-of-trade manipulation (Bagwel-Staiger 1999, Broda-Limao-Weinstein 2008)
- International macro: little work making the connection

Questions

- This paper:
  - bridge the gap: trade policy in t
  - capital controls change incentives for domestic saving
- Questions:
  - how do capital controls affect interest rates?
  - how output fluctuations affect incentives for interest rate manipulation?
  - how do they affect intra-temporal terms of trade?

Results

- One good:
  - optimal capital controls not driven by absolute incentive to alter price of goods produced in t, but by relative incentive in t and $t+1$
  - in one-good economy relative growth rates determine sign of the tax
  - Home net financial position in period t not the relevant variable
- Many goods:
  - trade agreements that prohibit static tariffs/subsidies do not eliminate opportunity for manipulation of intra-temporal terms of trade through capital controls
  - optimal capital controls depend both on level and composition of growth rate

Literature

- Trade:
  - Large literature on tax policy in open economies (Dixit 1985)
  - Less work on intertemporal considerations (though work on repeated games, e.g., Bagwell and Staiger 1990, Staiger 1995, Maggi 1998)
  - Some work on trade policy in high-dimensional environments (Feenstra 1986, Itoh and Kyono 1987, Bond 1990)
- Macro:
  - Textbook two-period one-good economy (Obstfeld and Rogoff 1996)
  - Growing work on second-best capital controls (Calvo and Mendoza 2000, Aoki et al. 2010, Jeanne and Korinek 2010, Martin and Taddei 2010, Caballero and Lorenzoni 2010)
  - Monetary literature emphasizes trilemma (McKinnon and Oates 1966, Obstfeld, Shambaugh, and Taylor 2010)

Model

- two countries, Home and Foreign
- no uncertainty
- time-separable preferences

$$\sum_{t=0}^{\infty} \beta^t u(c_t)$$

- Foreign: possible different u^* but same β
- $*$ for foreign variables

Model (continued)

- endowments $\{y_t\}$,$\{y_t^*\}$

$$Y_t = y_t + y_t^*$$

- Home country intertemporal budget constraint (0 initial wealth)

$$\sum_t p_t \left(c_t - y_t\right) \leq 0$$

- but Home gov't can distort consumers behavior with taxes

Model (continued)

- unilateral policy
- Home gov't sets taxes
- given taxes find competitive equilibrium
- Optimal policy problem: choose taxes to maximize utility in associated CE

Primal approach

- supporting prices must satisfy

$$\lambda^* p_t = \beta^t u^{*\prime}(c_t^*)$$

for some $\lambda^* > 0$

- so impose constraint

$$\sum_t \beta^t u^{*\prime}(c_t^*)\,(c_t - y_t) \leq 0 \tag{1}$$

and resource constraint

$$c_t + c_t^* = Y_t \tag{2}$$

Primal approach (continued)

- planner problem: maximize home consumer's utility subject to (1) and (2)
- optimality condition

$$u'(c_t) = \mu \left(u^{*\prime}(Y_t - c_t) - u^{*\prime\prime}(Y_t - c_t)(c_t - y_t) \right)$$

- **Result:** *At optimal policy,* c_t *only depends on* y_t *and* Y_t

Optimal allocation

Assume $Y_t = Y$

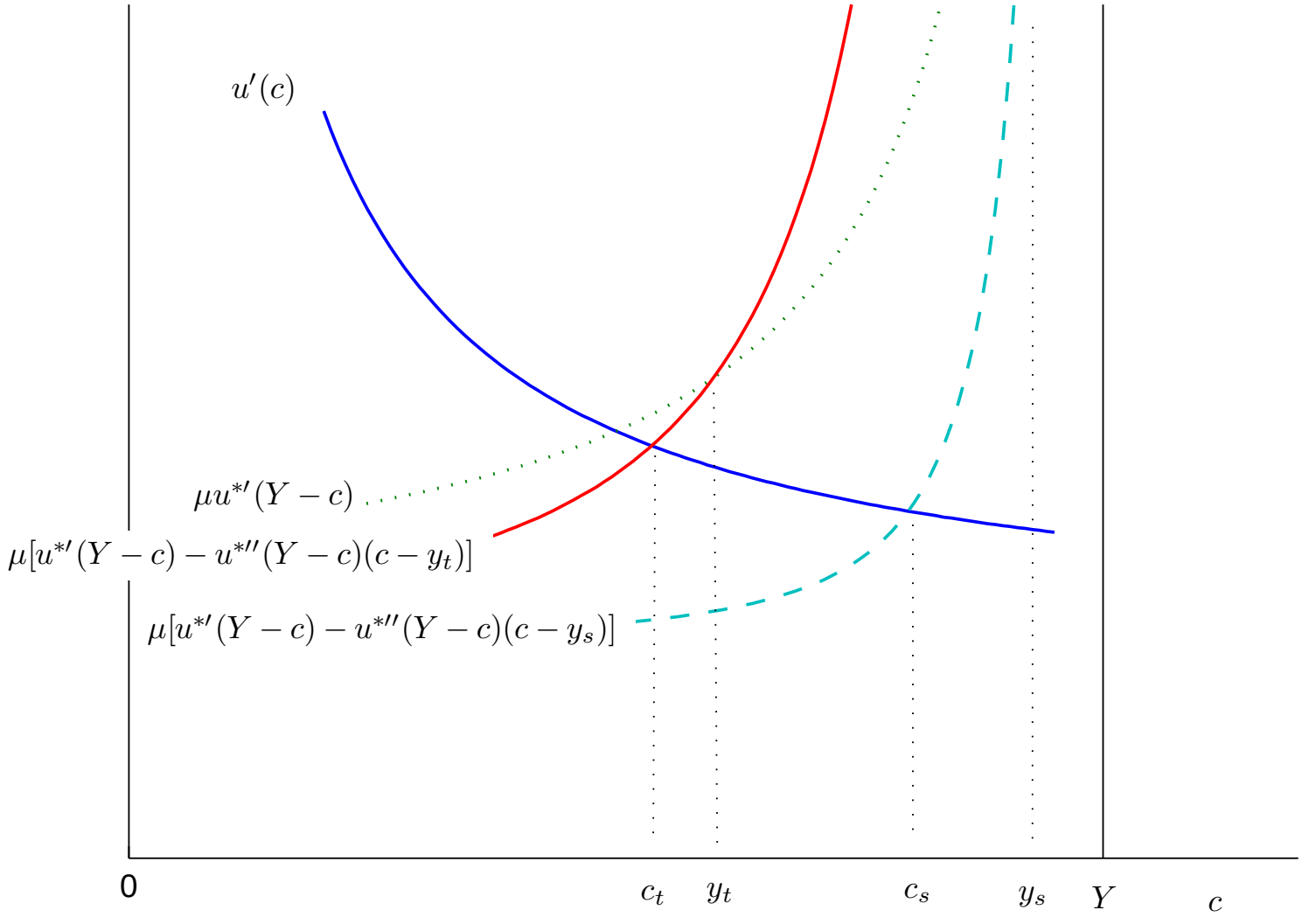
Proposition

Take two periods t and s, if $y_s > y_t$, then $c_s > c_t$

- Consumption is procyclical along the equilibrium path
- Graphical argument based on FOC:

$$u'(c_t) = \mu \left[u^{*\prime}(Y - c_t) - u^{*\prime\prime}(Y - c_t)(c_t - y_t) \right]$$

Optimal allocation (continued)



Optimal wedges

- Define

$$1+\tau_t = \frac{u'(c_t)}{\mu u^{*\prime}(Y-c_t)}$$

- using Home's FOC rearrange to get

$$\tau_t = -\frac{u^{*\prime\prime}(Y-c_t)}{u^{*\prime}(Y-c_t)}(c_t-y_t)$$

- $\tau_t > 0$ if and only if trade deficit $(c_t - y_t > 0)$
- intuition as in trade: Home wants to tax imports
- but also sharper result: monotonicity of τ_t in y_t
- from concave utility + Proposition 1

Optimal capital controls

Implementation using capital flow taxes

- Consumers trade one-period bonds on international capital markets
- Home government imposes proportional tax θ_t on gross return on net asset position
- per period budget constraint:

$$q_t a_{t+1} + c_t = y_t + (1 - \theta_t) a_t - l_t,$$

l_t lump sum tax

Optimal capital controls (continued)

- Home consumer's Euler equation:

$$u'(c_t) = \beta(1-\theta_t)(1+r_t)u'(c_{t+1}).$$

- Foreign consumer's Euler equation:

$$u^{*\prime}(c_t) = \beta(1+r_t)u^{*\prime}(c_{t+1}).$$

- So wedges τ_t and taxes θ_t satisfy

$$1-\theta_t = \frac{1+\tau_t}{1+\tau_{t+1}}$$

Optimal capital controls: main result

Combine relation θ-τ with monotonicity of $\tau \Rightarrow$

Proposition

Suppose optimal policy implemented with capital flows taxes. Optimal tax schedule satisfies:

1. *if* $y_{t+1} > y_t$ *tax inflows/subsidize outflows* ($\theta_t < 0$);
2. *if* $y_{t+1} < y_t$ *tax outflows/subsidize inflows* ($\theta_t > 0$);
3. *if* $y_{t+1} = y_t$ *no distortion* ($\theta_t = 0$).

Many goods

- same environment as before, except there are $n > 1$ goods
- $c, y, Y \in R^n$ vectors
- Home constrained by free-trade agreement $\Rightarrow$ relative prices of goods equalized across countries within periods
- only capital flows distortions
- how to capture restriction in Home's planning problem?

Monopolist problem revisited

- Home forced to choose Pareto optimal allocation each period
- assume homothetic preferences (useful to derive price indexes)

$$U\left(C_t\right)$$

where

$$C_t = g\left(c_t\right)$$

- Pareto optimal allocations $\left(c_t, c_t^*\right)$ solve

$$C^*\left(C_t\right) = \max_{c,c^*} \left\{g^*(c^*) : c + c^* \leq Y, g(c) \geq C_t\right\}$$

Monopolist problem revisited (continued)

- write solution to Pareto problem parametrized by Home consumption C_t

$$c\left(C_t\right)$$
$$c^*\left(C_t\right)$$

- and define

$$\rho(C_t) \equiv U^{*\prime}\left(C^*\left(C_t\right)\right) g_c^*\left(c^*\left(C_t\right)\right)$$

Monopolist problem revisited (continued)

- Home chooses sequence $\{C_t\}$ that maximizes U subject to

$$\sum_t^{\infty} \beta^t \rho(C_t) \cdot (c(C_t) - y_t) = 0$$

- Home's planning problem FOC:

$$U'(C_t) = \mu \left[\rho(C_t) \cdot \frac{\partial c(C_t)}{\partial C_t} + \frac{\partial \rho(C_t)}{\partial C_t} \cdot (c(C_t) - y_t) \right]$$

Optimal allocation

Proposition

Suppose between t and $t+1$ small change in Home's endowment

$$dy_{t+1} = y_{t+1} - y_t$$

Then domestic consumption is higher in period $t+1$, $C_{t+1} > C_t$, if and only if

$$\frac{\partial \rho(C_t)}{\partial C_t} \cdot dy_{t+1} > 0$$

Optimal allocation (continued)

- in one good case

$$\frac{\partial \rho(C_t)}{\partial C_t} = -u^{*\prime\prime}(Y - c_t)$$

  and only endowment level matters

- here composition matters

- e.g. if $\rho(C_t) \cdot dy_{t+1} = 0$ then Home taxes inflows/subsidizes outflows iff

$$Cov\left(\frac{\rho_i'(C_t)}{\rho_i(C_t)}, \rho_i(C_t) dy_{it+1}\right) > 0$$

Optimal capital controls

Proposition

Suppose optimal policy implemented with capital flows taxes. Suppose small change in Home endowment dy_{t+1} between t and $t+1$. Then it is optimal to

1. *tax inflows/subsidize outflows if* $\frac{\partial \rho(C_t)}{\partial C_t} \cdot dy_{t+1} > 0$
2. *tax outflows/subsidize inflows if* $\frac{\partial \rho(C_t)}{\partial C_t} \cdot dy_{t+1} < 0$

- **Proof:**
  - Same strategy as in the one good case. First write:

$$1 - \theta_t = \left(\frac{1+\tau_t}{1+\tau_{t+1}} \right) \left(\frac{P_{t+1}/P^*_{t+1}}{P_t/P^*_t} \right).$$

  - Then use consumption results to sign changes in τ and P^*/P

Intertemporal and intratemporal distortions

- Let $\pi_t \equiv p_t / P_t^*$ denote prices relative to Foreign consumption basket
- Sign of θ_t depends on sign of

$$\frac{P^{*\prime}(C_t)}{P^*(C_t)} \sum_i \pi_i(C_t)\, dy_{it+1} + \sum_i \frac{\pi_i'(C_t)}{\pi_i(C_t)} \pi_i(C_t)\, dy_{it+1}$$

- First-term captures intertemporal price channel
- Second-term captures intratemporal price channel
- To sign this term we need to know more about preferences
- With identical preferences, no effect

CRRA/Cobb-Douglas example

- Home preferences

$$U(C) = \frac{1}{1-\gamma} C^{1-\gamma},\ C = c_1^{\alpha} c_2^{1-\alpha}$$

- same for Foreign with α and $1-\alpha$ switched
- $\alpha > 1/2$ captures cross-country demand differences
- good 1 and 2 called import-oriented and export-oriented

CRRA/Cobb-Douglas example (continued)

Proposition

If growth import-oriented, $dy_{1t+1} > 0$ *and* $dy_{2t+1} = 0$*, optimal to tax inflows/subsidize outflows* ($\theta_t < 0$)

If growth export-oriented, $dy_{1t} = 0$ *and* $dy_{2t+1} > 0$*, optimal to tax inflows/subsidize outflows* ($\theta_t < 0$) *if and only if*

$$\gamma > \frac{2\alpha - 1}{\alpha} \frac{P_t^* C_t^*}{P_t^* C_t^* + P_t C_t}$$

Intuition:

- For import-oriented good, intertemporal and intratemporal considerations aligned: an increase in C further increase the relative price of good 1
- For export-oriented good, two forces go in opposite directions

Intertemporal and intratemporal trade

Main lessons

- incentive to distort trade over time does not depend only on overall output growth, but also on composition
- in multi-good world in which countries have different preferences, a change in aggregate consumption also affects intratemporal prices
- related to transfer problem of Keynes and Ohlin
- here distorting consumers' decision to allocate spending between different periods a country also affects its static terms of trade

Trade policy vs intertemporal policies

- Now allow country to tax each good separately
- Unrestricted tax instruments
- Same approach, now implementability constraint is

$$\sum_{t}^{\infty} \beta^t u_c^*(c_t^*) \cdot (c_t - y_t) = 0$$

- Solve planner problem, optimality condition

$$u_c(c_t) = \mu \left(u_c^*(c_t^*) - u_{cc}^*(c_t^*) \cdot (c_t - y_t) \right)$$

- 2 goods, write optimal wedges

$$\begin{aligned}\tau_{1t} &= (y_{1t} - c_{1t}) \left(\frac{u^*_{11}(c^*_t)}{u^*_1(c^*_t)} - \frac{u^*_{12}(c^*_t)}{u^*_2(c^*_t)} \Delta_t \right) \\ \tau_{2t} &= (c_{2t} - y_{2t}) \left(\frac{u^*_{21}(c^*_t)}{u^*_1(c^*_t)} \frac{1}{\Delta_t} - \frac{u^*_{22}(c^*_t)}{u^*_2(c^*_t)} \right)\end{aligned}$$

  where

$$\Delta_t = \frac{p_{2t}(c_{2t} - y_{2t})}{p_{1t}(y_{1t} - c_{1t})}$$

- say country exports 1, imports 2 at t
- near trade balance optimal policy involves the combination of an *import tariff* and an *export tax*

- if you cannot do it good by good then intertemporal wedge is a weighted average τ_t
- restricting consumption at t is good on the import tariff side, but it's bad on the export side
- consider an economy running a trade surplus
- if restricting domestic consumption C_t at t leads to: (i) to a deterioration in static terms of trade; (ii) to a lower intertemporal price P_t^*; then $\tau_t < 0$, incentive to expand consumption in that period

Concluding remarks

- Simple theory of optimal capital controls in which motive for capital controls is manipulation of interest rates and terms of trade

- **Lesson 1**: Optimal capital controls depend on relative strength of incentive to distort between periods

- **Lesson 2**: Intertemporal distortions can be used to affect intratemporal terms of trade

- Not easy to use 2 to rationalize mercantilistic saving policies