

# Trade and Macroeconomics

## Lecture 5: International markets and national governments

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July 11, 2014

# Policy Making in the Global Economy

- globalization is creating markets much larger than political constituencies
  - ▶ policy externalities?
  - ▶ free-riding?
  - ▶ tension on world political institutions?
- we will discuss:
  - 1 taxation in the presence of terms-of-trade effects
  - 2 redistributive policies in the presence of technology externalities
  - 3 globalization and the size of countries
- these are just some examples of the new challenges to policy making posed by globalization

# Rodrik (1998): Openness and the Size of Government

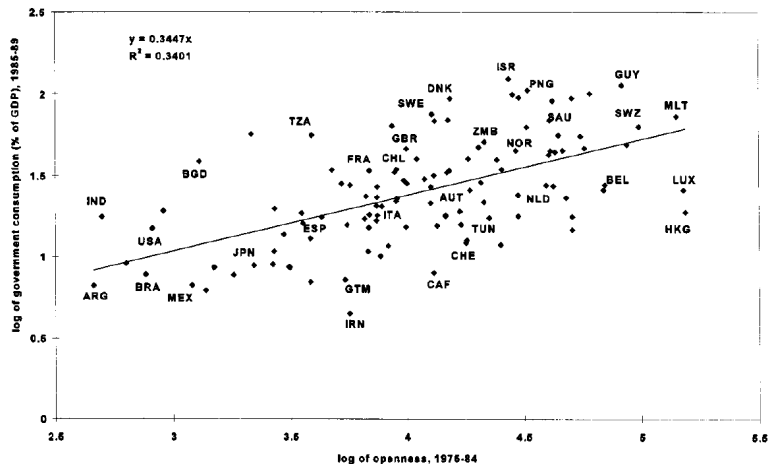


FIG. 2.—Partial relationship between openness and government consumption (when one controls for per capita income, urbanization, dependency ratio, area, and regional dummies).

# Epifani & Gancia (2009)

- idea:
  - ▶ trade may induce governments to increase (inefficiently) its size
  - ▶ why? in open countries part of the costs of domestic taxation is paid by foreigners
- world economy:
  - ▶ large number  $N$  of symmetric small countries, each of size 1
  - ▶ continuum  $[0, 1]$  of industries producing differentiated goods
  - ▶ each countries produces ONE variety in EVERY industry (Armington)
- governments provide:
  - ▶ a country-specific public good financed through taxation  $g$
- imperfect economic integration:
  - ▶ varieties are traded in a measure  $\tau \in [0, 1]$  of sectors only
  - ▶ study how  $\uparrow \tau$  affects  $g$

# Preferences

- focus on a single country (no country-index):

$$U = \left( \exp \int_0^1 \log C_j dj \right)^\eta G^{1-\eta}, \quad \eta \in (0, 1)$$

- ▶  $G$  = country-specific public good
  - ▶  $\eta$  = preference for private goods
  - ▶ log utility  $\rightarrow P_j C_j = P_i C_i$
- $C_j$  = CES basket of differentiated goods,  $j \in [0, 1]$  :

$$C_j = \left( \sum_{i \in N} c_{j,i}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \quad \sigma > 1$$

- ▶  $c_{j,i}$  = variety produced by country  $i$  in industry  $j$
- ▶  $\sigma$  = elasticity of substitution

# Demand and the Terms of Trade

- supply = aggregate demand:

$$y_{j,i} = \frac{p_{j,i}^{-\sigma}}{P_j^{1-\sigma}} E_j$$

- ▶  $y_{j,i}$  = supply of variety produced by country  $i$  in industry  $j$
  - ▶  $P_j \equiv \left( \sum_{i \in N} p_{j,i}^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$ ,
  - ▶  $E_j$  = world expenditure
- countries are small:
    - ▶ take  $E_j$  and  $P_j$  as parametric  $\rightarrow$  normalize  $P_j = E_j = 1$
    - ▶ for  $j \in [0, \tau]$ , export  $y_{j,i}$  import  $C_j$ :

$$\text{Terms of Trade} \equiv \frac{p_{\text{export}}}{p_{\text{import}}} = \frac{p_{j,i}}{P} = y_{j,i}^{-1/\sigma}$$

- ▶ a fall in  $y_{j,i} \rightarrow$  TOT improvement (more when  $\sigma$  is low)

# Production and Labor Allocation

- unit cost = wage (in all sectors, including  $G$ ) + perfect competition:

- ▶  $p_j = p = w$

- allocation of labor:

- ▶ to the public sector,  $L_g$  :

$$gw = wL_g \rightarrow L_g = g$$

- ★ tax revenue = wage bill

- ▶ to any nontraded sector,  $L_n$ :

$$(1 - g)w = wL_n \rightarrow L_n = 1 - g$$

- ★ after tax expenditure = revenue

- ▶ to any traded sector,  $L_\tau$ :

$$L_\tau = 1 - g$$

- ★ from labor market clearing,  $L_g + (1 - \tau)L_n + \tau L_\tau = 1$

# Aggregation

- by symmetry, utility collapses to:

$$U = \left[ \exp \int_0^1 \log C_j dj \right]^\eta G^{1-\eta} = \left( C_n^{1-\tau} C_\tau^\tau \right)^\eta G^{1-\eta}$$

- ▶ where

$$G = g$$

$$C_n = 1 - g$$

$$C_\tau = \frac{\text{after tax income}}{\text{price}} = \frac{w(1-g)}{P} = (1-g)^{1-\frac{1}{\sigma}}$$

- ▶ recall  $w = p_\tau = L_\tau^{-1/\sigma}$ ,  $P = 1$
- trade-off ( $g$ ):
  - ▶ public versus private consumption



# Openness and Taxation

- government objective function:

$$\text{Max}_g U = \left[ (1 - g)^{1 - \frac{\tau}{\sigma}} \right]^\eta g^{1 - \eta}$$

- ▶ FOC,  $\frac{\partial U}{\partial g} = 0$ :

$$g = \frac{1 - \eta}{1 - \eta\tau/\sigma}$$

- ▶ taxation grows with "globalization" ( $\tau$ ), the more so the smaller is  $\sigma$

- why?

- ▶  $g$  crowds out  $y_j$  and induces a TOT improvement
- ▶ stronger effect if more goods are traded (high  $\tau$ ) and TOT are sensitive (low  $\sigma$ )
- ▶ yet, if all countries behave symmetrically, no change in any TOT  $\rightarrow$  only overspending

# Some Evidence

- show evidence on the correlation between  $g$  and  $\tau$  using data for  $\sim 150$  countries between 1950-2000
- shows that the correlation depends on a low  $\sigma$ , as for the TOT argument
  - ▶ two proxy for  $\sigma$ :
    - ① share of differentiated products in total export (Rauch, 1999)
    - ② average  $\sigma$  of exports (Broda & Weinstein, 2006)
  - ▶ correlation between  $g$  and  $\tau$  is stronger for countries exporting more differentiated products (low  $\sigma$ )
- Rodrik (1998) alternative mechanism
  - ▶ openness increase risk and the demand for public insurance
  - ▶ less supported by the data

# Evidence

## *Openness, export differentiation and government size (fixed-effects, I)*

Dependent variable: government consumption (% of GDP).

Export differentiation proxy ( $z_i^{ra}$ ) built on Rauch (1999).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Openness	0.094*** [0.014]	0.039 [0.026]	-0.019 [0.023]	0.143 [0.090]	-0.022 [0.023]	-0.004 [0.026]	-0.222*** [0.043]	-0.152 [0.122]
Openness $\times z_i^{ra}$		0.111** [0.047]	0.147*** [0.043]	0.166*** [0.044]	0.160*** [0.044]	0.135*** [0.046]	0.280*** [0.048]	0.283*** [0.052]
Log of income			-2.820*** [0.903]	-1.717 [1.080]	-2.911*** [0.907]	-2.196** [0.964]	-2.378*** [0.889]	-1.278 [1.201]
Log of population			9.339*** [1.454]	8.678*** [1.494]	8.613*** [1.579]	9.313*** [1.579]	8.087*** [1.442]	7.576*** [1.681]
Openness $\times$ log of income				-0.020* [0.011]				-0.009 [0.013]
Openness $\times$ institutional quality					-0.02 [0.017]			-0.003 [0.020]
ToT variability						0.289 [1.184]		0.054 [1.157]
Openness $\times$ ToT variability						-0.014 [0.017]		-0.012 [0.017]
Openness $\times$ export concentration							0.414*** [0.074]	0.444*** [0.081]
Time dummies			YES	YES	YES	YES	YES	YES
Observations	973	859	859	859	859	765	859	765
Countries	128	112	112	112	112	111	112	111
$R^2$	0.05	0.06	0.30	0.31	0.31	0.29	0.33	0.33

# Technology Externalities and Asymmetric Institutions

- globalization can induce governments to adopt different redistributive policies
- different styles of capitalism:
  - ▶ US → unfettered competition, high risk taking, high inequality
  - ▶ Nordic-style social democracy → redistribution, social protection, low inequality
- Acemoglu, Robinson & Verdier (ARV, 2014):
  - ▶ with international economic linkages, institutional choices of different societies are entangled
- in the presence of technology spillovers:
  - ▶ Nordic-style capitalism may provide higher welfare
  - ▶ but it may be the cut-throat US capitalism that makes possible the existence of more cuddly Nordic societies

# ARV (2014): Main Argument

- technological spillovers:
  - ▶ all countries benefit from innovations in the most advanced country
- imperfect insurance:
  - ▶ moral hazard → inducing effort in innovation requires higher rewards to successful entrepreneurs (inequality)
- main result:
  - ▶ countries at the technology frontier will prefer high innovation and high inequality
  - ▶ followers may prefer institution with low innovation and low inequality
  - ▶ welfare may even be higher in followers!
- intuition:
  - ▶ when one country is at the frontier, the incentives for others to innovate are weaker
  - ▶ if the world technology frontier is pushed out by the US, low innovations in Nordic countries will only have level effects, not growth effect

# ARV (2014): Assumption

- the environment:
  - ▶  $J$  countries
  - ▶ each country inhabited by a unit measure of non-overlapping generations living for  $\Delta t \rightarrow 0$
  - ▶ agents work both as workers and innovators
  - ▶ no trade (only technological spillovers)
- final good technology:
  - ▶ production is a function of ideas ( $N_{j,t}$ ) and labor ( $L = 1$ ):  $Y_{j,t} = N_{j,t}$
- innovation:
  - ▶ law of motion of ideas ( $N_{j,t}$ )

$$\dot{N}_{j,t} = (e_{j,t} + g_L) (N_t)^\phi (N_{j,t})^{1-\phi}$$

- ▶  $e_t \in \{0, 1\}$  = average effort
- ▶  $N_t = \max \{N_{1,t}, \dots, N_{J,t}\}$  = world technology frontier
- ▶  $\phi$  = knowledge spillover from the technology frontier

# Preferences

- utility of generation  $t$ :

$$U_{j,t} = \ln C_{j,t} + \ln (1 - e_{j,t}\gamma)$$

- ▶  $\gamma$  = cost of effort
- objective function of the government

$$W_j = \int_0^{\infty} \exp(-\rho t) \mathbb{E} U_{j,t} dt$$

- ▶  $\rho$  = discount rate on future generations
- to simplify notation, omit  $t$ -index

# Policy Instrument: Reward Structure

- one policy instrument

- ▶ government can choose a time-invariant reward structure:

$$R_j^i = \tilde{R}_j^i + w_j, \quad i \in \{s, u\}$$

- ▶  $\tilde{R}_j^i$  = entrepreneurial income,  $w_j$  = wage
- ▶ success depends on effort:

$e_j = 1 \rightarrow$  probability of success ( $i = s$ )  $\rightarrow q$

$e_j = 0 \rightarrow$  zero probability of success  $\rightarrow i = u$

- conflicting goals:

- ▶ induce effort vs. providing insurance (moral hazard)



# Effort and Insurance

- moral hazard:

- ▶  $e_j$  is private information  $\rightarrow$  inducing effort requires  $\mathbb{E}U_{e=1} \geq \mathbb{E}U_{e=0}$

$$q \ln R^s + (1 - q) \ln R^u + \ln(1 - \gamma) \geq \ln R^u$$

rearranging

$$\frac{R^s}{R^u} \geq (1 - \gamma)^{-1/q} > 1$$

- ▶ success should be rewarded enough
- two possibilities for the government
  - ▶  $e = 1 \rightarrow R^s = R^u (1 - \gamma)^{-1/q}$  (max insurance, given incentives)
  - ▶  $e = 0 \rightarrow R^s = R^u$  (full insurance)
- $R^s$  and  $R^u$  must also satisfy the resource constraint
  - ▶ from  $qR^s + (1 - q)R^u = N_j$ , we can solve for  $R^s$  and  $R^u$  as fractions of  $N_j$

# Equilibrium Given Policies

- welfare

$$\mathbb{E}U_j = q \ln R^s + (1 - q) \ln R^u + e_j \ln(1 - \gamma) = \ln N_j + e_j \ln \omega$$

- ▶  $\omega < 1 \rightarrow$  given  $N_j$ , inducing effort is costly

- Balanced Growth Path

- ▶ leader<sup>(\*)</sup> ( $N^* = \max\{N_1, \dots, N_J\}$ ):

$$\dot{N}^*/N^* = g_L + e^* \delta = g^*$$

- ▶ followers<sub>(j)</sub> ( $N_j < N^*$ ):

$$\dot{N}_j = (g_L + e_j \delta) (N^*)^\phi (N_j)^{1-\phi}$$

- ▶ in a BGP,  $\dot{N}_j/N_j = g^* \rightarrow N_j = \left(\frac{g_L + e_j \delta}{g^*}\right)^{1/\phi} N^*$
- ▶ due to technology spillovers, all countries grow at  $g^*$ , but less innovative countries are poorer ( $N_j < N^*$ )

# Equilibrium Policies: Asymmetric Institutions

- problem of the government
  - ▶ choose  $R_j^i$  to induce  $e_j \in \{0, 1\}$  to maximize

$$W = \int_0^{\infty} \exp(-\rho t) \mathbb{E} U_t dt = \int_0^{\infty} \exp(-\rho t) (\ln N_j + e_j \ln \omega) dt$$

with:

$$\begin{aligned}\dot{N}_j &= (g_L + e_j \delta) (N^*)^\phi (N_j)^{1-\phi} \\ \dot{N}^* / N^* &= g_L + e^* \delta = g^*\end{aligned}$$

- trade-off:
  - ▶ cost of effort = less insurance ( $\ln \omega < 0$ )
  - ▶ benefit of  $e_j = 1$   $\begin{cases} \text{for leader} \rightarrow \text{higher growth (growth effect)} \\ \text{for follower} \rightarrow \text{higher } N_j \text{ (level effect)} \end{cases}$
- main results:
  - ▶ if  $\phi > \bar{\phi}$  and  $\delta > -\rho \ln \omega \rightarrow$  the leader will choose  $e^* = 1$ , followers  $e^* = 0$
  - ▶ welfare can be higher in followers countries,  $W^* < W_j$

# Asymmetric Institutions: Proof

- consider  $\phi \rightarrow \infty$  then  $N_j \rightarrow N^*$ 
  - ▶ using  $N_t^* = N_j^* \exp(g^* t)$ :

$$\begin{aligned}\rho W_j(N_j) &= \rho \int_0^\infty [e_j \ln \omega + \ln N^* + g^* t] \exp(-\rho t) dt \\ &= e_j \ln \omega + \ln N^* + \frac{g^*}{\rho}\end{aligned}$$

- ▶ problem of the leader

$$\begin{aligned}\rho W^* &= \max_{e^*} \left\{ \ln N^* + e^* \ln \omega + \frac{g_L + e^* \delta}{\rho} \right\} \\ W_{e=1}^* &> W_{e=0}^* \quad \text{if } \delta > -\rho \ln \omega\end{aligned}$$

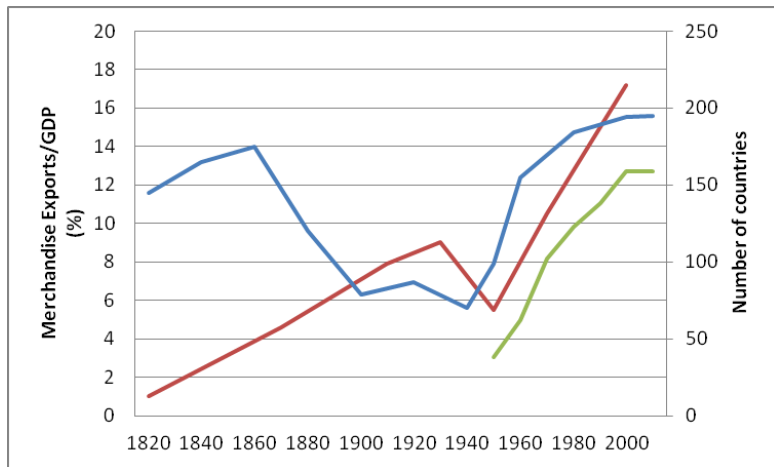
- ▶ problem of the follower

$$\rho W_j = \max_{e_j} \left\{ \ln N^* + e_j \ln \omega + \frac{g^*}{\rho} \right\} \rightarrow e = 0$$

note that in this case  $W_j > W^*$ !

- by continuity, true for sufficiently high technology spillovers,  $\phi$

# Globalization and Political Structure



red: exports; blue: countries; green: WTO members

# Alesina, Spolaore and Wacziarg (2000, 2005)

- trade integration can explain political disintegration
- optimal size of countries depends on a trade-off:
  - ▶ benefit of size → IRS on internal market
  - ▶ cost of size → higher "cultural" heterogeneity
- key idea:
  - ▶ the economic benefits of country size are mediated by the degree of openness to trade
  - ▶ trade allows even small countries to exploit large international markets
  - ▶ domestic markets matter less in a very integrated world
- by reducing the benefit of size, free trade makes the formation of smaller more homogeneous countries optimal

# Gancia, Ponzetto & Ventura (2014)

- alternative view of globalization
  - ▶ fraction of goods that can be traded
- alternative political structure:
  - ▶ countries: remove internal borders
  - ▶ international unions: remove borders between countries, fixed cost
- globalization increases the value of removing borders
  - ▶ autarky: small countries
    - ★ no trade  $\rightarrow$  no need to remove borders
  - ▶ low level of globalization: bigger countries
    - ★ to take advantage of trading opportunities country size grow
    - ★ still, cost of cultural heterogeneity  $<$  cost of creating unions
  - ▶ high level of globalization: unions + small countries
    - ★ trade opportunities high enough to justify the fixed cost of unions

# What Did We Learn?

- globalization is creating large international markets
- some political implications:
  - ▶ international externalities → inefficient national policies
  - ▶ need for more international cooperation
- globalization is putting pressure on national states
  - ▶ growth of international organizations
  - ▶ desire for political fragmentation at the local level