

# **North-South Trade and Food Standards: What Can Equilibrium Analysis Tell Us?**

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# Motivation

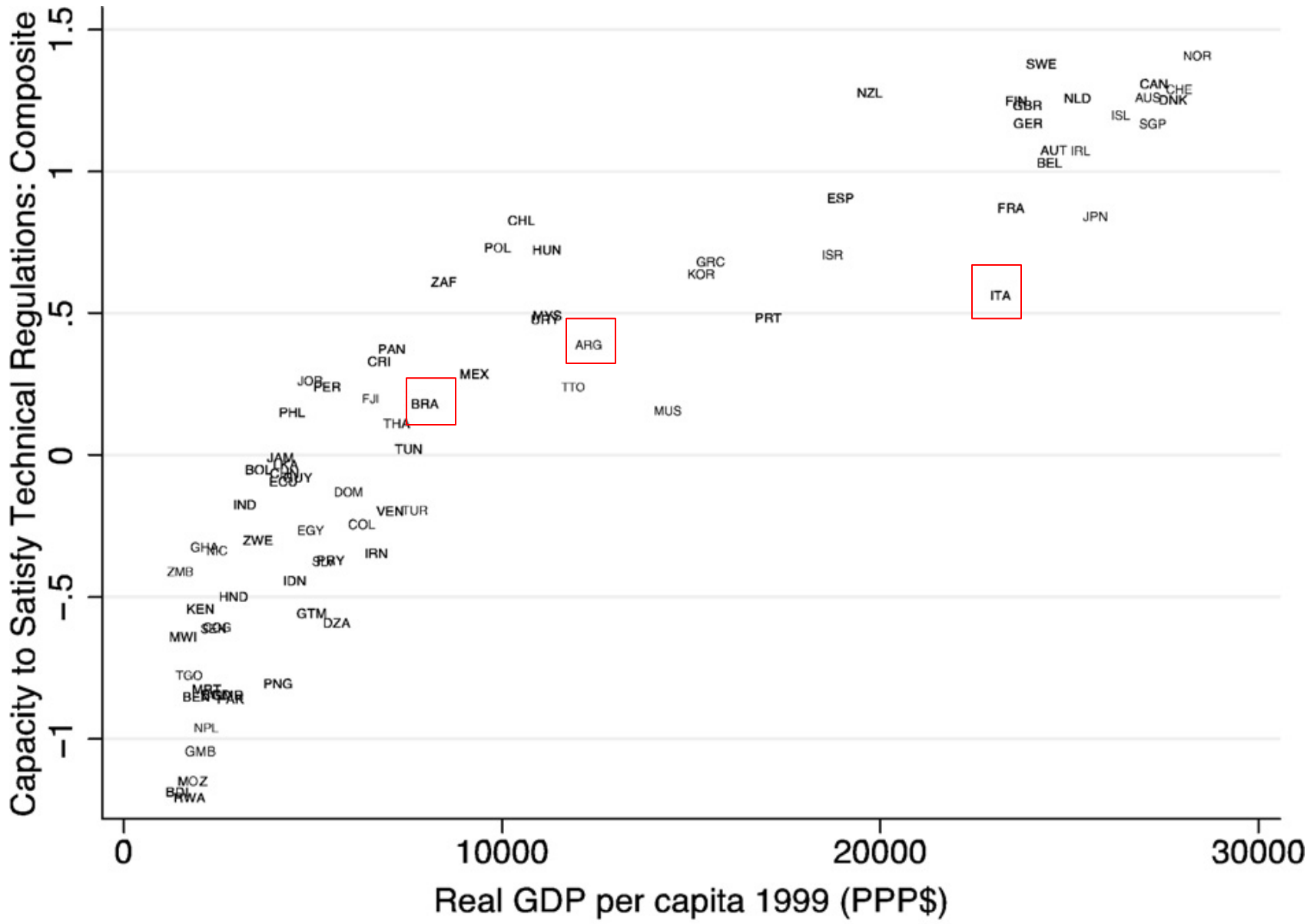
- In post-war period, distribution of goods within national markets and across borders increasingly affected by standards and technical regulations
- Particularly noticeable in food and agriculture over past 20 years – Essaji (2008) finds 6 of 10 sectors (2-digit HS) with highest regulation intensity, in food and agricultural products
- Proliferation of standards and technical regulations typically regarded as response of policymakers to consumer demands for food safety, environmental protection and greater product information

# Motivation

- While standards often justified as solving for specific market failures (Josling et al., 2004), may also provide protection and subject to “regulatory capture” (Swinnen and Vandemoortele, 2009)
- Early theoretical work by Casella (1996) shows provision of standards will differ between countries based on stage of development, but will converge over time as incomes rise
- In contrast to benign view, much empirical analysis of “standards as barriers” – results typically showing developed country (DC) standards are trade barriers

# Motivation

- **Specifically, less developed countries (LDCs) hampered in ability to meet standards due to lack of necessary human capital, and poor governance (Maskus and Wilson, 2001)**
- **Essaji (2008) presents empirical evidence to support notion that capacity to satisfy standards is correlated with GDP, LDCs specializing away from industries with heavier regulatory burdens**
- **Policy implication - DCs should target aid for trade at enabling LDCs better meet standards**
- **How far can one get with general equilibrium model of trade with standards that captures stylized facts?**



Source: Essaji (2008)

# General Equilibrium - Production

- Adapt model of Copeland and Taylor (1994)
- Assume developed North, and less developed South, producing along a continuum of goods  $z \in [0,1]$ , with one input, effective labor  $l$
- Local public bad  $b$  produced jointly with  $z$ , and output  $y$  of good  $z$  is function of  $b$  and  $l$ :

$$(1) \quad y(b, l; z) = \begin{cases} l^{1-\alpha(z)} b^{\alpha(z)} & \text{if } b \leq \lambda l \\ 0 & \text{if } b > \lambda l \end{cases}$$

where  $\lambda > 0$ ,  $\alpha(z)$  varies across goods, and assuming:

$$\alpha(z) \in [\bar{\alpha}, \hat{\alpha}], \text{ with } 0 < \bar{\alpha} < \hat{\alpha} < 1$$

# General Equilibrium - Production

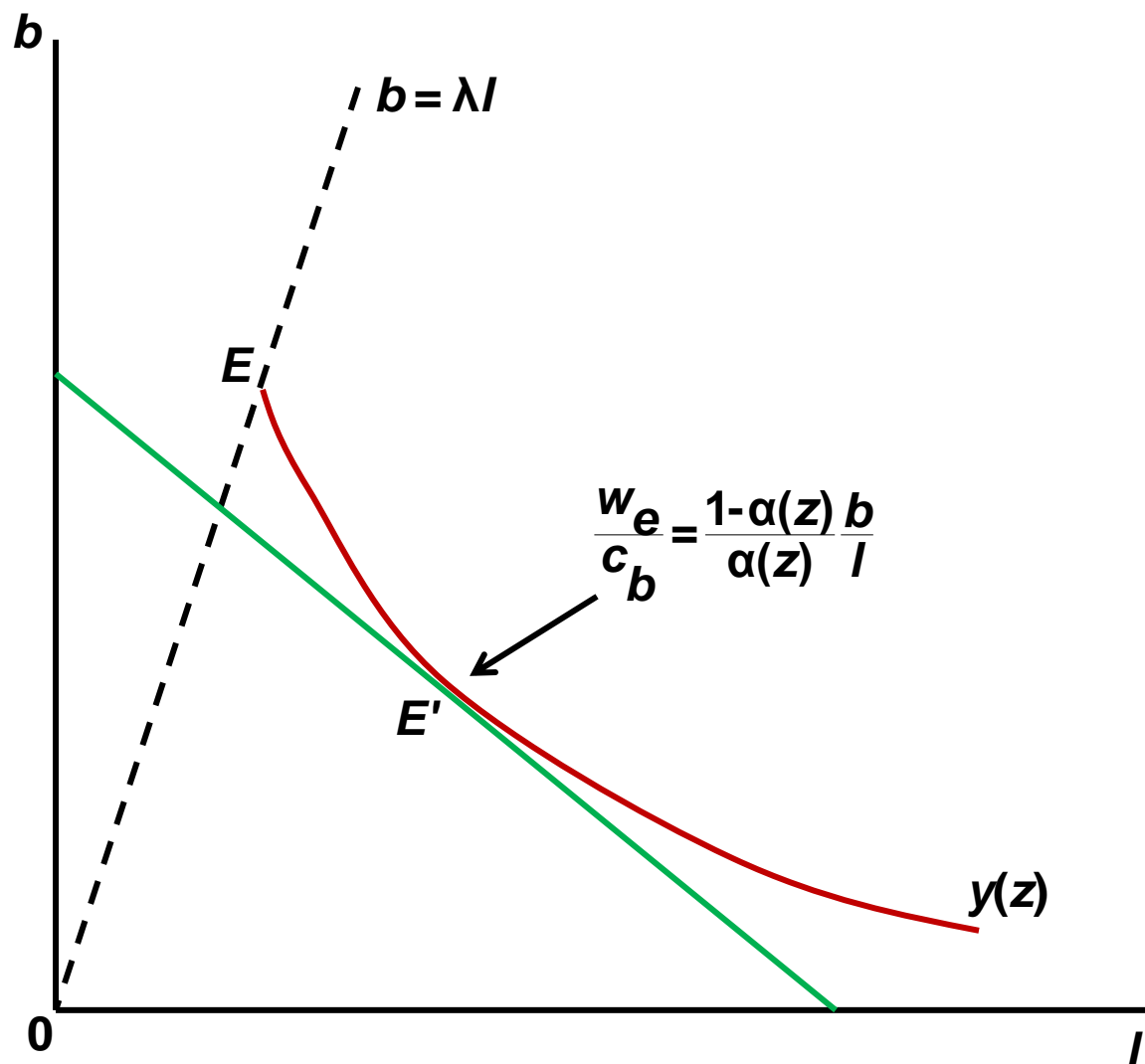
- (1) available to North and South, and each has same number of workers  $L$ , supply of effective labor being  $A(h)L > A(h^*)L$ , where  $h$  is human capital/worker, and  $h > h^*$  (\* denotes South)
- Standard  $s$ , set for level of local public bad, varies in income  $I$  - modeled as compliance costs  $c_b$  which vary in  $s$  (certification and monitoring costs for pesticides)

- Given effective wage  $w_e$  cost minimization implies:

$$(2) \quad \frac{w_e}{c_b} = \frac{1 - \alpha(z) b}{\alpha(z) I}$$

- Share of costs in meeting standard is  $\alpha(z)$ , goods being ordered in terms intensity of  $b$ ,  $\alpha'(z) > 0$

# Figure 1: Production Technology





# General Equilibrium - Consumption

- Consumers in North and South have identical indirect utility functions,  $z$  and  $b$  being separable in utility, and share of spending on  $z$  is constant:

$$(3) \quad V = \int_0^1 f(z) \ln[x(z)] dz - \int_0^1 f(z) [\ln p(z)] dz + \ln i - \frac{\beta D^\gamma}{\gamma}$$

$x(z)$  is consumption of  $z$ ,  $f(z)$  is budget share for each good in continuum,  $\int_0^1 f(z) dz = 1$

$p(z)$  is continuum of prices and  $i = Y/L$  is income per capita

$D$  is aggregate production of public bad;  $\beta$  is disutility from public bad,  $\gamma \geq 1$  implies willingness to pay for reducing bad is non-decreasing in level of bad

# General Equilibrium - Comparative Advantage

- Given (1) and (2), unit cost function for good  $z$  is:

$$(4) \quad a(w, p_b; h, z) = \Omega(z) p_b^{\alpha(z)} [w / A(h)]^{1-\alpha(z)}$$

$\Omega(z) \equiv \alpha^{-\alpha} (1-\alpha)^{-(1-\alpha)}$ , and  $w$  is wage rate for raw labor

- $z$  produced in North if:  $a(w, p_b; h, z) \leq a^*(w^*, p_b^*; h^*, z)$ ,

$$(5) \quad T(z) = \frac{c_b^* \alpha(z)/(1-\alpha(\tilde{z}))}{c_b A(h) (c_b^*)^{\alpha(z)}}$$

$T(z)$  is decreasing in  $z$  as  $c_b > c_b^*$ , and  $\alpha'(z) > 0$

- For any  $\omega$ ,  $T(z)$  determines point where goods are produced in North  $z \in [0, \tilde{z}]$ , and South  $z \in [\tilde{z}, 1]$

# General Equilibrium – Trade Balance

- Income spent on Northern and Southern goods:

$$(6) \quad \psi(\tilde{z}) \equiv \int_0^{\tilde{z}} f(z) dz$$

$$\psi^*(\tilde{z}) \equiv \int_{\tilde{z}}^1 f(z) dz$$

- Balanced trade defined as:

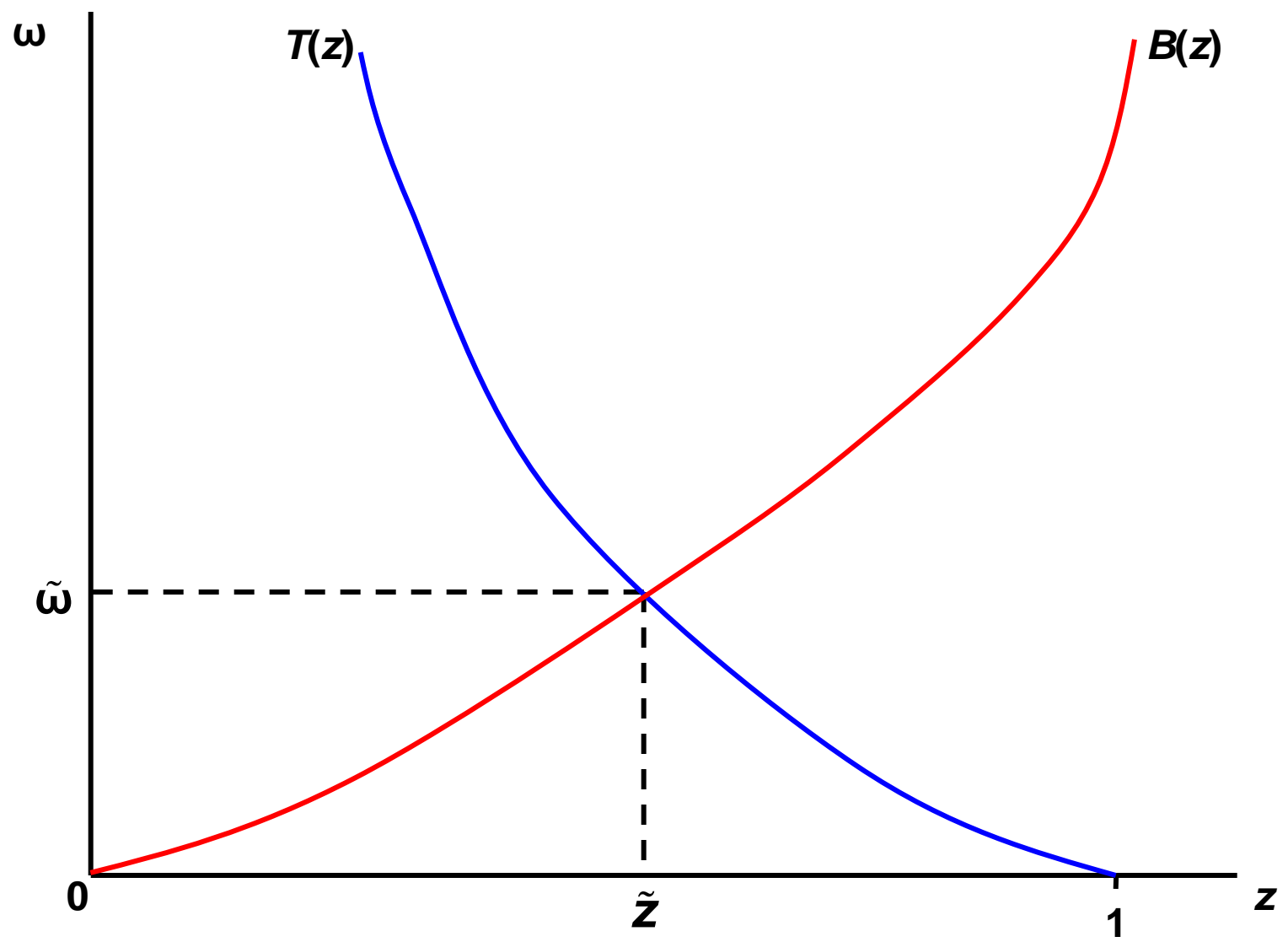
$$(7) \quad \psi^*(\tilde{z})wL = \psi(\tilde{z})w^*L^*$$

$$(8) \quad \tilde{\omega} = \frac{\psi(\tilde{z})}{\psi^*(\tilde{z})} \equiv B(\tilde{z}), \quad dB/d\tilde{z} > 0$$

i.e.,  $B(z)$  slopes upward due to trade balance constraint

- Combining  $T(z)$  and  $B(z)$ , determines  $\tilde{z}$  and  $\tilde{\omega}$  (Figure 2)

# Figure 2: Trading Equilibrium



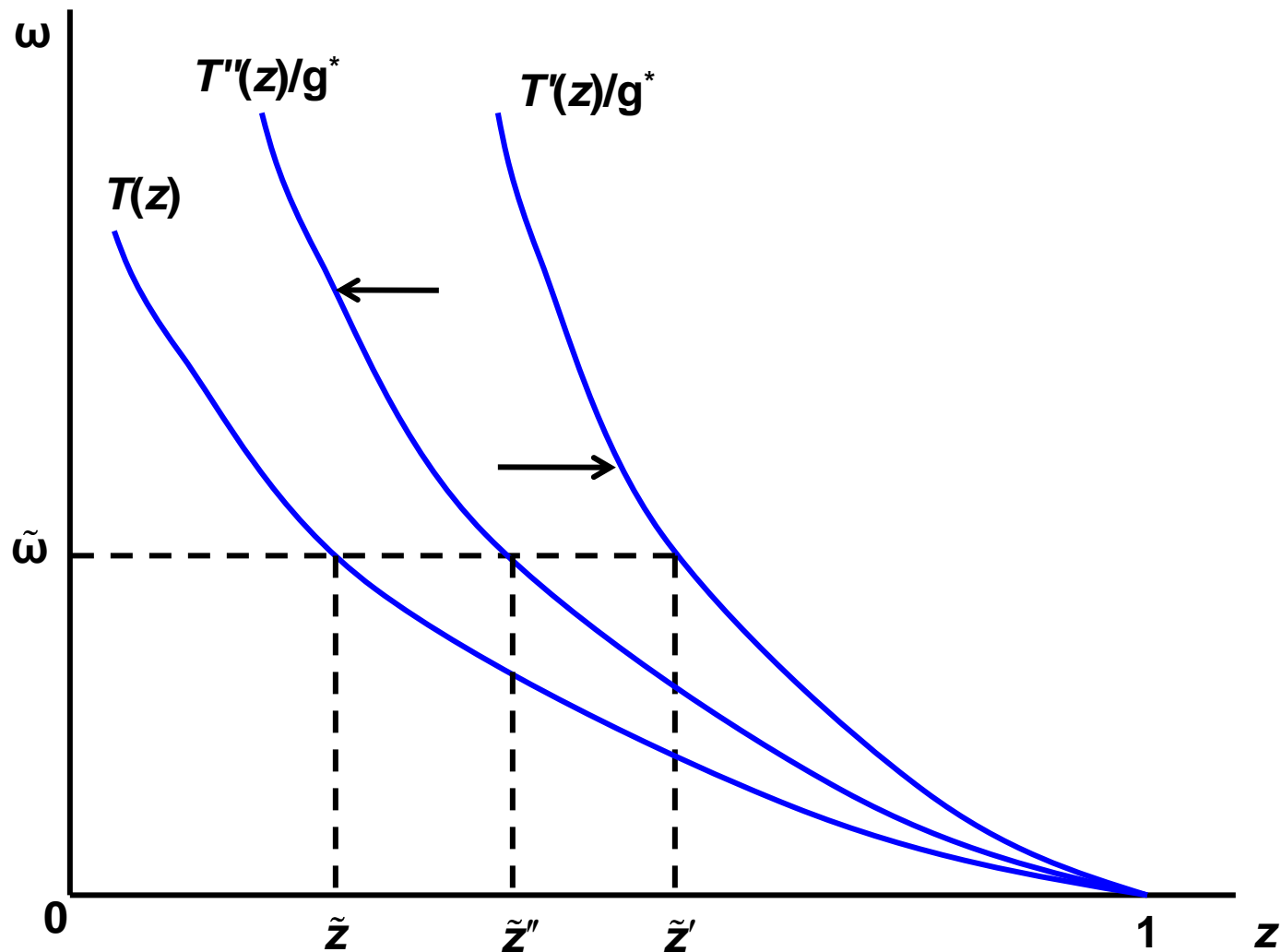
# Trading Equilibrium

- Given that  $h > h^*$ , and  $s > s^*$ , trading equilibrium one where North specializes in goods intensive in use of effective labor, while South specializes in goods that are intensive in their use of public bad
- Reflects North's comparative advantage in producing goods generating less of public bad, as well as fact that it sets higher public standards, which follows from it having a higher level of income than South
- Implication is that South becomes “pollution haven” for production of local public bad
- Strong result for which there is weak empirical support, although more support for higher standards deterring exports by North embodying public bad (Taylor, 2004)

# Standards as “Barriers” to Trade

- Suppose public bad in South has spillover effects in North, e.g., pesticide residues in food – EU reduced tolerance levels in 2005
- Northern standards applied to imports from South, but Southern producers unable to meet higher compliance costs in North due to  $h > h^*$
- Treat higher compliance costs in North as *iceberg* transport costs  $g^*$  facing exports from South to North,  $a(.) \leq [a^*(.)]/g^*$  range of non-traded goods ( $\tilde{z} - \tilde{z}'$ ) with new schedule,  $T'(\tilde{z})/g^*$
- Standards are “barriers” to trade – not necessarily protectionist if they satisfy GATT Article III and SPS

# Figure 3: "Barriers" to Trade



# Standards as “Catalysts” for Trade?

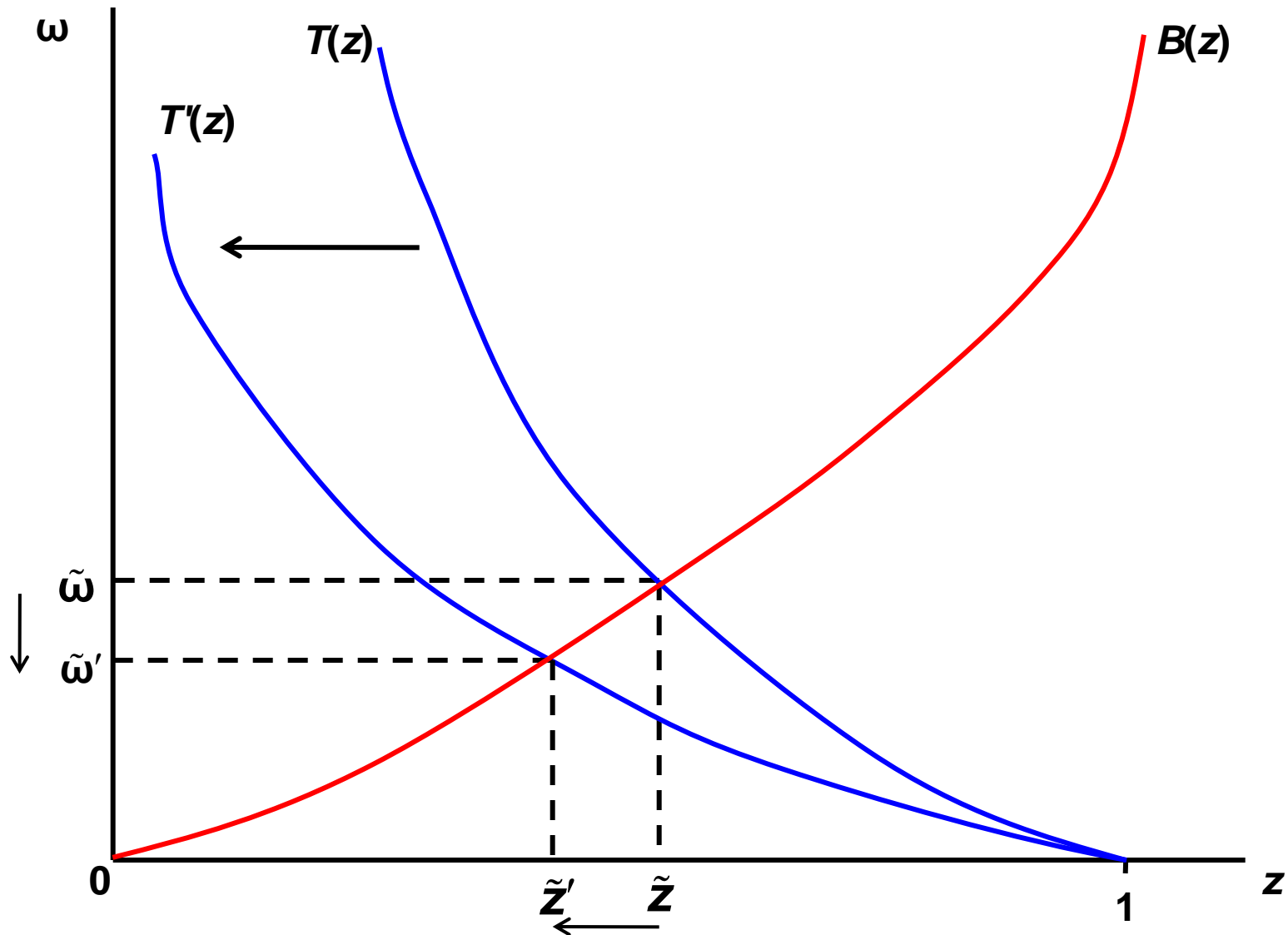
- Claimed South will innovate in face of higher standards in North (Henson and Jaffee, 2008)
- Forced to comply with higher standards provides incentive to firms and regulators to invest in ability to meet such standards, i.e., increase  $h^*$
- Increase in  $h^*$  causes  $T'(\tilde{z})/g^*$  to shift to  $T''(\tilde{z})/g^*$
- Limited empirical support for argument that standards are catalysts for trade (Anders and Caswell, 2009)
- Considerable doubt raised about idea of regulatory-induced innovation (Palmer *et al.*, 1995) and increase in  $h^*$  also observationally equivalent to aid for trade (and activities of MNCs)



# Technological Change vs. Aid for Trade

- Over time there could be labor-augmenting technological change in South due to increase in human capital  $h^*$ , i.e.,  $T(\tilde{z})$  schedule rotates down (Figure 4)
- In absence of technological progress in South in short-run, development aid from North to South could be tied to abatement of public bad
- Example: Pesticides Initiative Program (PIP) financed by European Development Fund – objective is to enable ACP exporters of fresh fruit and vegetables comply with EU pesticide residue requirements
- Jaud and Cadot (2011) - evidence that PIP has had positive impact on Senegal's exports to EU

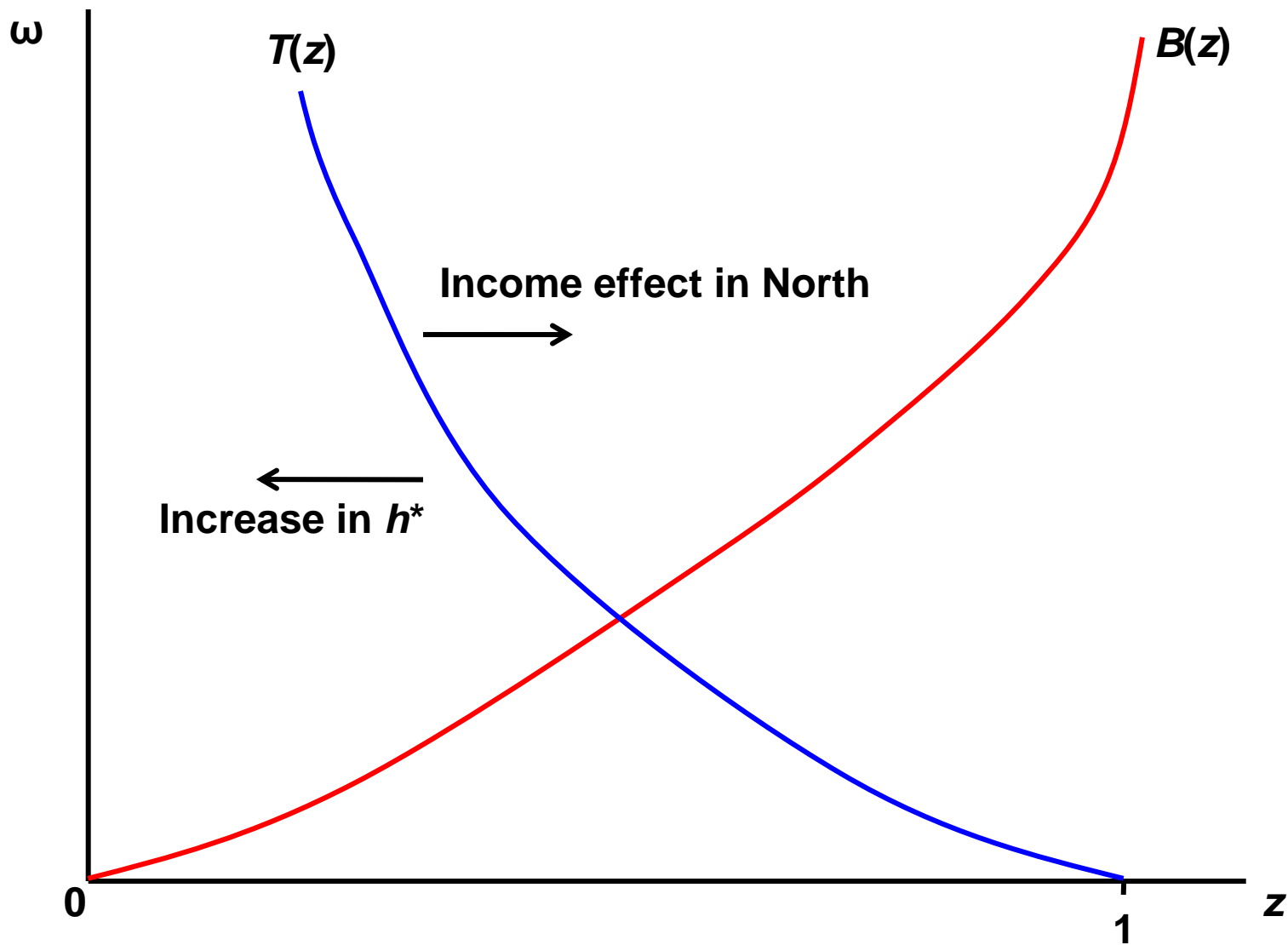
# Figure 4: Technological Change in South



# Technological Change vs. Aid for Trade

- Assume tied aid comes in form of transfer of necessary human capital to South to meet higher standards in North - specifically, tied aid improves productive capacity in South, i.e.,  $T(\tilde{z})$  rotates down (Figure 5)
- At same time there is redistributive effect in North, i.e., a negative income effect that lowers compliance costs  $c_b$  in North, causing  $T(\tilde{z})$  schedule to rotate up
- Overall impact on trade depends on relative factor prices, which depend on strength of income effect in North on  $s$ , and elasticity of supply of  $b^*$  in South
- Quite different to direct aid which causes upward rotation in  $T(\tilde{z})$  due to opposite income effects in North (negative) and South (positive)

# Figure 5: Aid for Trade



# Conclusions

- Standards can be benign where public bad is local, and South has less human capital than North – over time growth in South results in convergence
- Where there is potential for spillover effects, higher standards in North may be “barrier” to trade – although not necessarily protectionist
- Limited theoretical and empirical support for notion of standards as “catalysts” to trade – need robust theory of regulatory-induced innovation
- Aid for trade may be optimal approach for helping South deal with higher standards in North – needs empirical research on impact

**Forza Inghilterra!!**

