Competitive Equilibrium and Regulatory Bias in Converging Technologies

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Converging Technologies:

"Set of technological platforms that, although technically differentiated, tend to supply similar types of services"

Convergence is a consequence of two trends……

❑ Network Convergence:

"…increasing ability of ***networks*** to carry an increasing number of services"

❑ Interface Convergence:

"…increasing ability of ***terminal devices*** to be an efficient medium for accessing a new plethora of services"

Is convergence a driver of regulatory harmonization between industries?….

US Broadband Market

❑ Incumbent Phone Companies:

- ➢ Broadband retail offerings subject to price regulation by either states or the FCC

- ➢ Network facilities must be available to competitors (by 1996 TA)

In contrast…..

US Broadband Market

❑ Cable TV Companies:

- They are not regulated with respect to broadband connections

- The issue here are “Open Access” requirements

So, asymmetric regulation is still an open issue……

Research Agenda:

Convergence ⇒ Competition

Regulatory Asymmetry ⇒ Welfare

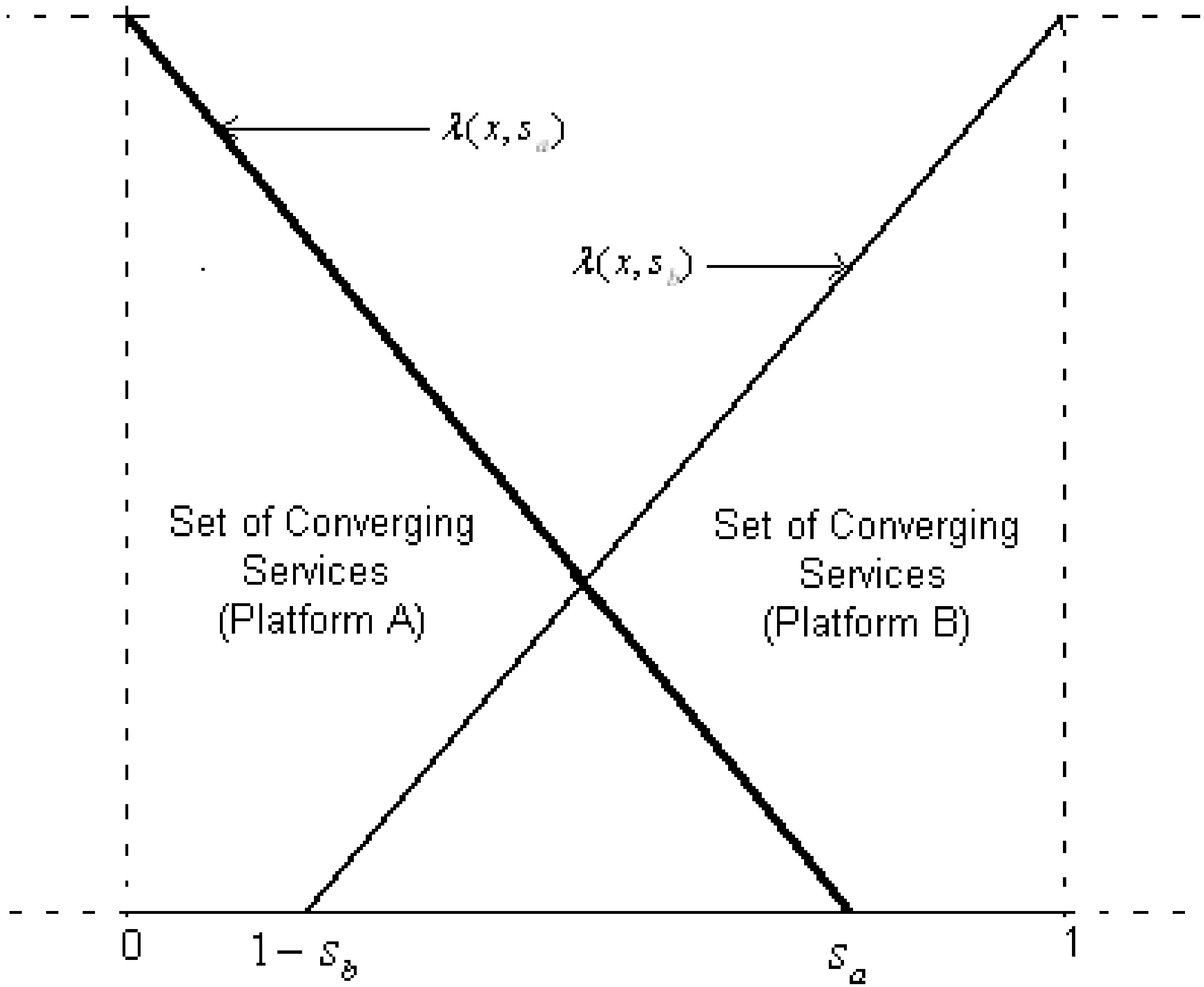
We start discussing the first issue……

Framework of Analysis:

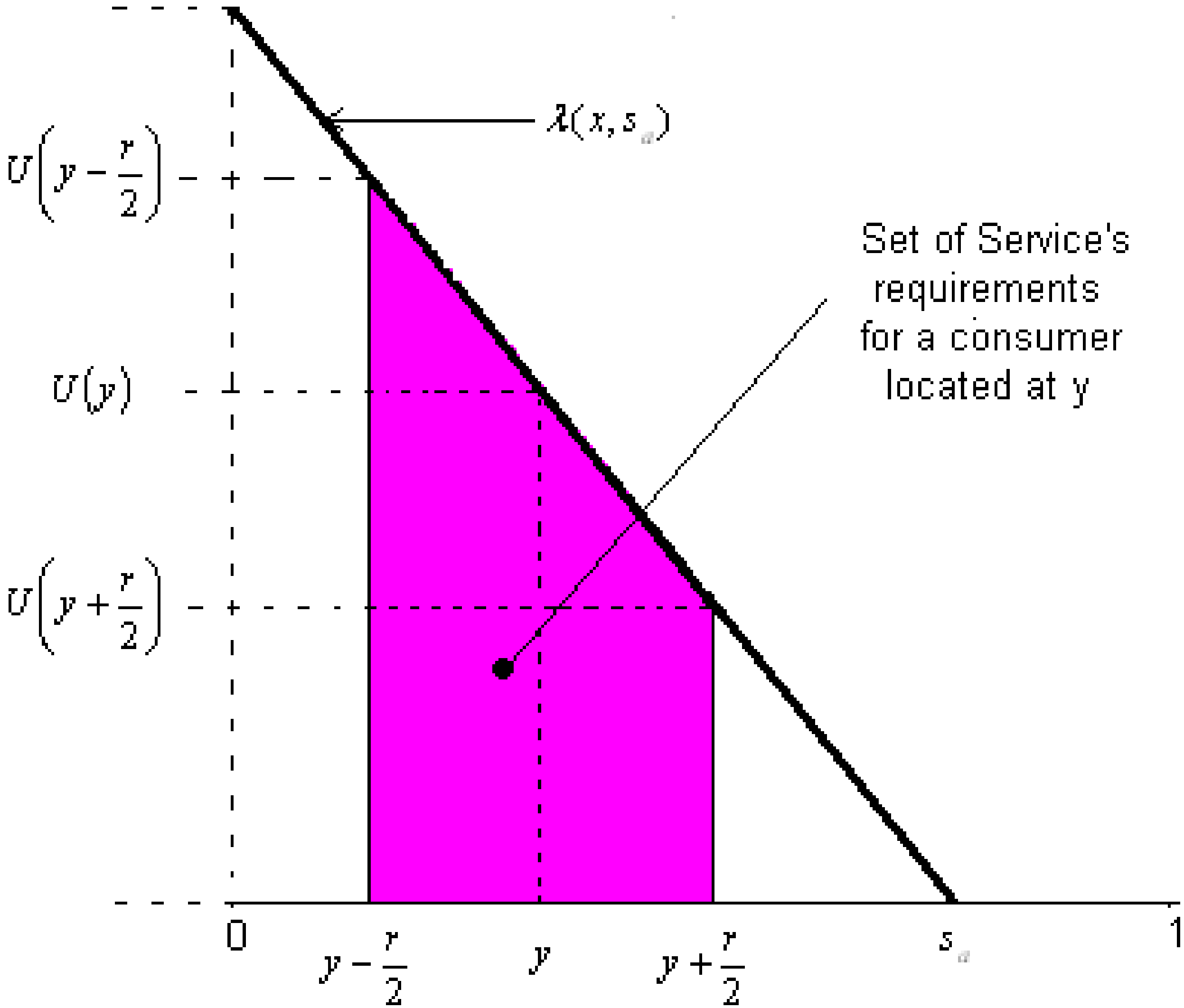
ASSUMPTIONS:

- Two platforms (A & B) offering bundles of services
- There is a continuous set of services: $x \in [0,1]$
- Bundles contain services with different functionality
- Functionality of service x is lower the higher the distance between service x and the provider's location.
- Platforms are associated to ***scopes***, $s \in (0,1]$: set of services supplied w/ + functionality

Technologies:

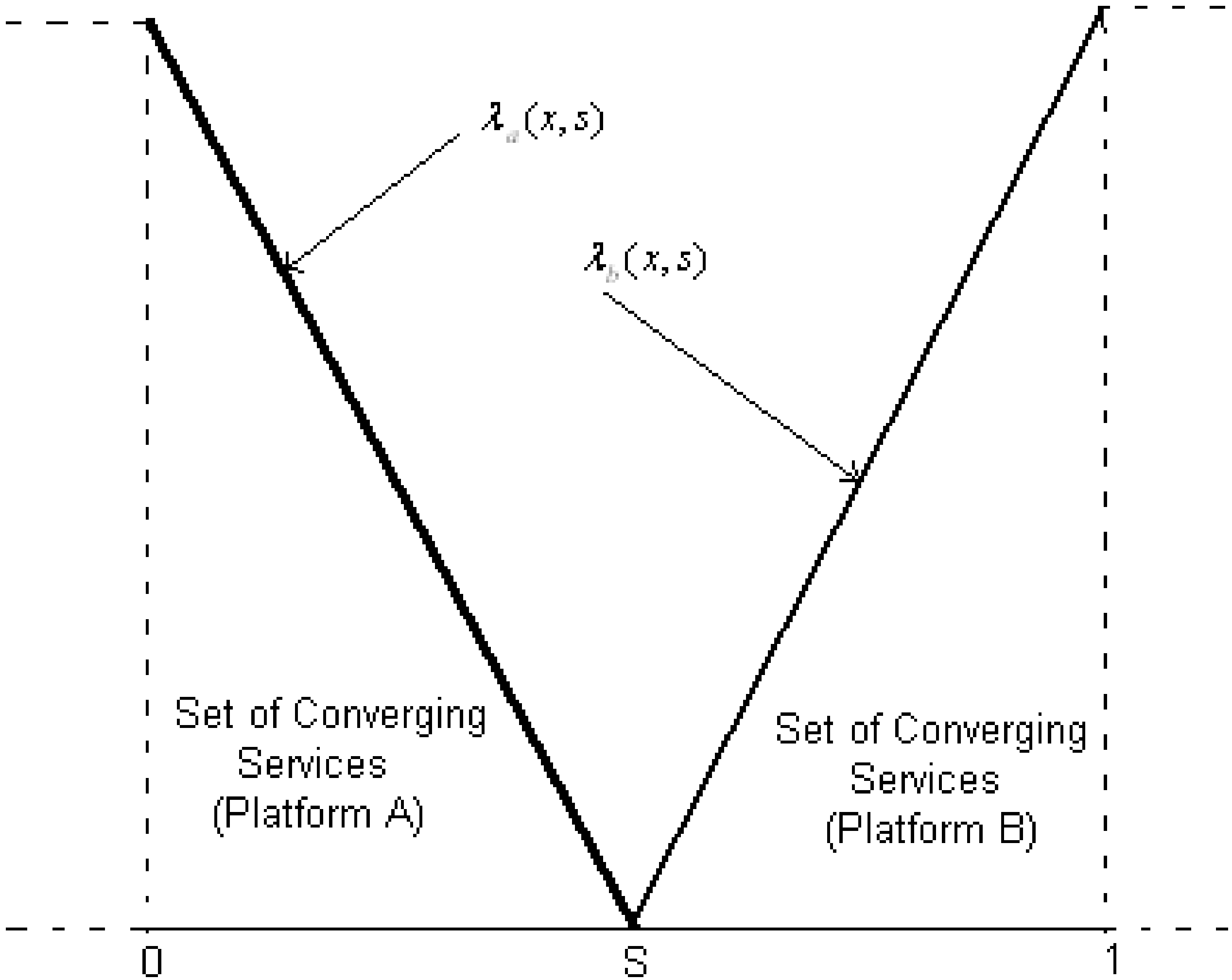


Consumers:



$\lambda(x, s_a)$
$U\left(y - \frac{r}{2}\right)$
$U(y)$
$U\left(y + \frac{r}{2}\right)$
Set of Service's requirements for a consumer located at y
0
$y - \frac{r}{2}$
y
$y + \frac{r}{2}$
s_a
1

Monopolistic Equilibrium: No Convergence



Monopolistic Equilibrium: No Convergence

Utility of a consumer located at *y* consuming services from platform A:

$$U_y^a = \int_{y-r/2}^{y+r/2} \lambda_a(x,s)dx = r\left[1 - \frac{y}{s}\right]$$

- If p=U(y*) $\Rightarrow$ all consumers to the left of y* will demand services from platform A (Mantena & Sundararajan, 2003)
- Then p=U(y*) represents an inverse demand function

Monopolistic Equilibrium: No Convergence

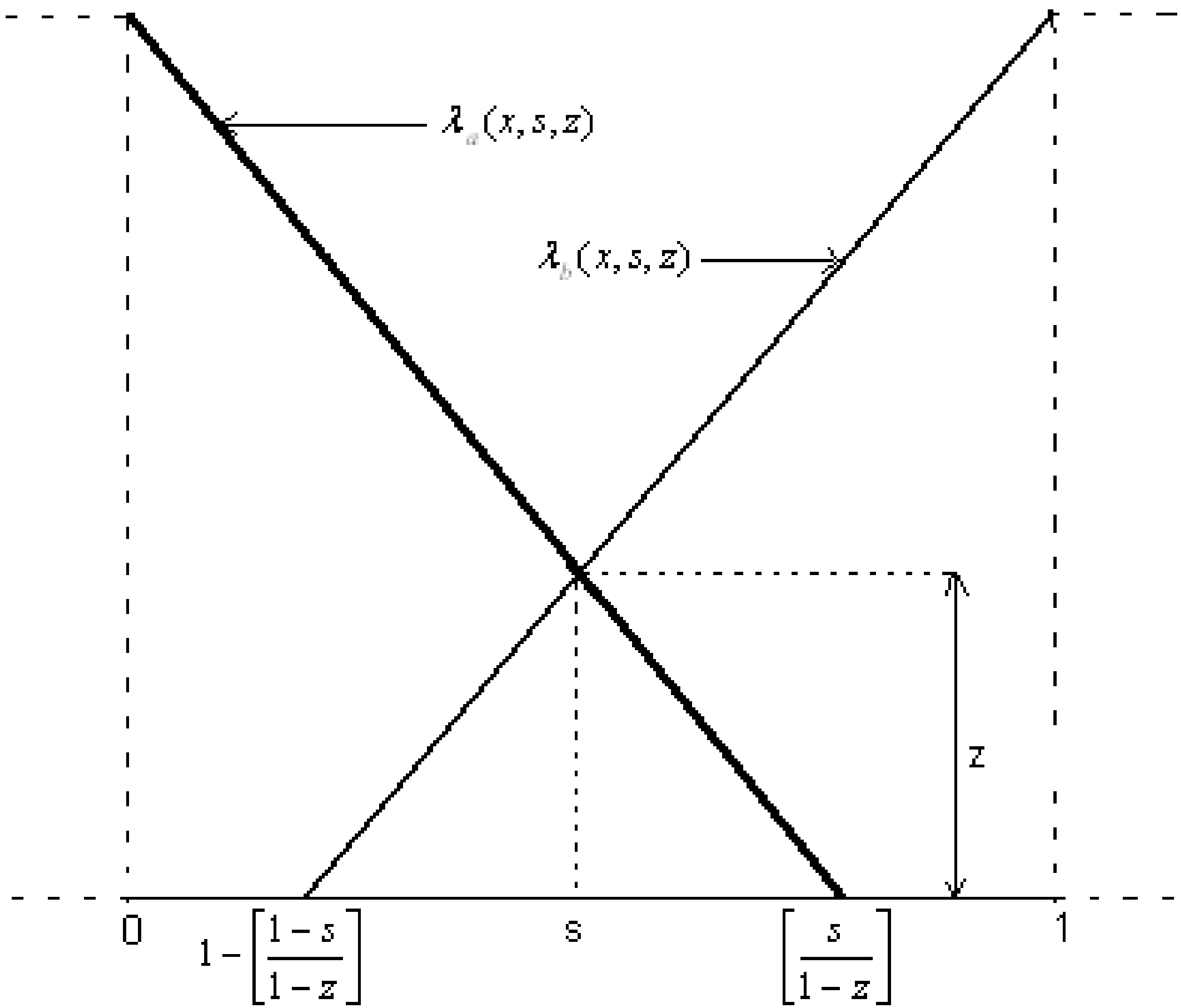
Platform A optimises:

$$\max_{q_a} \quad \Pi_A = nq_a \left[\int_{q-r/2}^{q+r/2} \lambda_a(x,s)dx - c_a \right]$$

which gives:

$$q_a^* = \frac{s(r - c_a)}{2r} \qquad\qquad p_a^* = \left(\frac{r + c_a}{2} \right)$$

Competitive Equilibrium: Convergence



Competitive Equilibrium: Convergence

Utility needs to be re-defined as follows:

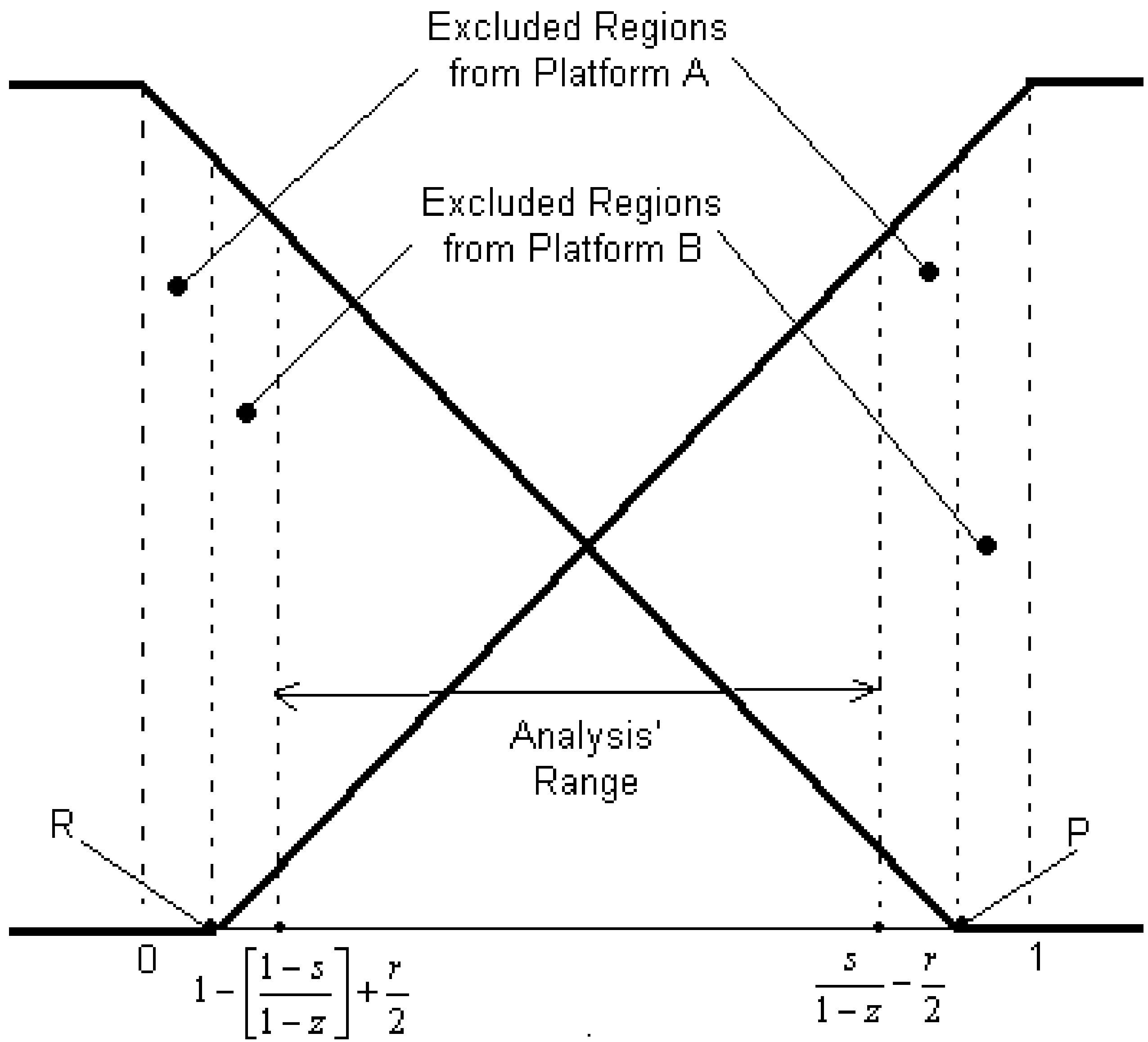
$$p_a = U_y^a - U_y^b + p_B$$

Observe that, under competition, platform A *expects*:

$$p_B^e \in [c_B, U_B(y)] \Rightarrow p_B^e = \theta_a U_B(y)$$

where: $\theta_a \in \left[\frac{c_B}{U_B(y)}, 1 \right]$

Competitive Equilibrium: Convergence



Competitive Equilibrium: Convergence

Platform A optimises:

$$\max_{q_a^c} \ \Pi_A = nq_a^c \left\{ \int_{y-r/2}^{y+r/2} \lambda_a(x,s,z)dx - \left(\int_{y-r/2}^{y+r/2} \lambda_b(x,s,z)dx \right)(1-\theta_a) - c_a \right\}$$

which gives:

$$q_a^c = \frac{s(r\delta_a - c_a(1-s))}{2r(1-z)(1-\theta_a s)} \qquad p_a^c = \left(\frac{r\delta_a + c_a(1-s)}{2(1-s)} \right)$$

where: $\delta_a = 1 - \theta_a s - z(1-\theta_a)$

Competitive Equilibrium: Convergence

Solving Out for Linear Expectations

Observe that: $z = 0 \Rightarrow \theta = 1$

$$z = 1 \Rightarrow \theta = 0$$

Thus, θ must be a decreasing function of z:

$$\theta_i(z) = 1 - z \qquad \forall i = a, b$$

Competitive Equilibrium: Convergence

Solving Out for Linear Expectations

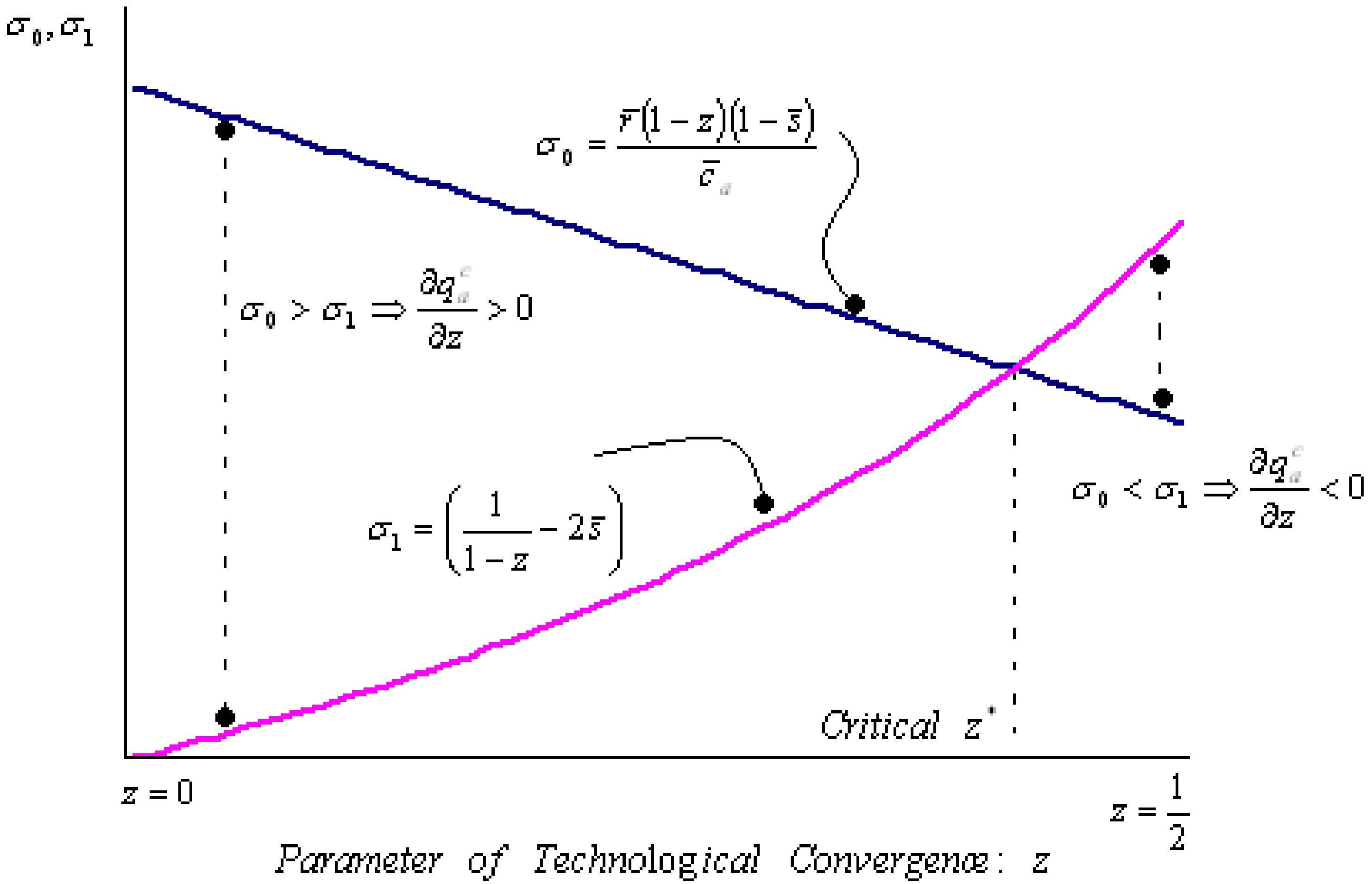
$$q_a^c = \frac{s(1-s)\left(\hat{\delta}_a - c_a\right)}{2r(1-z)\left(1-(1-z)s\right)}$$

$$p_a^c = r(1-z)\left(1+\frac{z}{1-s}\right)+c_a \Big/ 2$$

where: $\hat{\delta}_a = r(1-z)\left(1+\frac{z}{1-s}\right)$

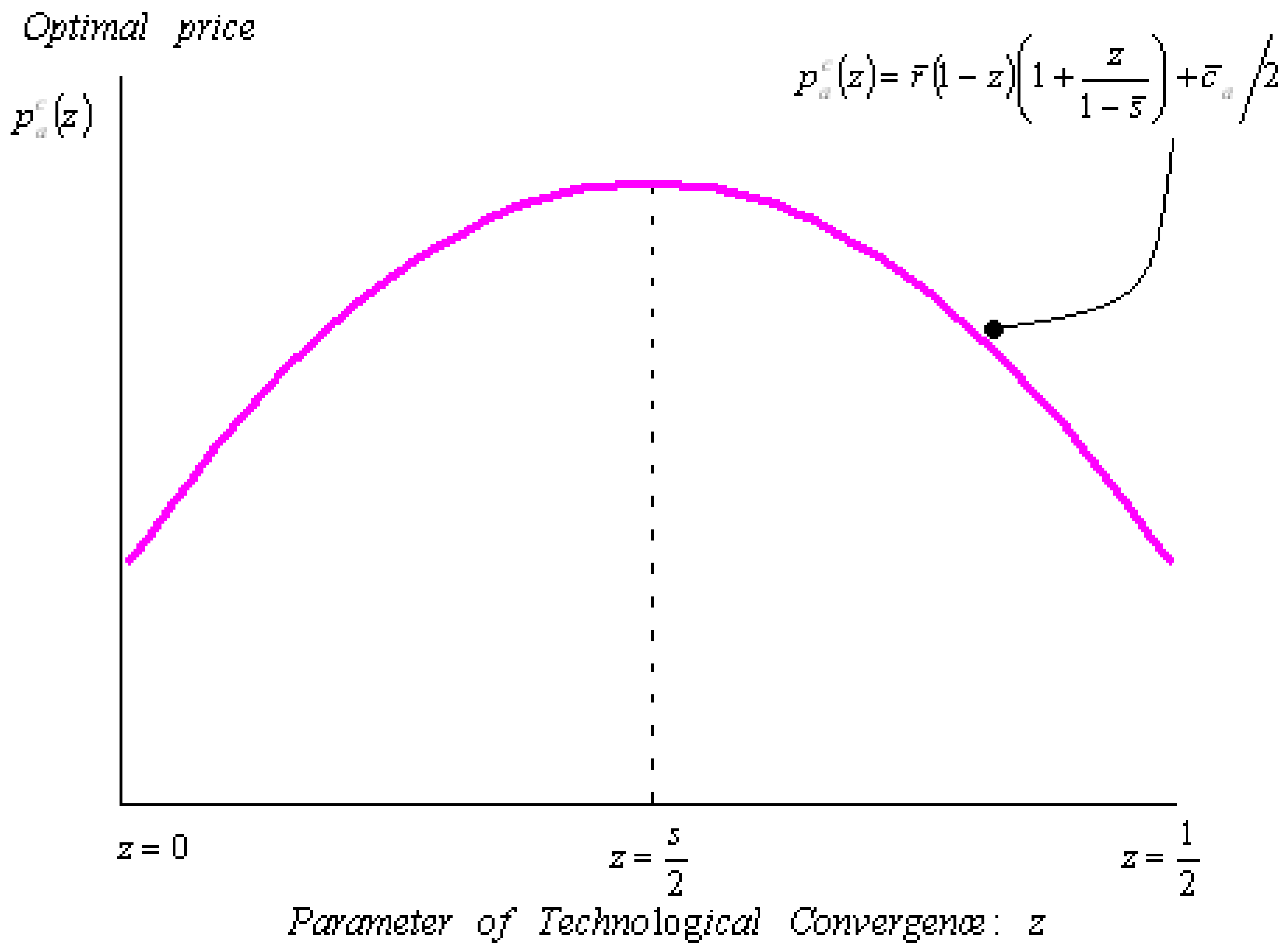
Competitive Equilibrium: Convergence

$$\frac{\partial q_a^c}{\partial z} > 0 \Leftrightarrow \sigma_0 = \frac{r(1-z)(1-s)}{c_a} > \left(\frac{1}{1-z} - 2s\right) = \sigma_1$$



Competitive Equilibrium: Convergence

$$\frac{\partial p_a^c}{\partial z} = \frac{1}{2}\left[\frac{r(s-2z)}{1-s}\right] < 0 \Leftrightarrow z > \frac{s}{2}$$



Asymmetric Regulation & Convergence

INDUSTRY A

Regulator optimises: $$\max_q \; W_a = \int_0^q \left(p_a(t) - c_a \right) dt$$

Proposition 1. The regulator's optimisation problem has first- and second-best optimums characterized, respectively, by:

$$q_a^f = \frac{s(r - c_a)}{r(1 - z)} \qquad p_a^f = c_a$$

$$q_a^s = \frac{s}{1 - z} - \frac{r}{2} \qquad p_a^s = \frac{r^2(1 - z)}{2s}$$

Asymmetric Regulation & Convergence

INDUSTRY B

Platform B optimises:

$$\max_{q_b} \; \Pi_B = nq_b \left\{ \int_{y-r/2}^{y+r/2} \lambda_b(x,s,z)dx - \int_{y-r/2}^{y+r/2} \lambda_a(x,s,z)dx + \hat{p}_a - c_b \right\}$$

$\hat{p}_a$: price chosen by the regulator in industry A.

Asymmetric Regulation & Convergence

INDUSTRY B

Optimal Service: $q_b = \dfrac{(1-s)\left[r(1-z)+s(\hat{p}_a - c_b)\right]}{2r(1-z)}$

Suppose: $c_a = c_b$. If a first-best prevails in industry A:

$$q_b^f = \frac{(1-s)}{2} \qquad p_b^f = c_b + \frac{r(1-z)}{2s}$$

But, if a second-best prevails in industry A:

$$q_b^s = \left(\frac{1-s}{2}\right)\left[1+\left(\frac{r^2(1-z)-2sc_b}{2r(1-z)}\right)\right] \qquad p_b^s = \frac{1}{2}\left(c_b + \frac{r(1-z)(2+r)}{2s}\right)$$

Asymmetric Regulation & Convergence

Welfare Analysis

By construction: $W_a^f > W_a^s$

Proposition 2. When a first-best is implemented, the effect of convergence on welfare across industries is asymmetrical: welfare is strictly increasing in industry A but strictly decreasing in industry B:

$$\frac{\partial W_a^f}{\partial z} = \frac{2sr(r-c)^2}{[2r(1-z)]^2} > 0 \qquad W_b^f = \frac{3r(1-z)(1-s)}{8s} \Rightarrow \frac{\partial W_b^f}{\partial z} < 0$$

Final Remarks

Harmonisation of regulatory frameworks

↕

Convergence of regulatory institutions