Growth of a open economy with excess labor supply

N. Kaldor

1. Growth is demand-induced also in the long run

> "economic growth is [...] always *demand-induced* and not resource-constrained. [...] 'Resources', such as capital and labour do not determine growth, partly because they are mobile between regions, and partly because they are never optimally allocated (there are always economic sectors where labour is in surplus in the sense that its marginal productivity is zero or even negative, as e.g. in agriculture); and partly because capital (in the sense of industrial capacity) is automatically generated as part of, and in consequence of, the growth of demand" (Kaldor, 1981, p. 603; italics in the original).

The super-multiplier

$$Y(t) = [1 / (1 - c - vg^A)] \; I^A(t)$$

- *long-run growth determined by growth of autonomous demand*

Components of 'autonomous' demand:

- *Public infrastructure investment*
- *Exports: depend on world, rather than, internal demand*
- *Autonomous consumption*
- *R&D expenditure*

2.3 Exports as a source of autonomous demand

"..the main ***autonomous*** factor governing both the level and the rate of growth of effective demand of an industrial country .. is *the external demand for its exports…*

the main factor governing the latter is *international competitiveness*, *which in turn depends on the level of its industrial cost relatively to other industrial exporters*." (Kaldor 1971 , p.7)

Some historical antecedents

Adam Smith

“By means of [foreign trade], the narrowness of the home market does not hinder the division of labour in any particular branch of art or manufacture from being carried to the highest perfection.

By opening a more extensive market for whatever part of the produce of their labour may exceed the home consumption, it encourages them to improve its productive powers, and to augment its annual produce to the utmost, … (Smith, 1776, pp. 561-62)

P. J. Verdoorn: an empirical law

"Fattori che regolano lo sviluppo della produttività del lavoro" in *Giornale degli Economisti*, 1949:

causal interpretation, through increasing returns in manufacturing, of the *positive correlation between output growth and productivity growth*.
The point was later elaborated by Kaldor:

> The faster the rate of growth of manufacturing output, the faster will be the rate of growth of labor productivity in manufacturing owing to ***static and dynamic economies of scale***, or increasing returns in the widest sense.... (Kaldor 1971)

static economies of scale explained by the pervasive presence of indivisibilities and threshold effects in production (e.g. labor hoarding)

dynamic economies of scale are *irreversible effects* associated to:

- 'learning by doing' (Arrow 1962),
- specialization opportunities (A. Young 1928),
- new technologies embodied in new investment goods: higher investment flows → lower average age of existing capital stock → more efficient techniques in use

composition effects induced by shifts of employment from low-productivity to high-productivity sectors, when demand for modern output is higher.

Verdoorn's Law

Labor productivity $\equiv Q(t) = Y(t) / L(t)$ *L = employment*

$Q_t = A_t B_t$

$A_t = A\, e^{Ct}$ *exogenous efficiency component affected by tech. progress*

$B_t = Y_t^{\alpha}$ *endogenous efficiency component affected by output*

$$Q_t = A\,(Y_t)^{\alpha}\, e^{Ct} \qquad 0 < \alpha < 1 \qquad (1)$$

C = exponential rate of exogenous technological progress

$q \equiv g_Q = \alpha\, g_Y + C$ *productivity growth determined by:*
output growth + exogenous technological progress

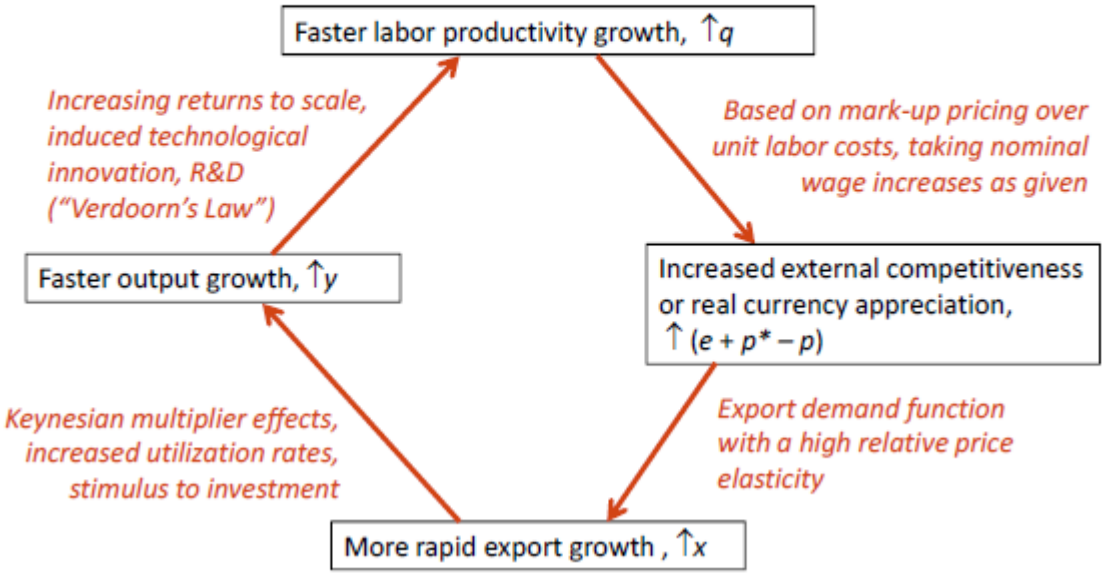
***empirical corroboration of Verdoorn's causal interpretation of (1) is problematic*:**

serious endogeneity problem is involved in a regression of productivity growth on output growth, that must be appropriately dealt with in empirical analysis.

Kaldorian models of export led growth

(Blecker 2010, Setterfield and Cornwall 2002, Boggio 2011)

Figure 1:
The Basic Export-Led Growth Model



Price rigidities

Price rigidities still retained in the form of:

- price making (rather than price taking) by firms
- monetary wage setting by collective bargaining
- nominal interest rate fixed by monetary policy

Export dynamics (*equation in growth rates*)

$$x = \varepsilon_x (-p + p^*) + \eta_x y^* , \qquad \varepsilon_x , \eta_x > 0 \qquad (1)$$

x = growth rate of exports X
p =growth rate of internal export price
p^* = growth rate of world export price
ε_x = price elasticity of exports
η_x = income elasticity of exports
y^* = growth rate of world income: exogenous (small country)

price formation (* = world variables)

firms are price makers: mark-up pricing

price $P = (W/Q)\,T =$ unit labor cost • mark-up T

T = P / (W/Q) assumed constant (at home and abroad)
T is a structural parameter reflecting degree of competition

money wage W assumed constant (at home and abroad)
real wage: non-constant

w = *growth rate of money wages = 0*
q = *growth rate of labor productivity*
$w - q$ = *growth rate in unit labor cost*

$$p = w - q = -q \qquad (2)$$
$$p^* = w^* - q^* = -q^* \qquad (2')$$

price dynamics explained by productivity growth

W / Q = *unit labor cost*
Q ≡ Y/L = *productivity*

Verdoorn's Law: (*stars refer to world variables*)

$q = q_0 + \alpha y$, $1 > \alpha > 0$ (3)

$q^* = q_0^* + \alpha y^*$, $1 > \alpha > 0$ (3)

$q_0 > 0$ parameter representing **exogenous technical change**

α sensitivity of productivity growth to output growth (**'*Verdoorn's effect*'**)

GDP dynamics (*equation in growth rates*) as affected by income 'super-multiplier'

y = *growth rate of output*

y = $(\omega_x x + \omega_A a)$ = *growth rate of autonomous expenditure* (4)

a = *exogenous growth rate of A = non-export autonomous demand*

$X + A = Z$ = *total autonomous demand*

$\omega_x = X / Z$

$\omega_A = A / Z$

proof of $y = (\omega_x x + \omega_A a)$

$Y = \lambda Z = \lambda (X + A)$

λ = *expenditure* ***super-multiplier*** *(assumed constant)*

$$\dot{Y}=\lambda\left(\dot{X}+\dot{A}\right)=\lambda\left(x\cdot X+a\cdot A\right)=\lambda\left(x\omega_x\cdot Z+a\omega_A\cdot Z\right)$$

Divide both sides by $Y = \lambda Z$ to obtain

$y = z = (\omega_x x + \omega_A a) =$ *growth rate of autonomous expenditure*

growth rate of exports:

$x = \varepsilon_x (-p+p^*) + \eta_x y^*$

$x = \varepsilon_x (q - q^*) + \eta_x y^*$ *(substitute –q and –q* for p and p*)*

$x = \varepsilon_x (q - q_0^* - \alpha y^*) + \eta_x y^*$ *(substitute for q* from Verdoorn law 3)*

notice that faster world-output growth y* has twofold effect on internal demand:

- positive effect: Increases home exports through $\eta_x y^*$
- negative effect: lowers home competitiveness, through higher q* abroad

demand side determination of y ***Demand Regime***

$$x = \varepsilon_x (q - q_0^* - \alpha y^*) + \eta_x y^* = \phi(q)$$

$$y = (\omega_x x + \omega_A a) = (\omega_x \phi(q) + \omega_A a) = f_{DR}(q)$$

$$y = f_{DR}(q) \equiv \Omega + \omega_x \varepsilon_x q \qquad (5)$$

y depends positively on q *through competitiveness*

recall: a = growth rate of non-export autonomous expenditure

$\Omega \equiv [\omega_a a - \omega_x \varepsilon_x q_0^* + \omega_x (\eta_x - \alpha^* \varepsilon_x) y^*] = constant$

Ω = effect on y of exogenous variables a, q_0^*, y^*

notice that left-hand side > 0 only if a > 0 and/or income elasticity of x large enough

Demand-side + Supply-side effects:

$q = q_0 + \alpha y$, $\quad 1 > \alpha > 0$ *Verdoorn* (3)

$y = f_{DR}(q) \equiv \Omega + \omega_x \varepsilon_x q$ (5)

$y = f_{DR}(q) \equiv \Omega + \omega_x \varepsilon_x q = \Omega + \omega_x \varepsilon_x (q_0 + \alpha y)$ (5.a)

$$y_E = \frac{\Omega + \omega_x \cdot \varepsilon_x \cdot q_0}{1 - \alpha \cdot \omega_x \cdot \varepsilon_x} > 0$$ ***equilibrium growth*** (6)

iff $1 - \alpha \ \omega_x \varepsilon_x > 0$ rate of exogenous tech. change > 0 and /or omega > 0 (that is: large enough growth rate of non-export autonomous expenditure and/or income elasticity of exports)

(6) generates constant growth rates of other endogenous variables *p, q, x*

Footnote: $\Omega > 0$, $\varepsilon_x > 0$, $1 > \omega_x > 0$

$1 - \alpha \ \omega_x \varepsilon_x > 0$ *if the Verdoorn effect α is small relative to the price elasticity of exports*

Kaldor (1978): different view on unit costs dynamics and export growth

Kaldor (1978) compared:

- time rate of change (periods > 10 years) of relative export shares in manufacturing
- time rate of change of relative unit costs (of main industrialized countries)

positive correlation resulted (***Kaldor paradox***)

Table 1

The Kaldor Paradox Re-examined. Twelve Industrialized Countries, 1978–94

	Growth in market share for exports[a]	Growth in relative unit labour cost[a]	Growth in GDP per capita at constant prices[a]	Change in R&D as a share of GDP[b]
USA	0.08	−1.17	1.36	0.24
Japan	0.95	0.82	2.94	1.10
Germany	−1.03	1.62	1.65	0.23
France	−0.98	−0.18	1.36	0.54
Italy	−0.16	−1.13	2.00	0.59
UK	−0.89	0.81	1.57	−0.01
Canada	−0.10	−0.38	0.97	0.36
Belgium–Luxembourg	−0.89[c]	−2.85[c]	1.70	0.31
Netherlands	−1.53	−1.60	1.23	0.13
Korea	4.85	1.89	6.33[c]	1.16
Taiwan	4.68	3.77	5.94[d]	1.13
Hong Kong	8.36	2.58	5.35[c]	n.a.
Regression on growth in market share[e]	slope	1.17	1.43	4.48
		(0.36)	(0.21)	(0.94)
	R^2	0.52	0.82	0.71

Notes: [a] Annual rate of growth. [b] Difference between 1992 and 1979 levels of R&D as a share of GDP. [c] 1978–92. [d] 1978–91. [e] Estimated by ordinary least squares with constant term (not reported), standard deviation in brackets, 12 observations except for R&D (11 observations).

Sources: OECD (GDP per capita and relative unit labour cost); IMF (merchandise exports); and EMF/IMD–World Economic Forum and national sources (R&D).

possible explanation of Kaldor's paradox:

"Higher prices could equally well reflect higher quality of products, and more specialized workers, which, in turn, might justify higher wages.

From this perspective higher growth in relative unit labor cost (RULC) could just as well be seen as an indicator of:

- growing quality relative to other countries
- increasing - rather than deteriorating - competitiveness."
(Fagerberg 2002, p.1.)

Boggio (2003): Kaldor's paradox may vanish if x depends on price level

Beckerman (1962) export led model (*linear version*)

A. Export growth and competitiveness:

- crucial difference: competitiveness depends on price levels, not on price growth rates!
- In a small open industrial economy exports are the main source of autonomous demand: at given parameters

$g_X \approx g_Y$ *where* $g_X \equiv x$ $g_Y \equiv y$

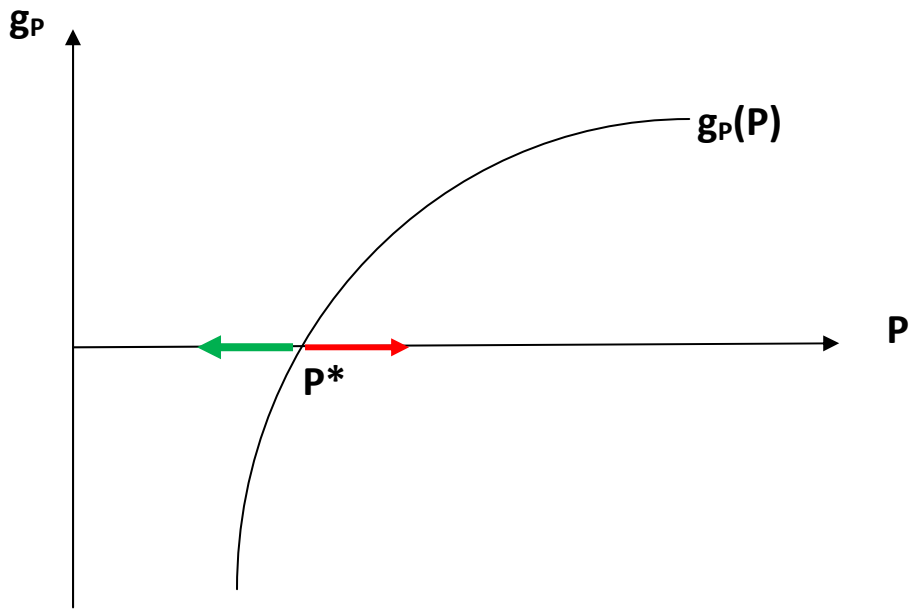
$$g_x = -\sigma(P/A - 1) + g^*$$

P = internal export price

A = world price (exogenous- small country assumption) assumed constant

g = growth rate of world demand (exogenous- small country assumption)*

export growth related to level of P/A not to rate of change



linear Verdoorn's law + competitiveness depending on price level P:

- *P** is **dynamically unstable**: ***self-reinforcing cumulative growth or decline***
- *$P > P^*$ implies $g_P > 0$ competitiveness deteriorates*
- *$P < P^*$ implies $g_P < 0$ competitiveness improves*

*P** **dynamically unstable**: ***self-reinforcing cumulative growth or decline***

But explosive growth is empirically implausible

Asian NICs: A case of export led growth?

Problem 1. If export competitiveness depends on (1 - P/A) (price level) using *cumulative-causation* model to interpret NICs growth is misleading because Growth of Asian NICs was not explosive!

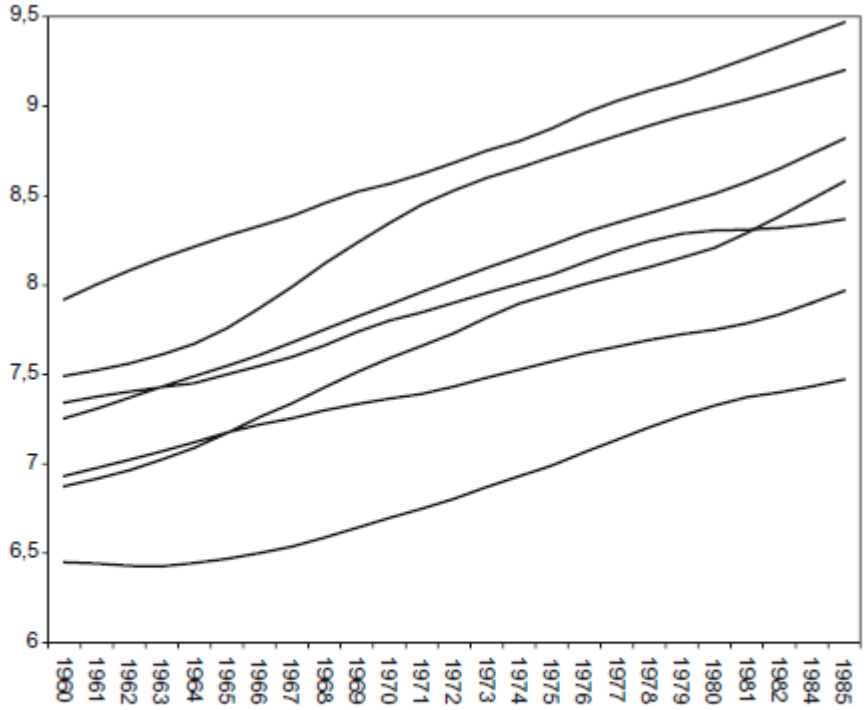


Figure 1. East Asian NIEs: logarithms of per capita real income, five-years moving averages, 1960–1990. The lines refer to Hong-Kong, Singapore, Taiwan, Korea (Republic), Malaysia, Thailand and Indonesia and for 1985 appear in this order from top to bottom. Elaboration on Penn World Tables.

Boggio (2003): Dynamic decreasing returns

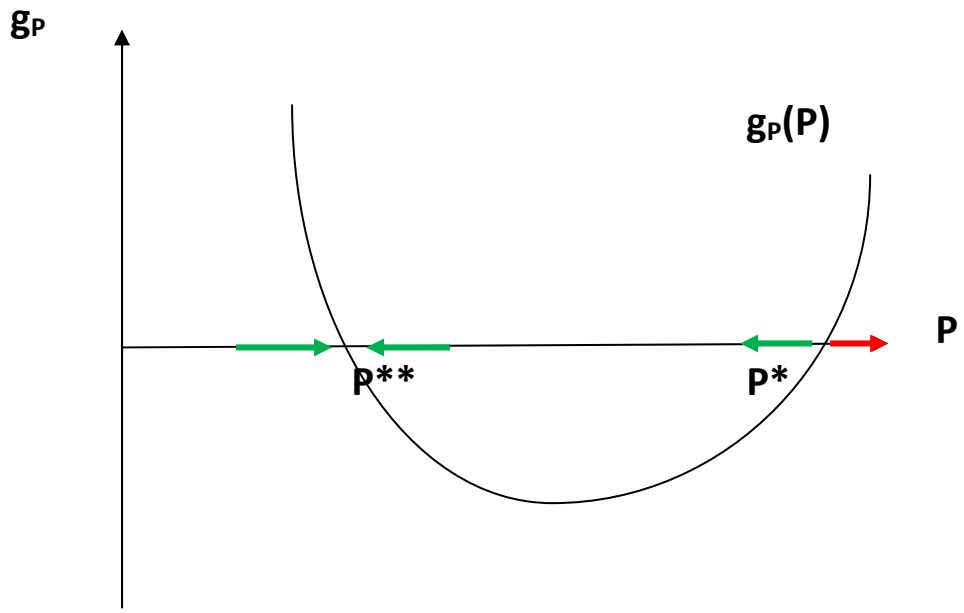
- effect of output growth ***g*** on productivity growth g_o is non linear

- critical growth rate $\mathbf{g_M}$ beyond which a further increase of ***g*** lowers productivity growth, because if resources are nearly fully employed, the economy lacks the flexibility required for the working of Verdoorn's law. Firms are focused on current output, not on productivity improvement

- above g_M Verdoorn's law works in reverse

$$g_o = \beta + \mu\, g - max\,(0, Qg^2) \qquad Q > 0 \text{ and small}$$

Dynamic effects of non-linear Verdoorn law



P** stable equilibrium
P* unstable equilibrium

Comparing interpretations of East Asia growth:

1. Factor accumulation (Allyn Young 1994, 1995)
2. Coordinating action by government (Rodrik, Grossman, Norman1995)
3. Export-led growth + techn. change (Boggio 2003, but see also Nelson and Pack 1999)

4. interaction between argument 1 and 3, through quality growth

Notes on Keynesian export- led growth in the presence of price and quality competition

In what follows we reformulate the building blocks of Kaldor's export-led growth model, to take into account of quality competition.

$y =$ growth rate of output
$x =$ growth rate of exports
$z =$ growth rate of quality
$q =$ growth rate of labour productivity
$p =$ growth rate of money prices
$w =$ growth rate of money wages
$\mu =$ arrival rate of innovations = 'new ideas'
$Q =$ labour productivity level
The world variables are denoted with *

On the simplifying assumption that the components of autonomous demand other than exports X are negligible, we use the super-multiplier equation:

$$Y = \lambda X$$

where $\lambda = \frac{1}{1-c-vg_t^e}$ is Hicks' supermultiplier, c is the marginal propensity to consume, and g_t^e is the expected growth rate of demand between time t and t+1. On a equilibrium constant growth path, g is constant, and expectations are fulfilled, to the effect that $\lambda = \frac{1}{1-c-vg}$ is constant. This leads to the growth equation (1) below, stating that the growth rate of output is equal to the growth rate of exports:

$$y = x \qquad (1)$$

Taking quality growth into account, the growth rate of exports is:

$$x = \varepsilon_x(p^* - p) + \eta y^* + \xi z \qquad (2)$$

$$\varepsilon_x = price\ elasticity\ of\ exports$$

$$\eta = income\ elasticity\ of\ exports$$

$$z = intensity\ of\ product\ innovation$$

The intensity with which new products are brought to the market, in that they are produced by new plant and/or equipment is

$$z = z\left(\mu,\ \frac{I}{Y}\right) \qquad (3)$$

The partial derivatives of $z()$ with respect 1st and 2nd argument are:

$$z_1 > 0, \qquad z_2 > 0$$

$\frac{I}{Y}$ = investment ratio = is a proxy for the rate at which new ideas are embodied in new equipment , that is, made 'productive'.

The growth rate of labour productivity depends on output growth (through the Verdoorn coefficient α), and on the rate at which the flow of new ideas μ is implemented in process innovations that are embodied in new plants and/or equipment, and/or in new plants producing new products.

$$q = \alpha y + f\left(\mu, \frac{I}{Y}\right) \qquad (4)$$

$$f_1 > 0, \qquad f_2 > 0$$

The growth rate of money prices depends on the growth rate of money wages and the growth rate of labour productivity:

$$p = w - q \qquad (5)$$

Let $GAP = 1 - \frac{Q}{Q^*}$ denote the distance with respect to frontier productivity Q^*. Then the arrival rate μ of new ideas depends positively on:

- productivity adjusted R&D expenditure (as suggested by neo-Schumpeterian literature)
- distance to frontier GAP (as suggested by technology transfer literature)
- endowment of human capital H (this may be measured through education attainment)

$$\mu = g\left(\frac{R\&D}{Q}, GAP, H\right) \qquad (6)$$

Comments:

1.

As in the standard export-led Kaldorian model, we can identify within the above model structure (1) – (6) the working of the self-reinforcing circle of cumulative causation (that may work in either direction, depending on initial conditions):

$$y \uparrow causes\ g_q \uparrow causes\ p \downarrow causes\ x \uparrow causes\ y \uparrow$$

The working of this self-reinforcing process is now integrated by the effects of quality growth and non-price competition, the force of which depends on investment intensity I/Y , and on human capital per worker H

Remark: The role of I/Y and H provides a unifying framework integrating the 'factor accumulation' and 'export-led' explanations of East-Asia miracle.

2.

There is now also a stabilizing force, that was not present in the simpler formulation of the model. If GAP is rising because $q^* - q > 0$, then the rise in GAP favors technology transfer, that will cause a rise in the innovation flow μ.

However, this stabilizing force is effective only if the investment ratio I/Y is large enough. If the investment ratio is too low, there is nothing to stop, let alone revert, the vicious circle triggered by a rise of the productivity GAP. This may cause a process of long-run divergence from the frontier for the country in question. As an example, we may consider the recent discussion and evidence on premature de-industrialization in Latin American countries, including Brazil.

2.1.

2.2. example 2: High factor accumulation in East-Asian Tigers, favored by government policy, enabled the exploitation of the 'advantage from backwardness' (GAP). 1960 export share of South Korea and Taiwan was too low to support a significant export-led growth miracle. The initial 'spark' was government aided factor accumulation, rather than exports (Rodrik 1994).