Acquiring Technology in a Global Economy: investigating the case of developing countries

Watu Wamae
Université de la Méditerranée (Aix-Marseille II)

Income distribution across countries

- Growth trends indicate that world income gaps remain very high

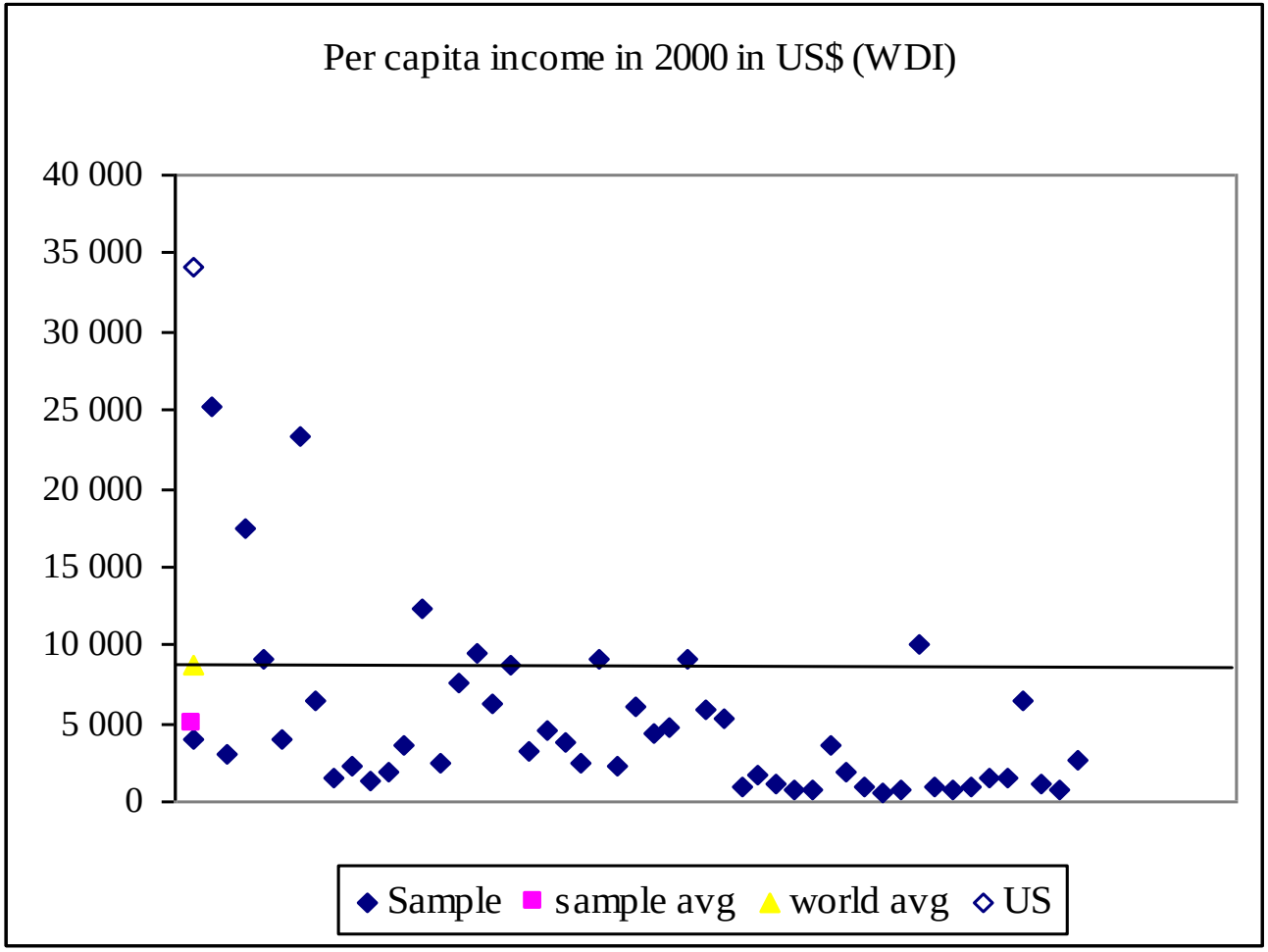
- The per capita income of the US is 34 times that of Uganda (WDI)

"Poor countries are not catching up with the rich, and to some extent, the international income distribution is becoming polarized." Temple (1999)

Situation in developing countries

There is a growing rift between the few economies that have managed to "take-off" and the overwhelming majority that is increasingly being marginalised by the current economic trend of rapid transformations.

Income across developing countries



Question

What lies behind the ability of a handful of developing countries to catch-up with industrialised countries while the vast majority recedes further into marginalisation?

Sources of growth

Economic literature identifies four sources that contribute to the improvement of productivity

- Domestic sources – domestic R&D and outward FDI
- Foreign sources – foreign R&D (via imports partnerships/licensing) and inward FDI

Debate

Developing countries hardly invest in own R&D

- Foreign R&D is the main source of technology: north-south spillovers are substantial Coe, Helpman & Hoiffmaister (1996)
- Technology diffusion from industrialised countries has stronger effects in relatively rich countries Eaton & Kortum (1996), Xu (2000) and Keller (2001d)

R&D activities have a dual role

- Cohen & Levinthal (1989) argue that R&D activities generate innovations and also create an absorptive capacity.

  "firms conduct basic research less for particular results than to be able to provide themselves with the general background knowledge that would permit them to exploit rapidly useful scientific and technological knowledge…" Cohen & Levinthal (1990).

Réalité

- The capacity to benefit from international technology spillovers appears to depend on the absorptive capacity whose development relies largely on domestic innovation rather than foreign R&D

=> Countries that invest in domestic innovation and develop an absorptive capacity benefit from international spillovers.

Methodology – growth regression

$$Y = AF(K, H, L)$$

Y = output A = technology K = physical capital
H = human capital L = labour

- Solow (1956) estimate on productivity growth in the US economy, found that technical change accounted for 80% of per capita growth.
- Easterly and Levine (2001) also found that technology accounts for two thirds in the variation of output growth across countries.

$$Y_{it} = AK_{it}^{\alpha}\left(e^{\phi s}L_{it}\right)^{1-\alpha}$$

s = average time spent in school

ϕ = rate of return to schooling

Human capital (skilled labour) is produced from raw labour (unskilled labour) by means of education

Dividing both sides of the equation by labour, taking the logs and extracting total factor productivity yields,

$$p_{it} = y_{it} - \alpha k_{it} - (1-\alpha)\phi s_{it}$$

Estimation specification

We relate total factor productivity to both foreign and domestic knowledge to analyse the impact of foreign knowledge on productivity growth.

$$p_{it} = \varphi p_{it-1} + \beta_1 v_{it}^{M} + \beta_2 v_{it}^{FDI} + \beta_3 v_{it}^{D} + \lambda_t + \mu_i + \omega_{it}$$

v_{it}^{D} is an interaction term between human capital and GDP ratio of machinery and equipment imports, Mayer (2001), Coe, Helpman & Hoiffmaister (1996)

Methodological issues

- Unobserved effects – country A is poor because it is country A
- Endogeneity – e.g. human capital depends on income level
- Measurement error
- Parameter heterogeneity
- Model uncertainty

Estimation

We investigate the growth of total factor productivity using a sample of 51 developing countries for the period 1980-2000.

REGRESSION RESULTS: ALTERNATE ESTIMATION TECHNIQUES

	period 1980-2000						5 five-year periods
estimation method	Fixed effects	Random effects	Hausman & Taylor	Arellano & Bond	Arellano & Bond diff gmm	Arellano & Bond system gmm	Arellano & Bond system gmm
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	pdvty	pdvty	pdvty	D.pdvty	pdvty	pdvty	pdvty
fkm	0.080	0.078	0.080		0.087	0.032	0.056
	(7.39)**	(7.45)**	(7.37)**		(7.92)**	(9.49)**	(3.08)**
fkfdi	-0.019	-0.018	-0.019		0.031	-0.002	0.025
	(3.28)**	(3.12)**	(3.27)**		(5.72)**	(0.76)	(2.00)
dk	-0.064	-0.061	-0.064		-0.008	-0.024	-0.050
	(5.40)**	(5.19)**	(5.39)**		(2.24)*	(7.07)**	(4.27)**
lpdvty					0.612	0.923	0.589
					(14.14)**	(47.95)**	(7.46)**
const	4.183	4.188	-7.439			0.148	1.350
	(69.37)**	(57.75)**	(0.03)			(1.79)	(4.21)**
LD.pdvty				0.845			
				(14.59)**			
D.fkm				0.050			
				(3.63)**			
D.fkfdi				0.013			
				(1.23)			
D.dk				-0.008			
				(0.72)			
ctry			0.383				
			(0.05)				
obs	1071	1071	1071	969	969	1020	204
countries	51	51	51	51	51	51	51
R-squared	0.06						

Absolute value of t statistics in parentheses

* significant at 5%; ** significant at 1%

Effect of the absorptive capacity on growth

- Efforts to inject foreign knowledge through for example high technology content imports are bound to penalise the learning process that leads to knowledge accumulation by provoking a fall in labour productivity.

- Devarajan, Easterly & Pack (2001) study on Tanzania revealed that an increase in capital accumulation led to a fall in output per unit of labour, and consequently to a fall in output per unit of capital due to under-utilisation.

Conclusion

Benefits from international spillovers are not automatic: they accrue only to the handful of developing countries that invest in domestic innovation and develop an absorptive capacity.

Domestic technology investments are crucial