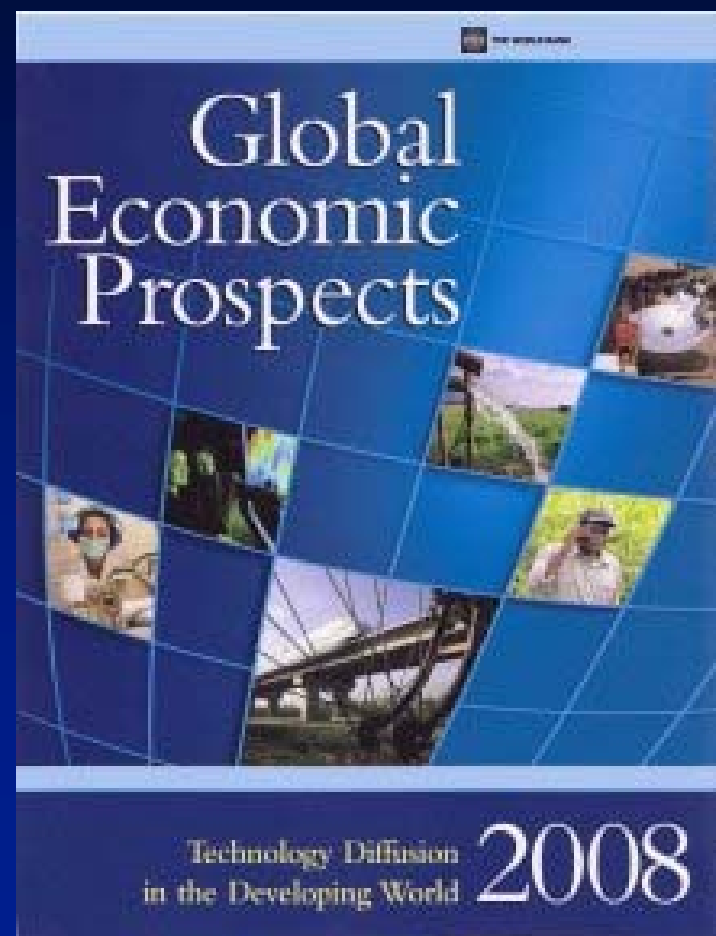


Technology diffusion in the developing world

Richard Newfarmer
Special Representative
to the WTO and UN

World Bank
March 10, 2008



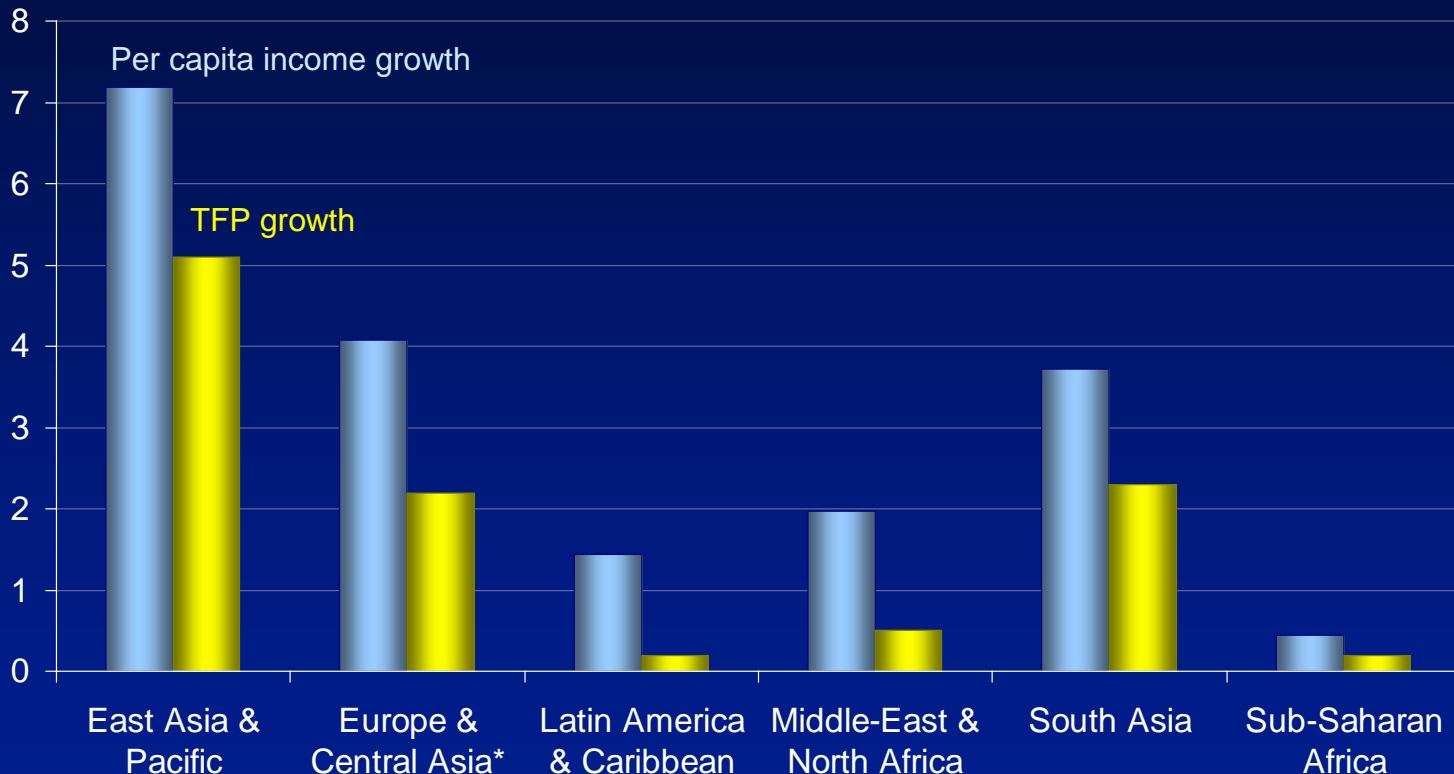
Key Points

- **Technology is a main driver of growth, often accounting for more than half of the increase in per capita incomes**
- **The technology gap between rich and poor countries is large but narrowing – as developing countries pre-existing technologies**
- **Globalization has been a main driver of technological progress**
- **Taking advantage of global opportunities requires overcoming weaknesses in technological absorptive capacity**



Technological progress is at the heart of income growth and poverty reduction

Average annual per capita income and total factor productivity growth, 1990-2005

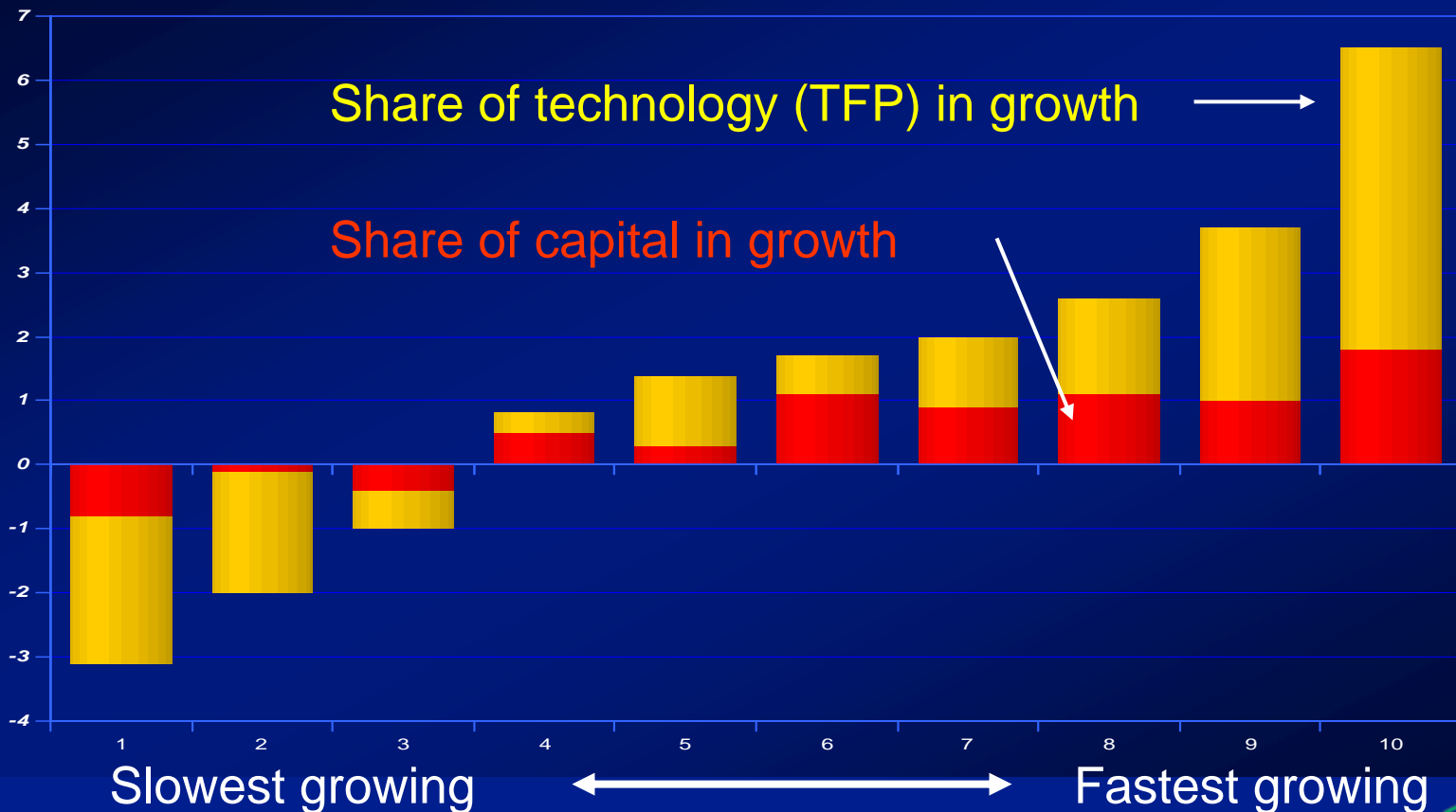


* Data for Europe & Central Asia cover period 2005/1995

Source: World Bank, Poncet 2006

Why is technology important? ... it is the main driver of fast growth

Growth Rates Per Capita, by Decile, 1980-92:
Contribution of Technology and Capital



Source: Easterly and Levine, 2001



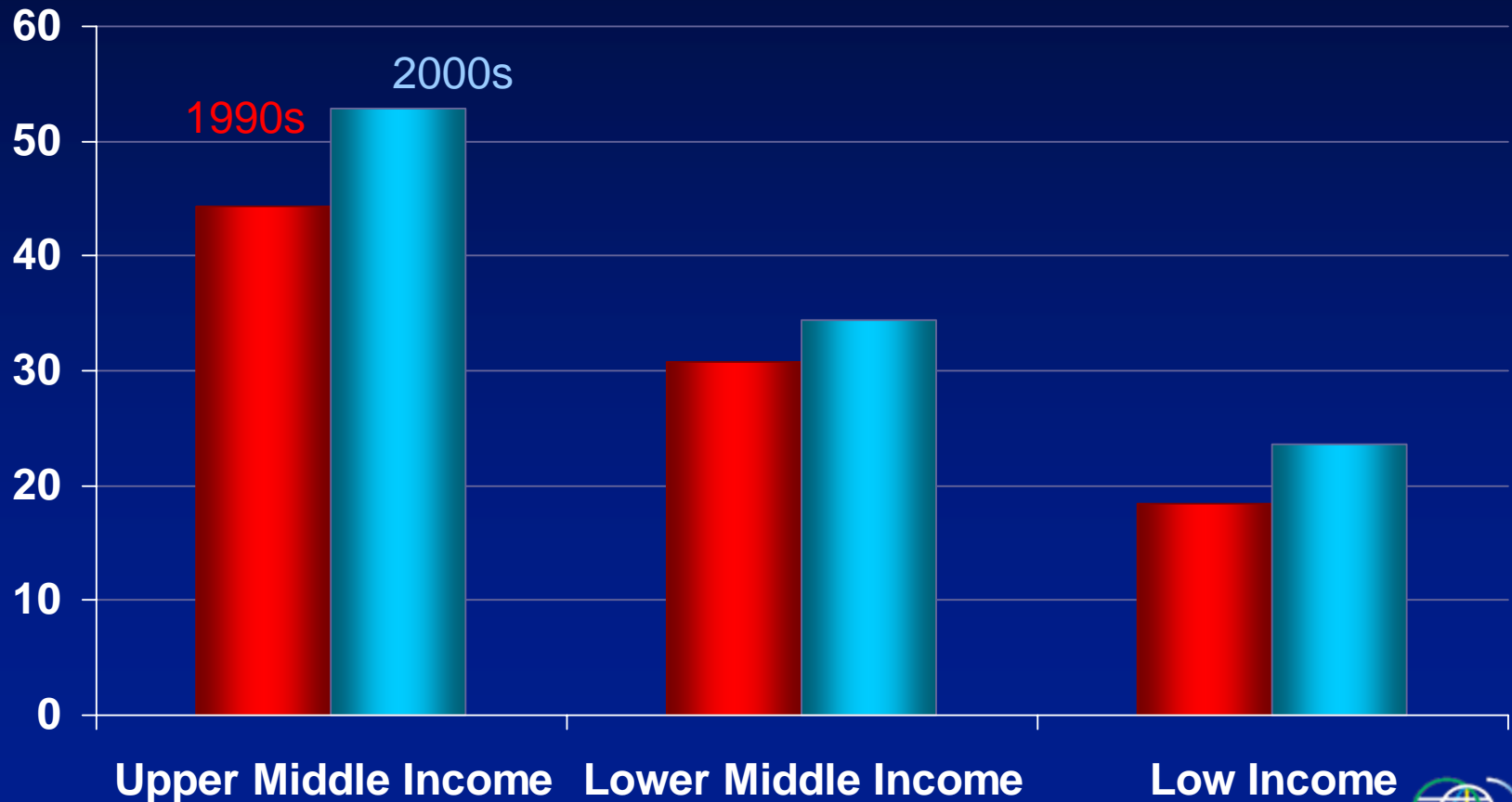
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Technology gap: still wide but narrowing

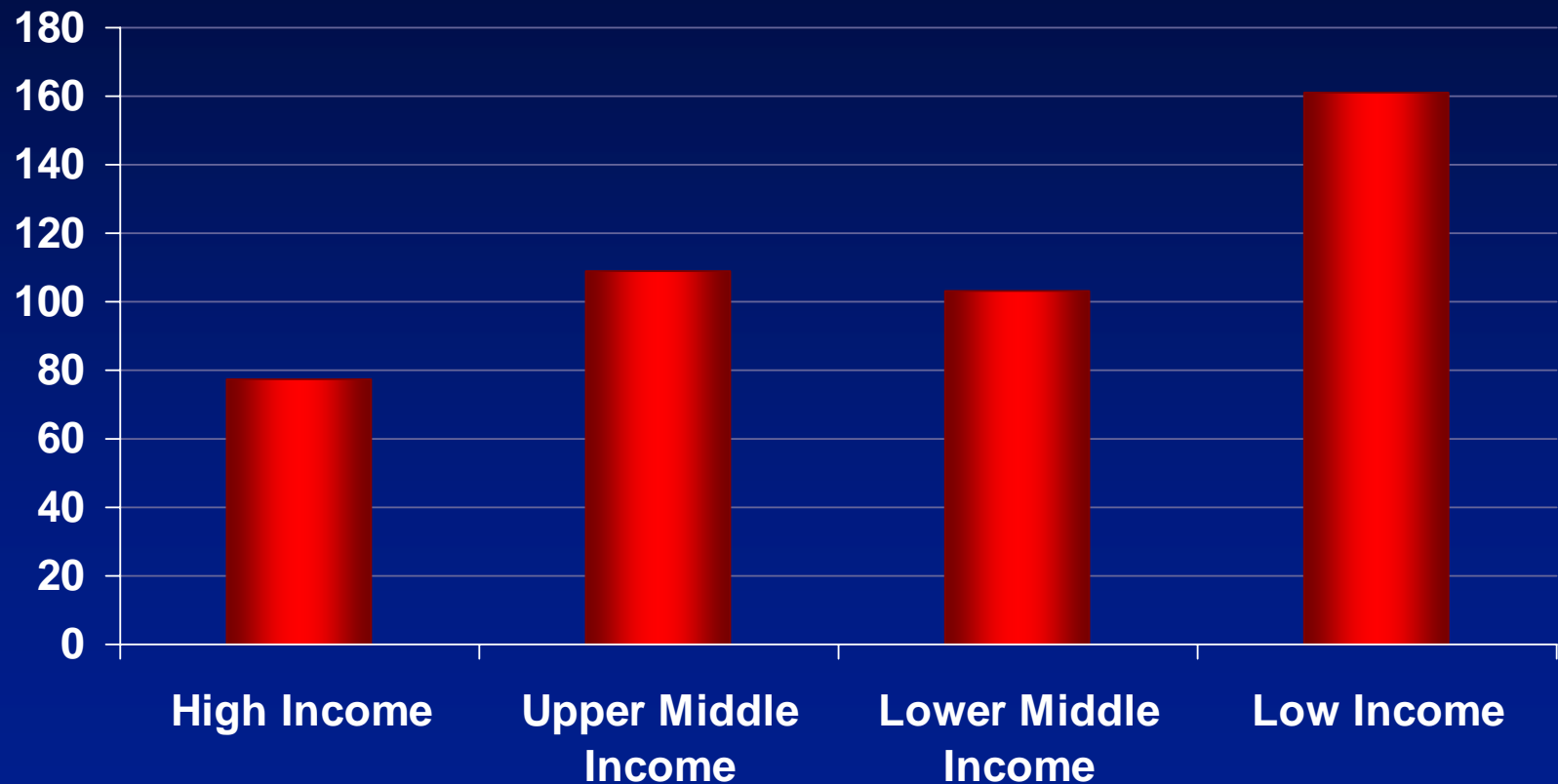
Index of technological achievement: Level compared to high-income countries (=100)



Source: World Bank, Global Economic Prospects (2008)

Technological progress in developing countries has outpaced high-income countries

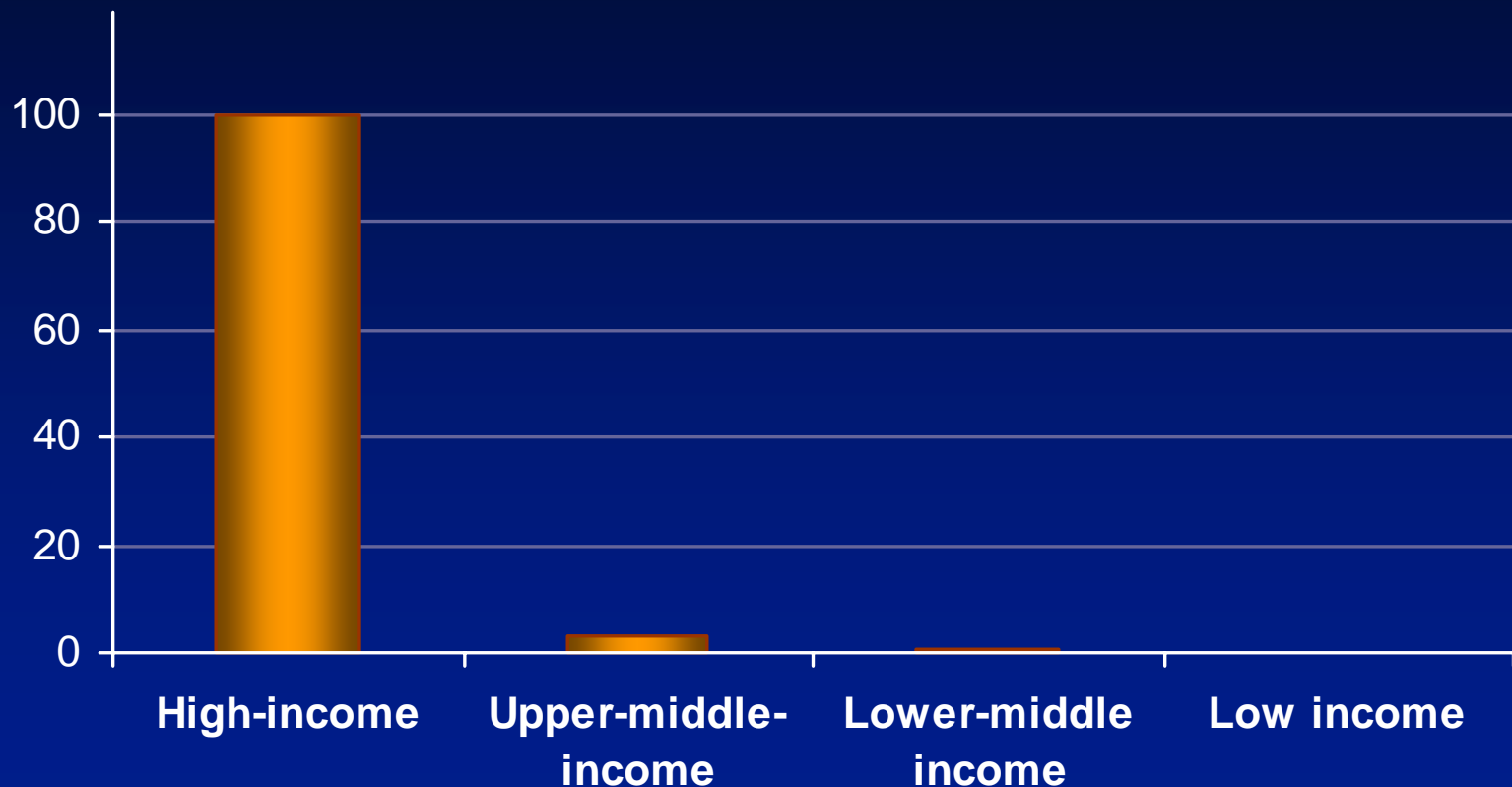
Percent change in technological achievement, 2000s vs 1990s



Source: World Bank, Global Economic Prospects (2008)

Developing countries are scarcely active at the global technology frontier

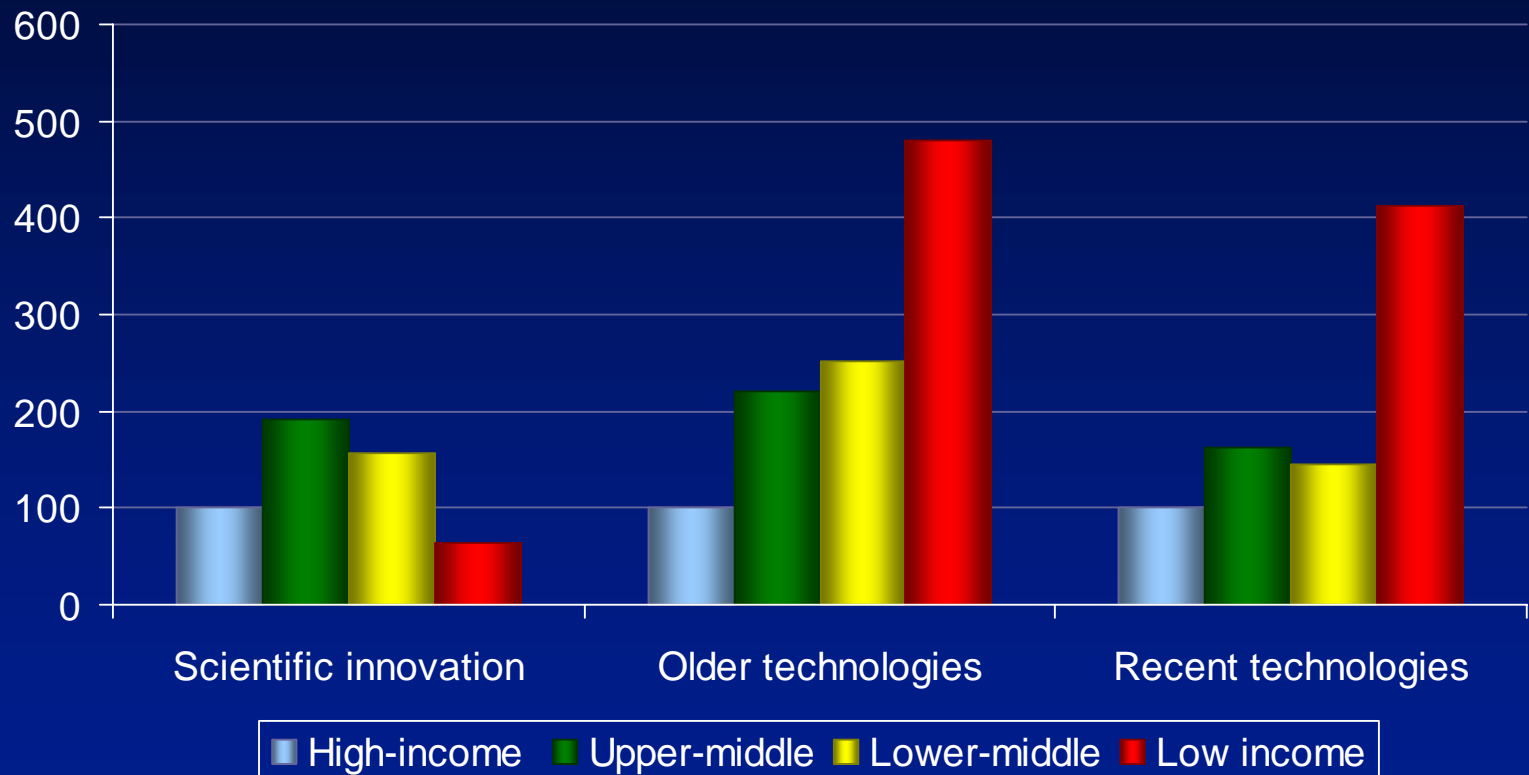
Intensity of scientific innovation and invention, High-income countries=100



Source: World Bank, Global Economic Prospects (2008)

Increased penetration of older technologies drives the rise in technological achievement in developing countries

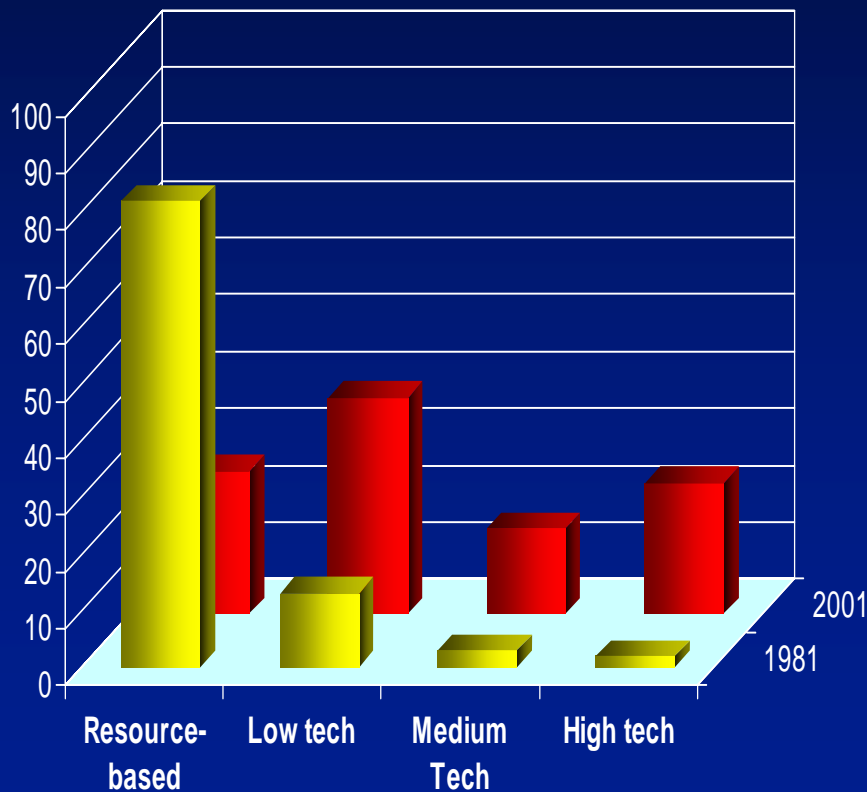
Increase in summary index, relative to high-income increase=100



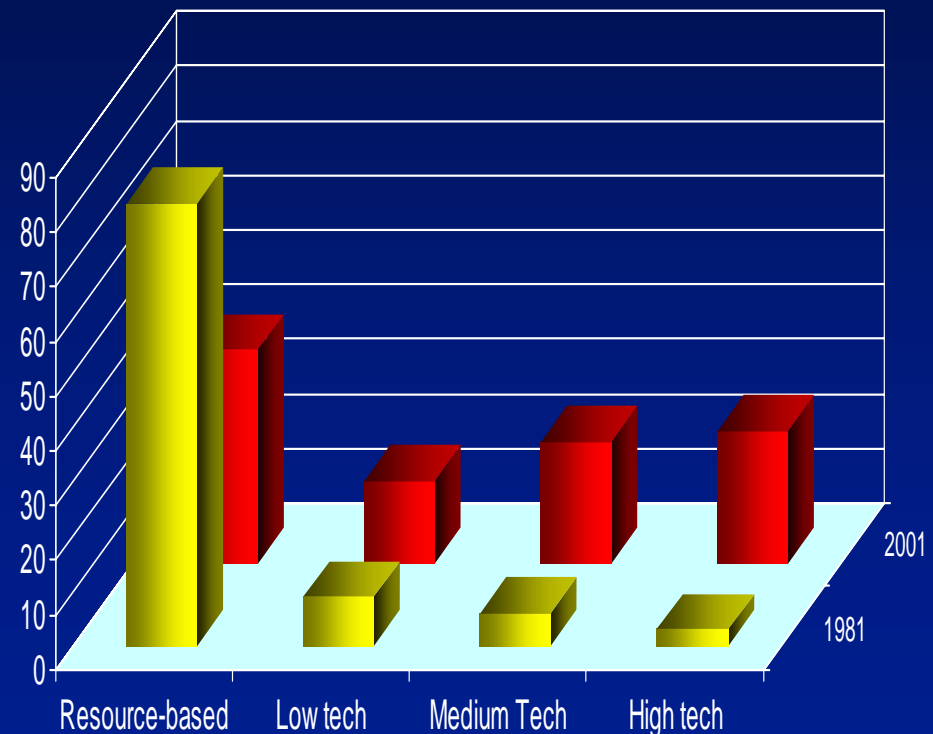
Source: World Bank, Global Economic Prospects (2008)

Developing countries are moving up the technology ladder... as evidenced in exports

Low income countries: Share of exports, 1981-2001 (percent)



Middle income countries: Share of exports, 1981-2001 (percent)



Source: World Bank, Global Economic Prospects, 2004

Key Points

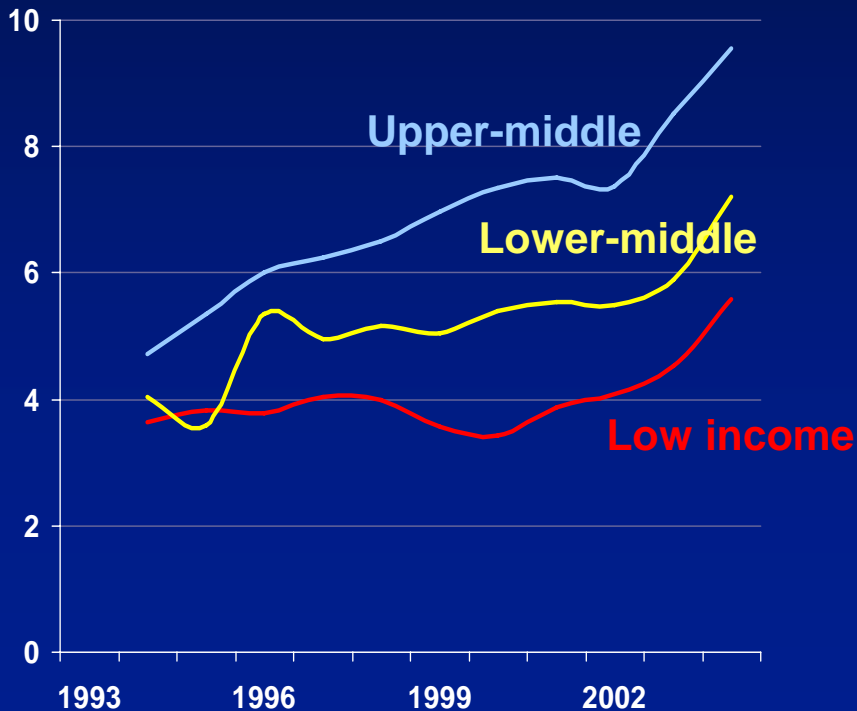
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Globalization is a key driver of technology transfer

Trade

- Import competition (Hoekman and Javorcik 2007; Amity, 2007)
- R&D content of imports (Coe, et al 1997)



Total Factor Productivity



Globalization is a key driver of technology transfer

Trade

- Import competition (Hoekman and Javorcik 2007)
- R&D content of imports (Coe, et al, 1995)
- Exports (?) (Kraay, 2007)

FDI

- Direct transfers (Hoekman and Javorcik, 2007)
- Spillovers (?) (Djankov and Hoekman, 2007)
- Competition (Pack, 2007)



The diagram illustrates the relationship between globalization drivers and technology transfer. On the left, two lists of factors are presented: 'Trade' (Import competition, R&D content of imports, Exports) and 'FDI' (Direct transfers, Spillovers, Competition). Two white arrows point from these lists towards a large blue circle on the right. The top arrow originates from the 'Trade' list, and the bottom arrow originates from the 'FDI' list. The blue circle contains the text 'Total Factor Productivity' in white, indicating that these factors collectively drive this outcome.

Total Factor Productivity



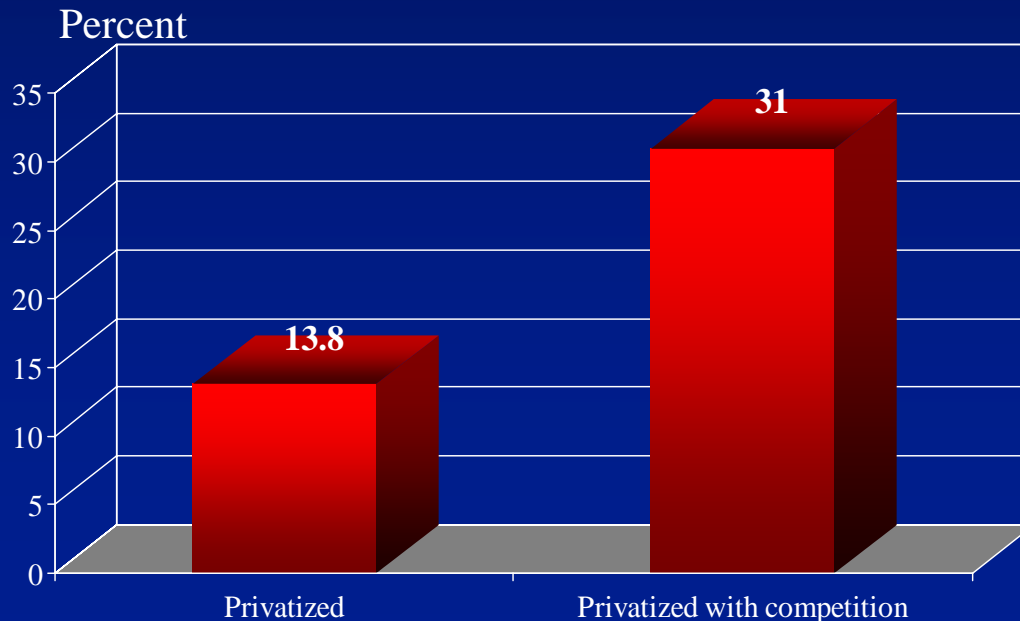
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FDI Growth of productivity: Telephony 1990s

Fixed line telephones, 1990s



Total Factor Productivity

Source: Fink, Mattoo, and Rathindran, 2002

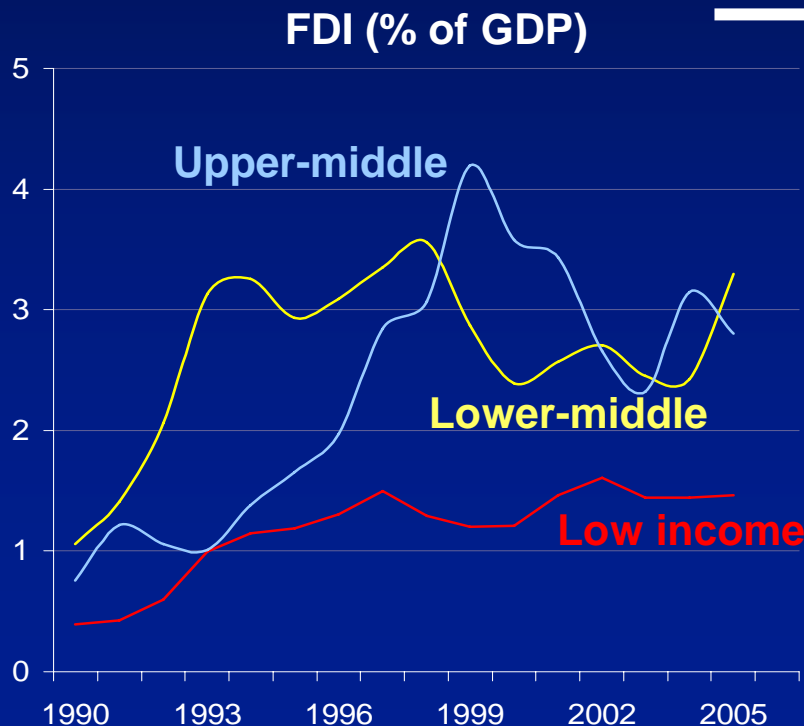


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Direct Access

- Internet
- Purchase via patents

Diaspora and Migration



Total Factor Productivity

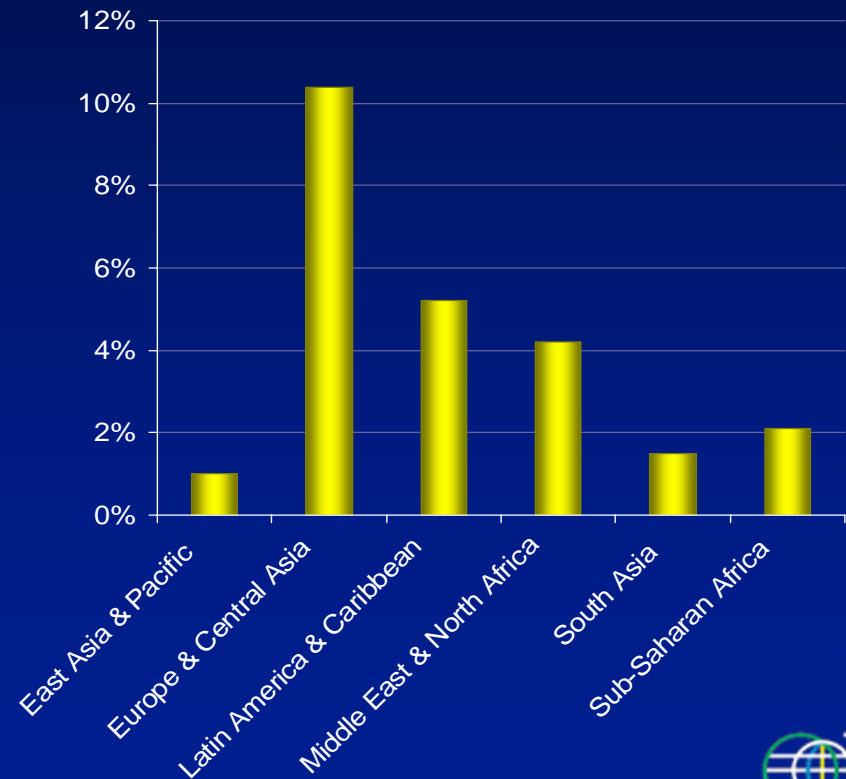


Highly-skilled migrant populations facilitate technology transfer

Developing country remittances
(% of GDP)



Size of diaspora
(% of origin-country population)



Source: www.worldbank.org/prospects/migrationandremittances.

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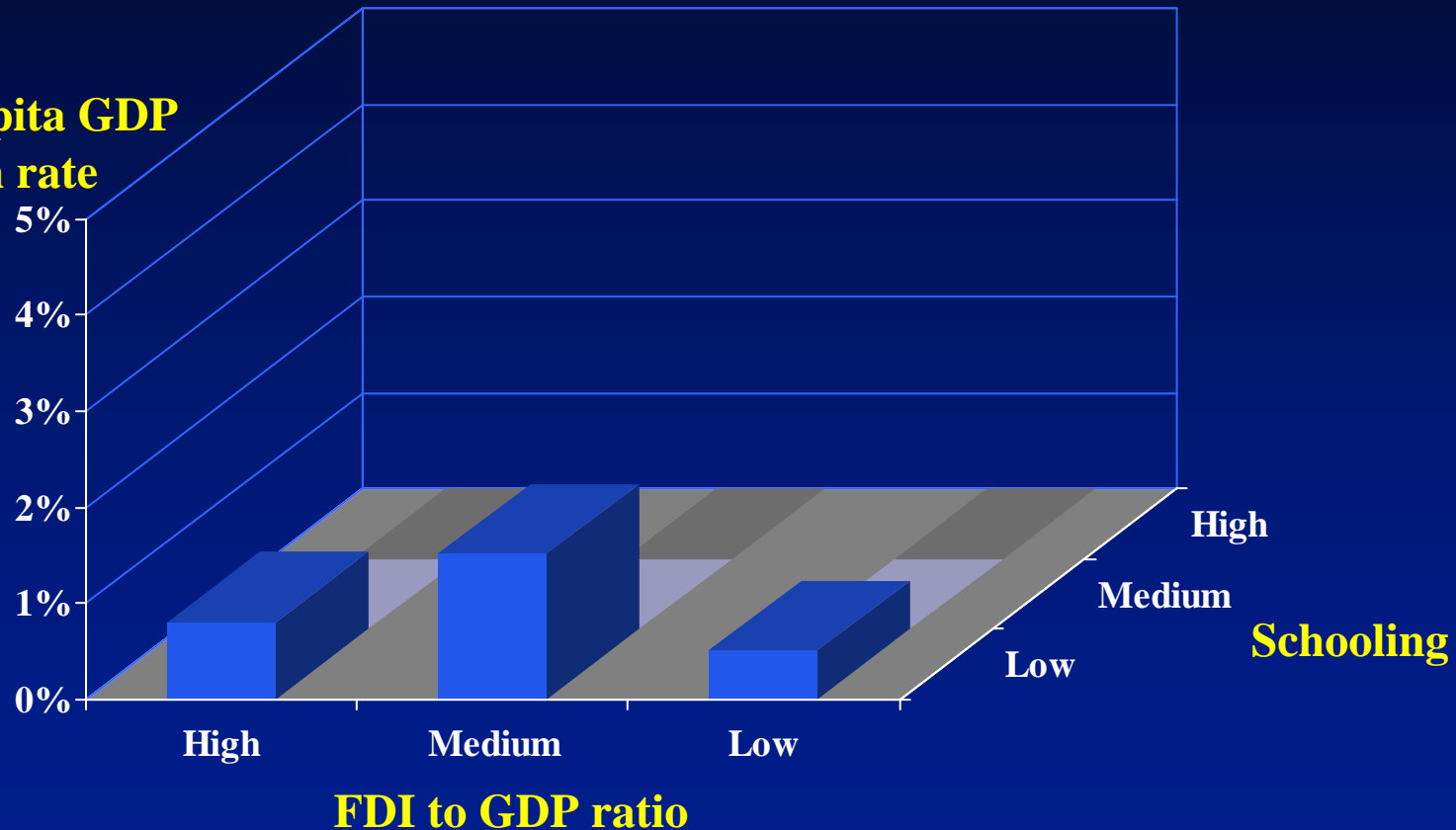
Four dimensions of absorptive capacity

- Macroeconomic environment
- Financial structure and intermediation
- Regulatory environment and governance
- Basic and advanced technological literacy



For example, technology literacy raises the productivity of FDI and its contribution to growth...

Per capita GDP growth rate

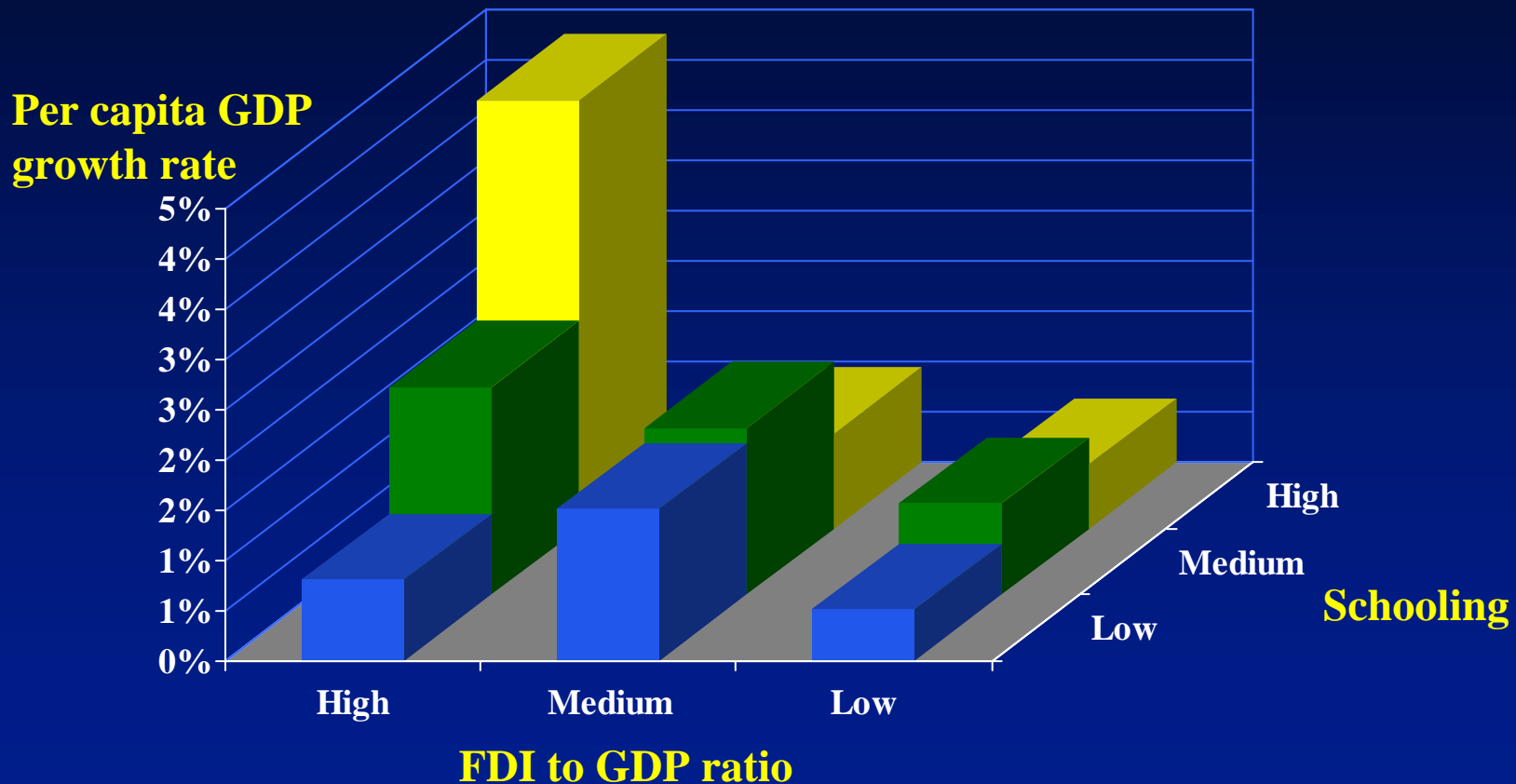


Note: The low, medium, and high categories for FDI to GDP ratio are below 0.01%, 0.01%-0.2%, and over 0.2% respectively. For the schooling variable, the low, medium, and high categories are below 0.4, 0.4-1.0, and over 1.0, respectively

Source: Borensztein et al (1998)



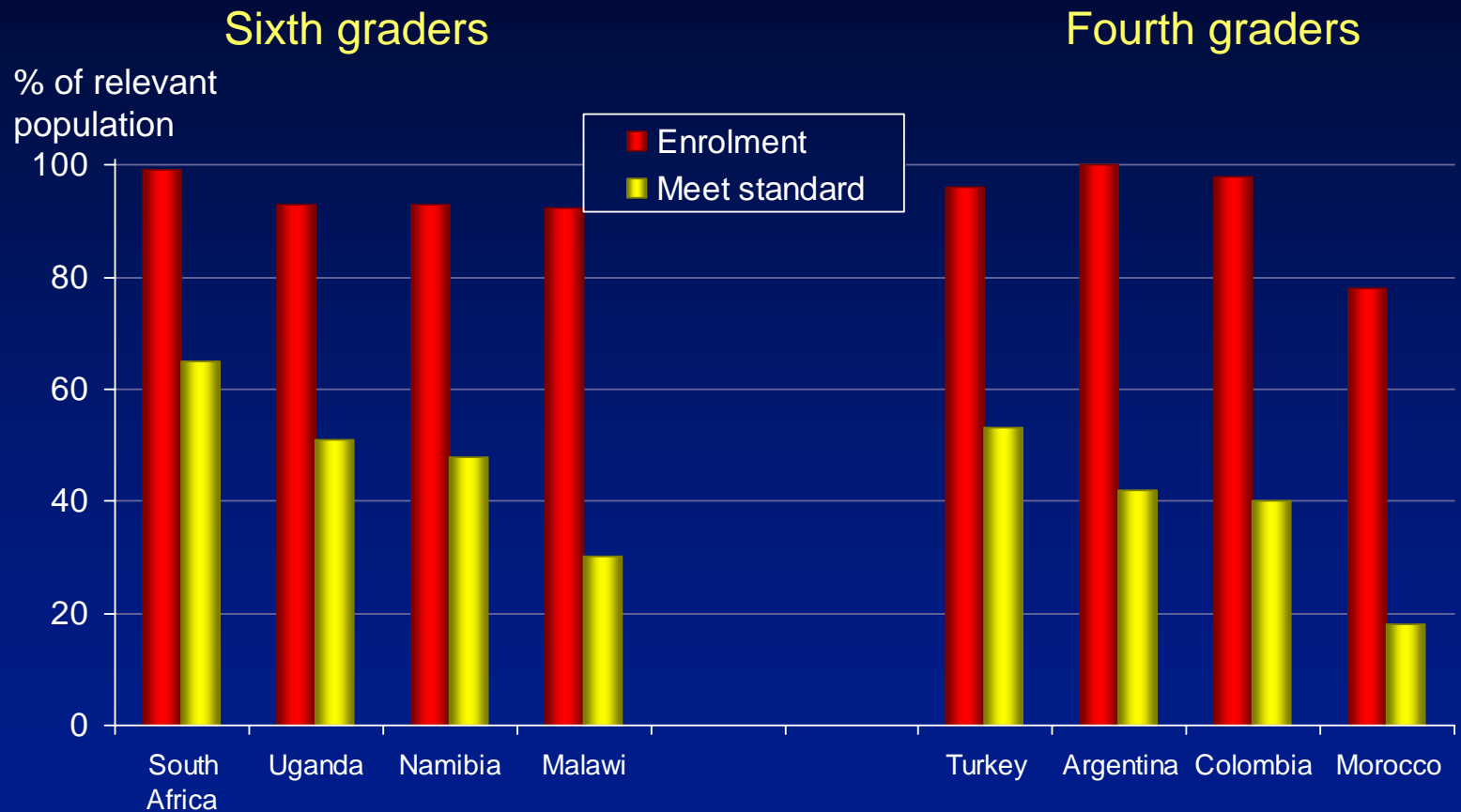
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Source: Borensztein et al (1998)

Despite high enrolment rates, few students pass standardized tests (2000s)



Sources: SACMEQ II (2000), PIRLS (2001), and DHS

Key features of a pro-technology policy stance

- **Each country must customize its technology policy to suit its particular circumstances..**
- **But in general policies with the greatest long term effects include:**
 - **Maintain openness to trade, foreign direct investment and participation of diaspora**
 - **Improve the investment climate so as to allow innovative firms to flourish**
 - **Improve basic infrastructure (roads, electricity, telephony)**
 - **Raise the quality and quantity of education throughout economy not just major centers**
 - **Pro-active policies: reinforce dissemination systems, increase the market-orientation of R&D programs**



References and further reading

This presentation is adapted from that of the *Global Economic Prospects 2008* team, led by Andrew Burns, World Bank

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World Bank *Global Economic Prospects 2008: Technology Diffusion in the Developing World* World Bank: Washington DC.



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For more info:

GEP: <http://www.worldbank.org/gep2008>

Trade: <http://www.worldbank.org/trade>

