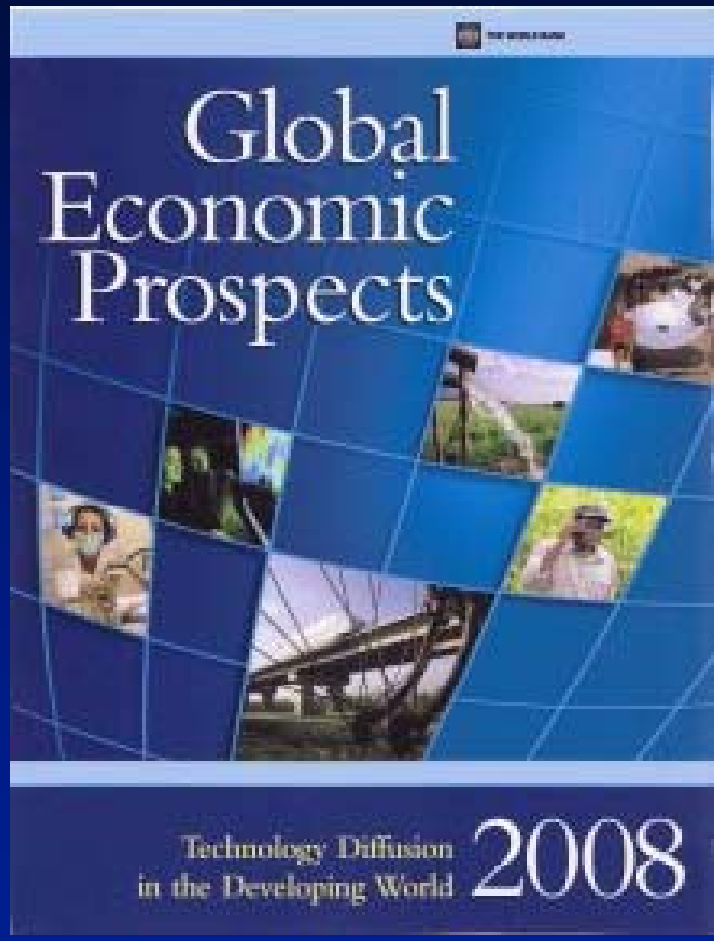
Technology diffusion in the developing world



Andrew Burns

World Bank

November 18, 2008

About this study

- Broad definition of technology: comprises machines, techniques (including business processes), and even market knowledge
- Not about technology's contribution to growth
- Not about total factor productivity
- About understanding better the diffusion of technology across and within developing countries and recent trends in the determinants of that diffusion

DEVELOPMENT PROSPECTS

Technology in the developing world

- Globalization and better policies have enabled developing countries to narrow the technology divide with high income countries – but the gap remains large
- Progress in developing countries depends mainly on absorbing and adapting foreign technologies – rather than at-the-frontier innovations
- Persistent weakness in technological absorptive capacity may increasingly constrain developing-country technological progress

DEVELOPMENT PROSPECTS

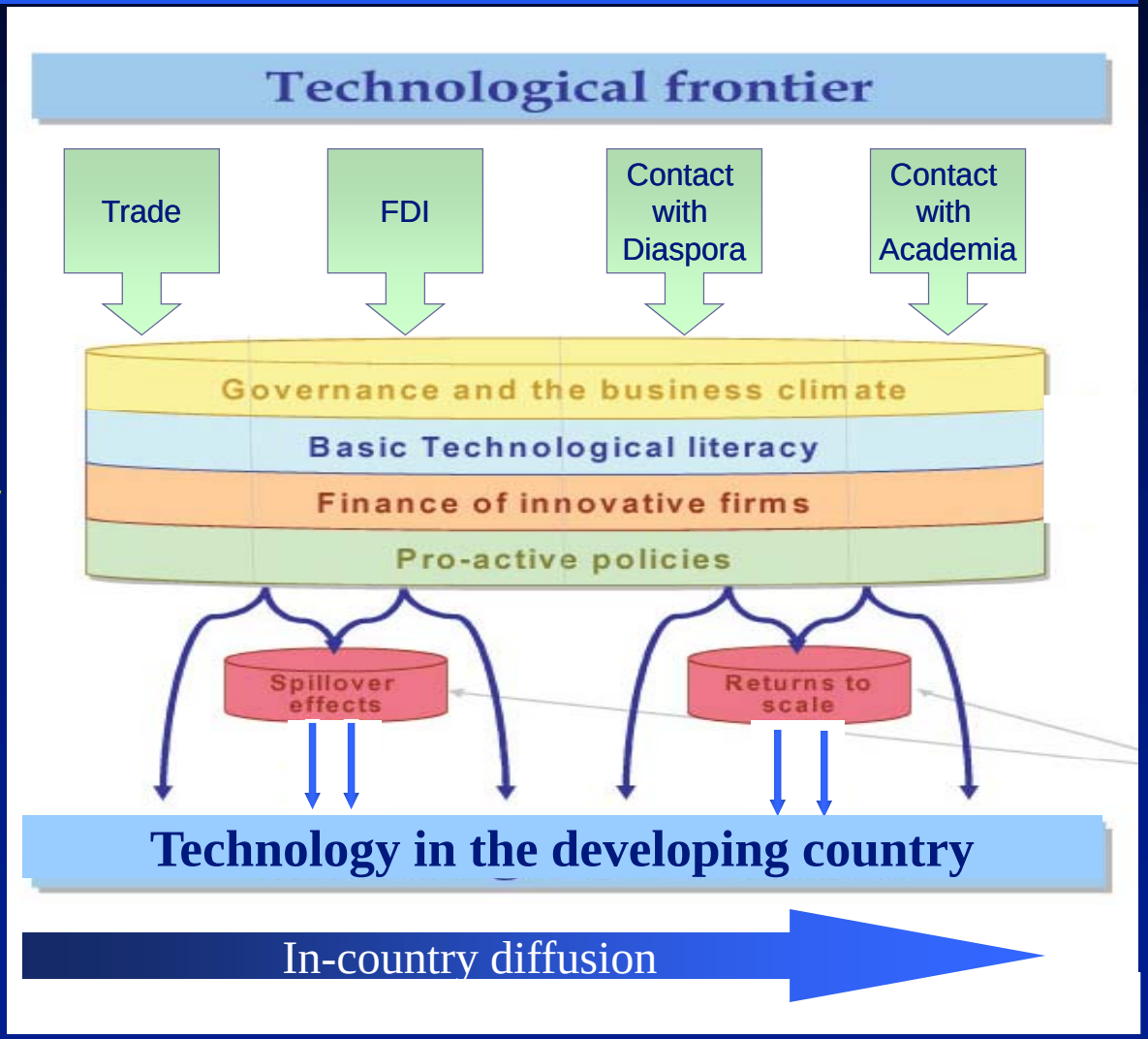
A framework for understanding technological progress in developing countries

Exposure to technological frontier

Domestic technological asborptive capacity

Yields technological progress

Spread of technology within country is key



DEVELOPMENT PROSPECTS

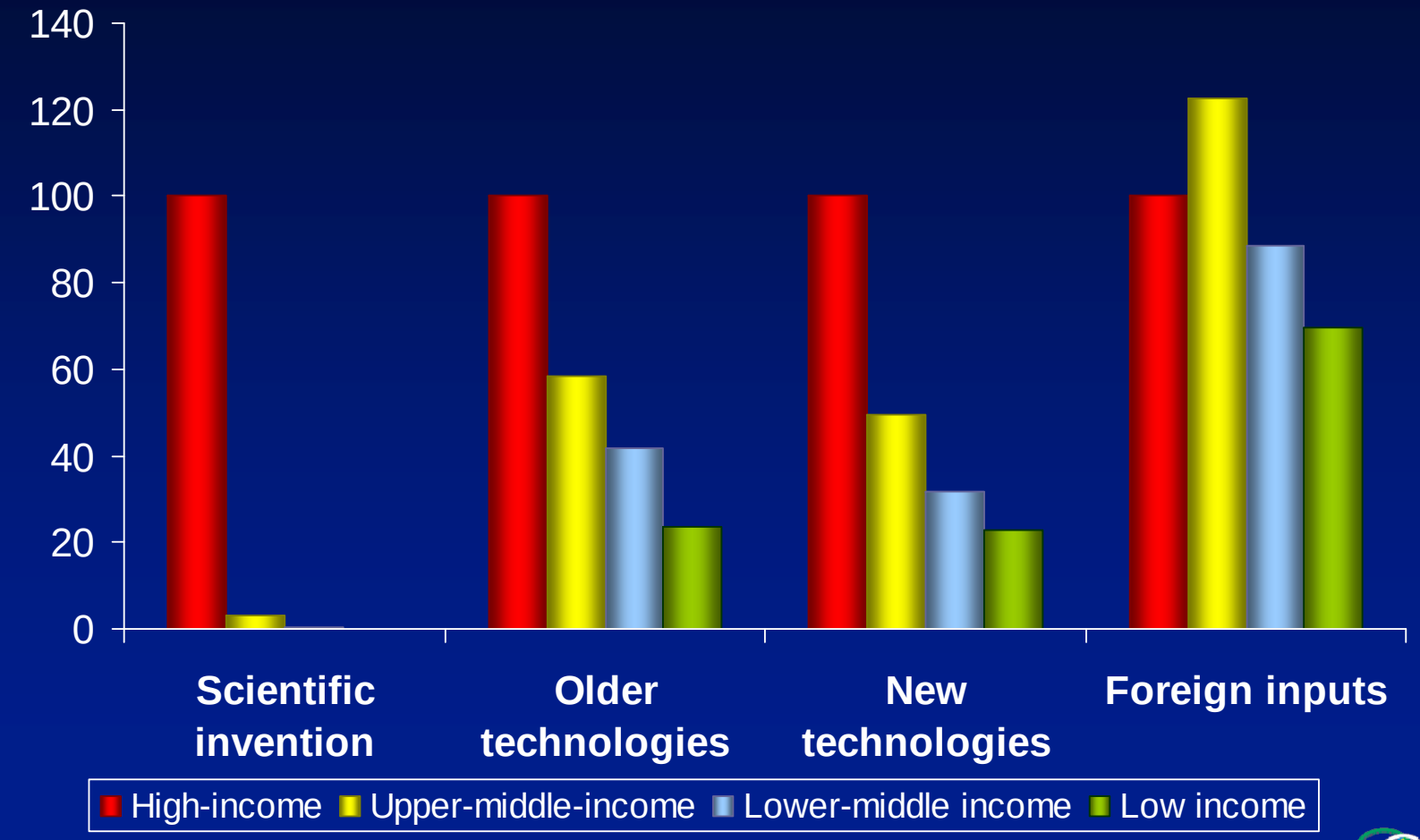
Measuring technological achievement

- Index based on 20 sub-indicators along 4 dimensions
  1. Scientific innovation and invention
  2. Penetration of older technologies
  3. Penetration of recent technologies
  4. Exposure to foreign technologies
- A flexible data-driven weighting scheme (principal components) used to calculate summary indices of each dimension and an overall index

DEVELOPMENT PROSPECTS

Developing countries are intensive consumers of foreign inputs but do little at-the-frontier innovation

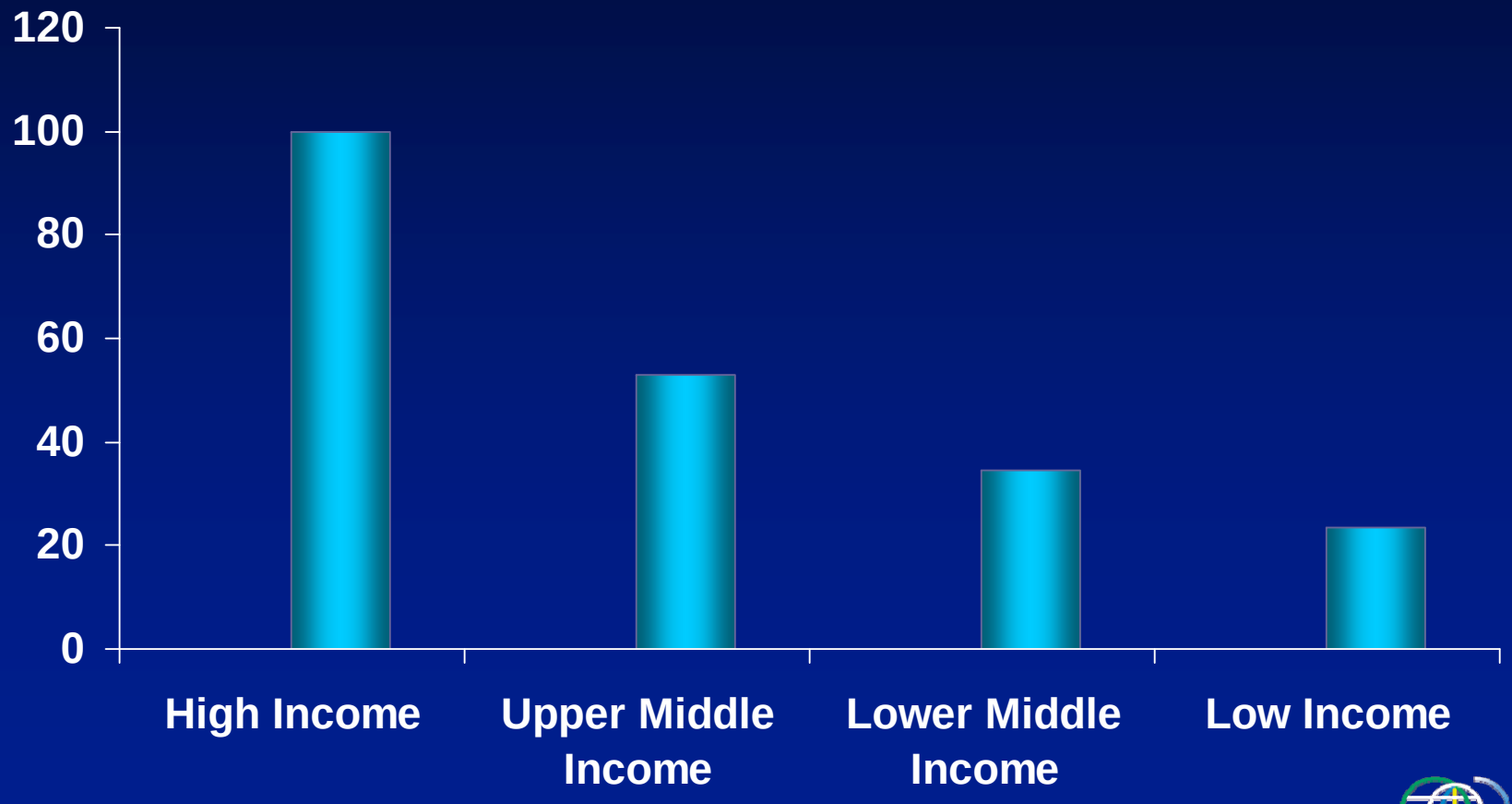
Sub-indexes of technological achievement (2000s), high-income countries=100



DEVELOPMENT PROSPECTS

Although closing, the gap remains large

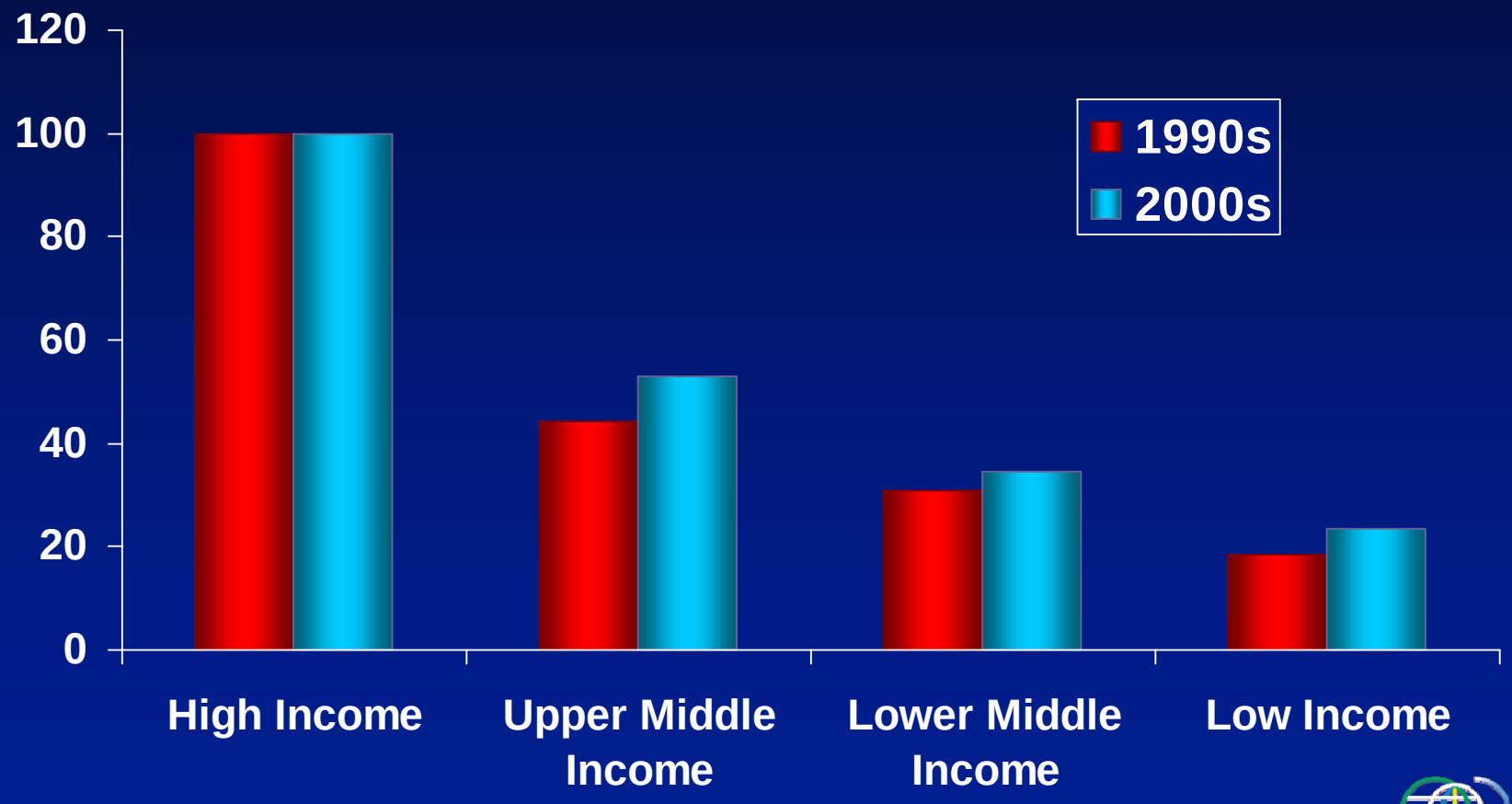
Index of technological achievement, index high-income countries = 100



DEVELOPMENT PROSPECTS

Although closing, the gap remains large

Index of technological achievement, index high-income countries = 100



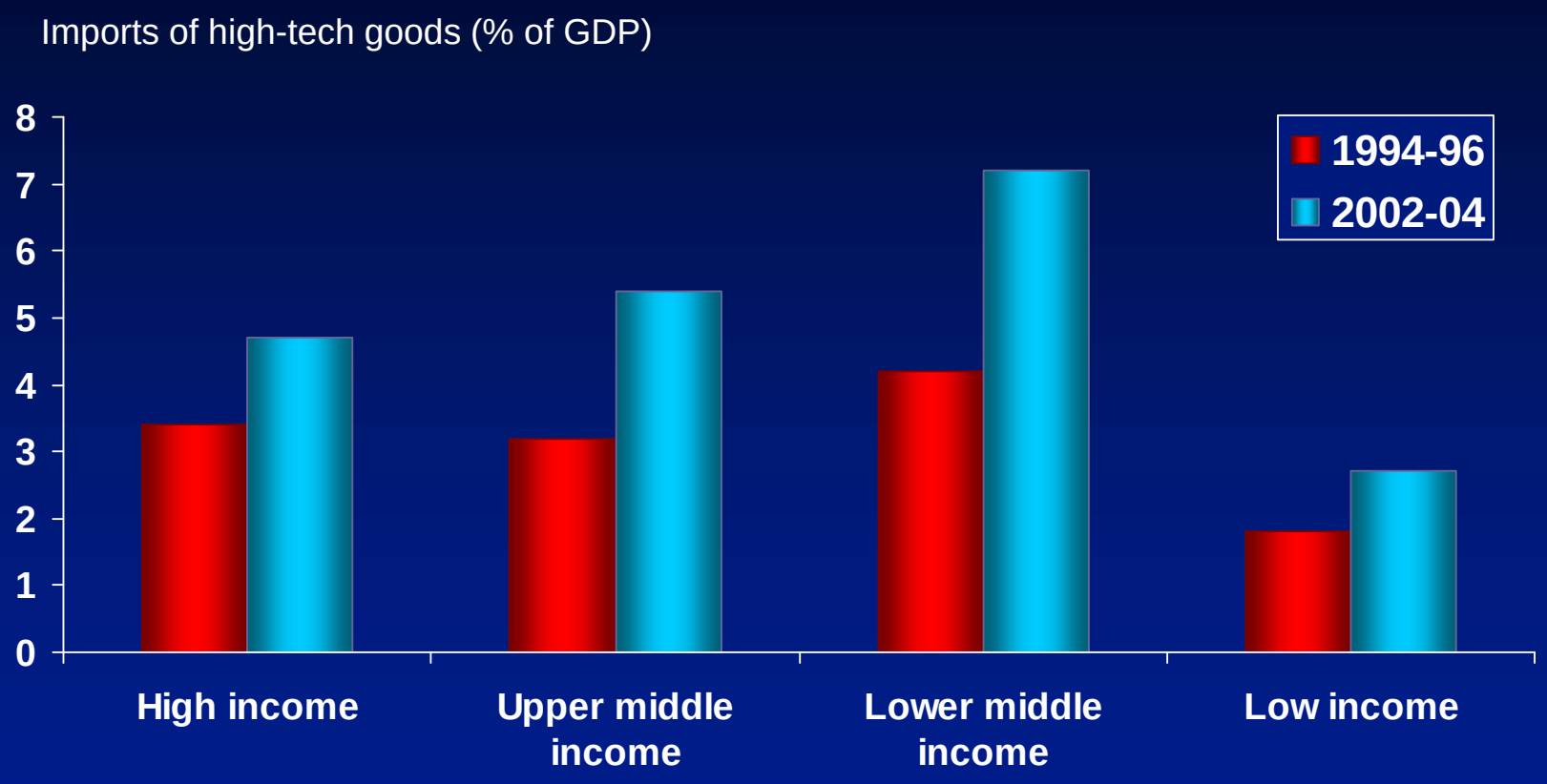
DEVELOPMENT PROSPECTS

Technology in the developing world

- Globalization and better policies have enabled developing countries to narrow the technology divide with high income countries – but the gap remains large
- Progress in developing countries depends mainly on absorbing and adapting foreign technologies – rather than at-the-frontier innovations
- Persistent weakness in technological absorptive capacity may increasingly constrain developing-country technological progress

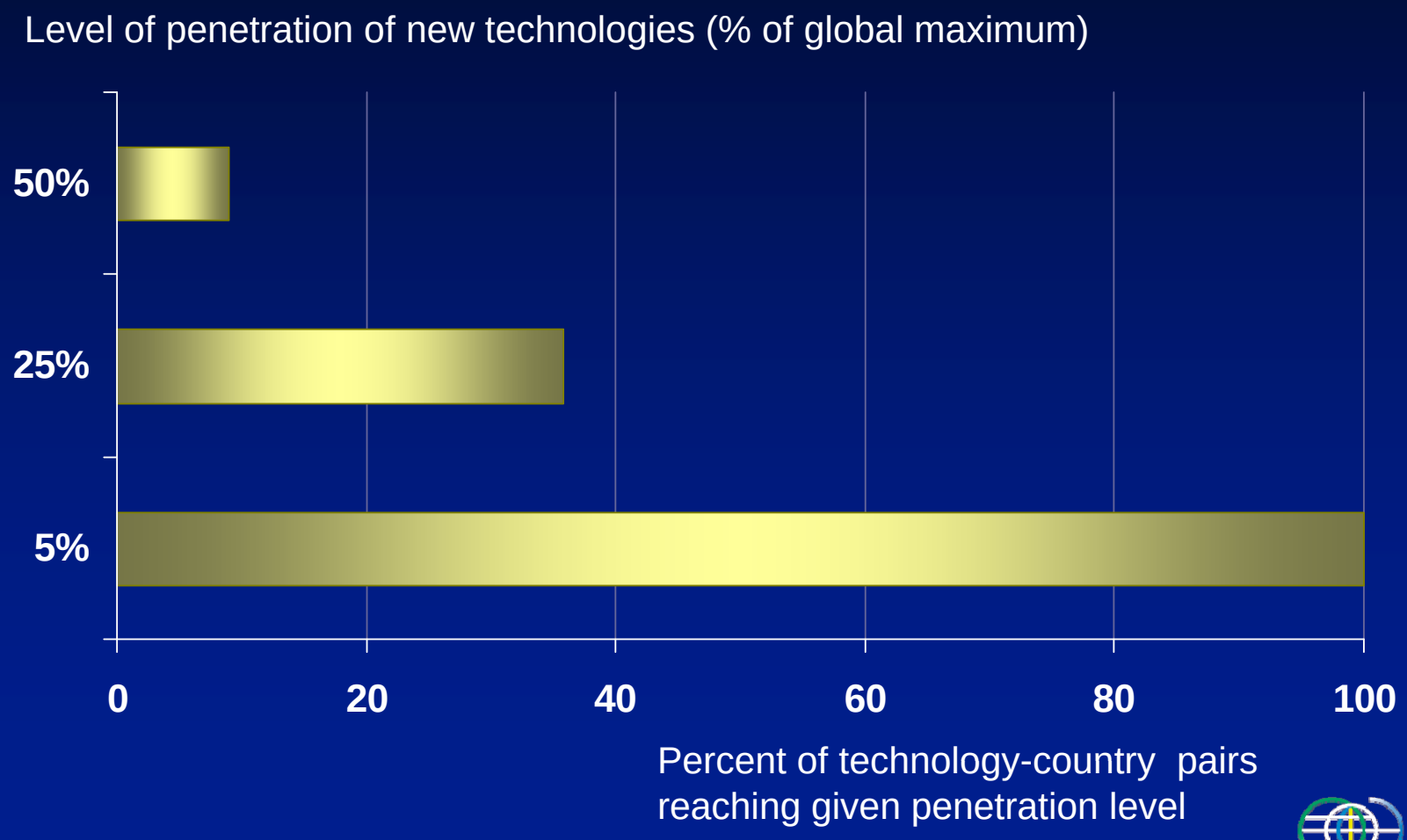
DEVELOPMENT PROSPECTS

Developing countries exposure to foreign technology has increased enormously



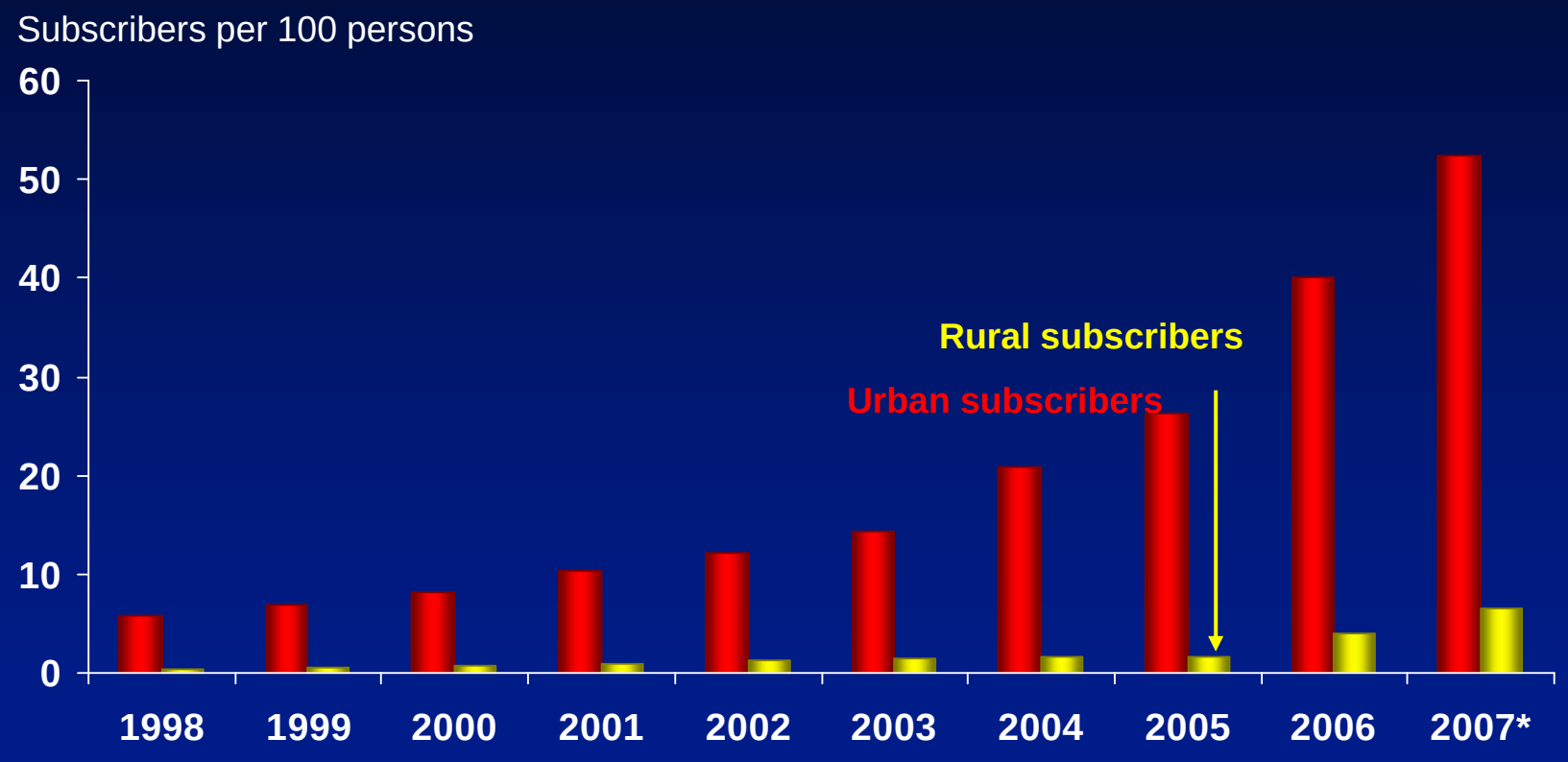
DEVELOPMENT PROSPECTS

Technology spreads to developing countries relatively rapidly, but is much slower to spread within these countries



DEVELOPMENT PROSPECTS

Witness telephone pentration rates in India



* 2007 data are for June 2007

Source: Telecommunications Regulatory Authority of India

DEVELOPMENT PROSPECTS

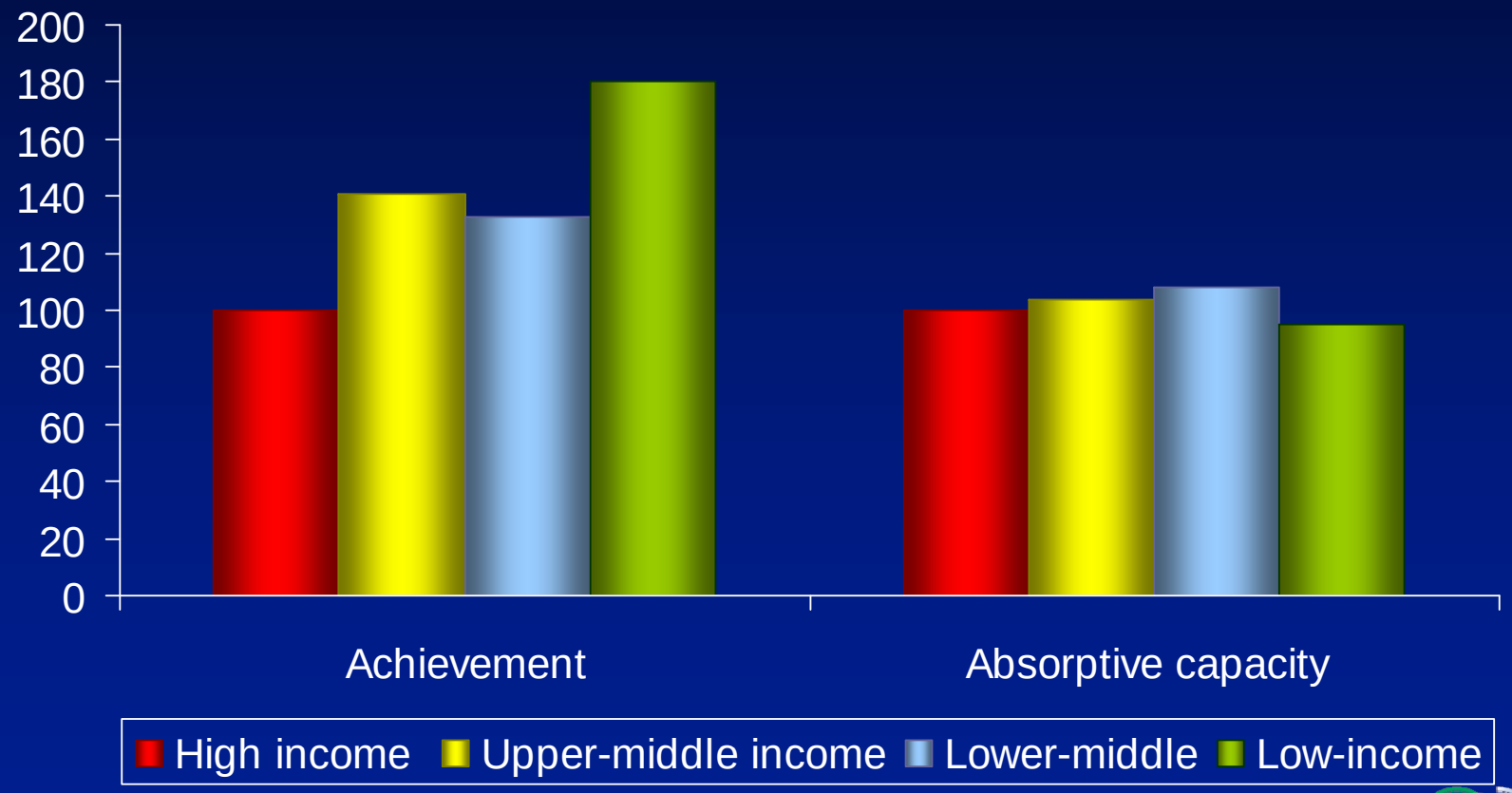
Technology in the developing world

- Globalization and better policies have enabled developing countries to narrow the technology divide with high income countries – but the gap remains large
- Progress in developing countries depends mainly on absorbing and adapting foreign technologies – rather than at-the-frontier innovations
- Persistent weakness in technological absorptive capacity may increasingly constrain developing-country technological progress

DEVELOPMENT PROSPECTS

Overall technological absorptive capacity has improved much less rapidly than achievement

Index of relative improvement in index, high-income countries=100



DEVELOPMENT PROSPECTS

Progress in absorptive capacity

Substantial improvements

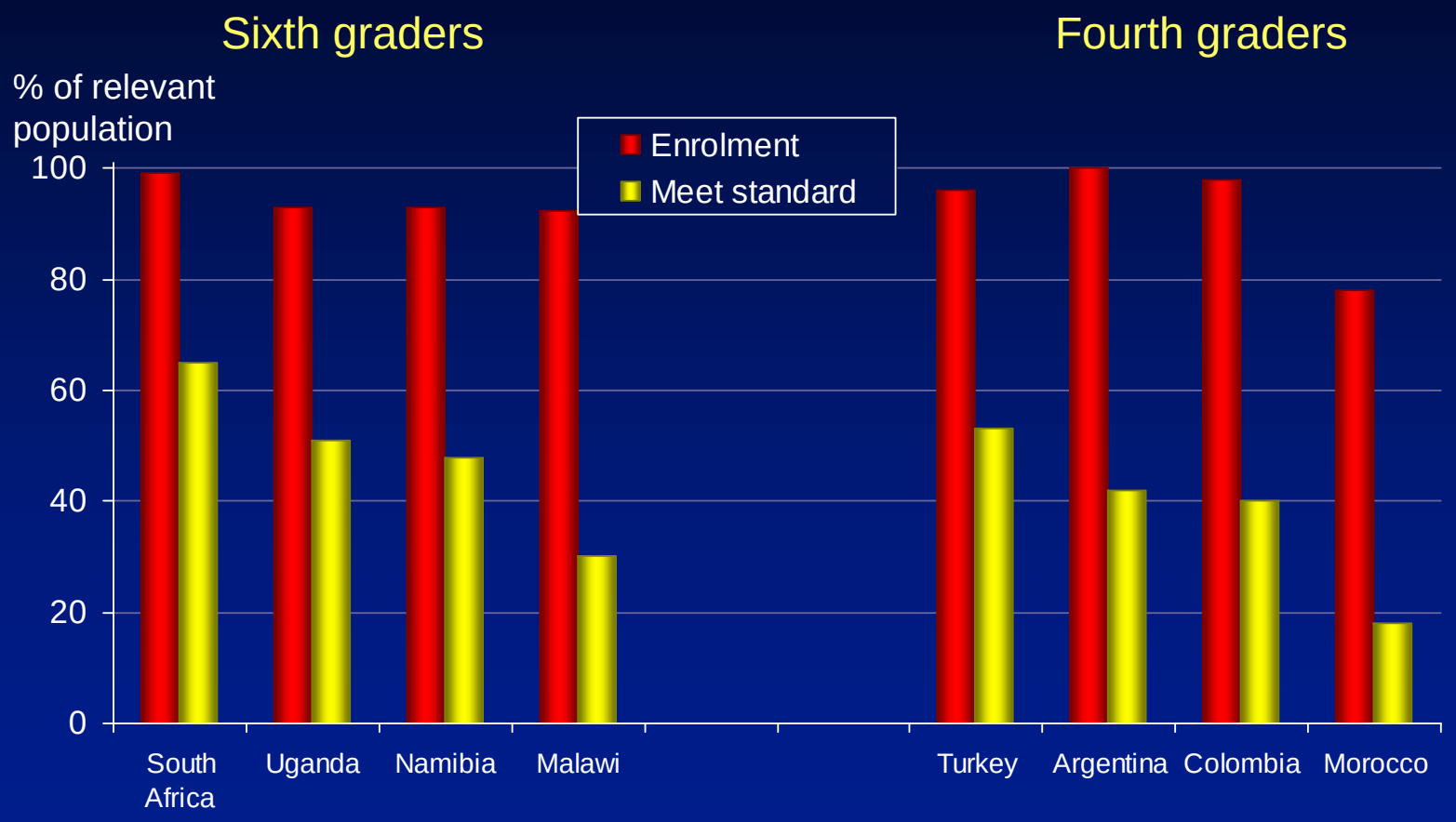
1. Macroeconomic environment
2. Financial structure and intermediation

Relatively weak improvements

1. Basic and advanced technological literacy
2. Regulatory environment and governance

DEVELOPMENT PROSPECTS

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

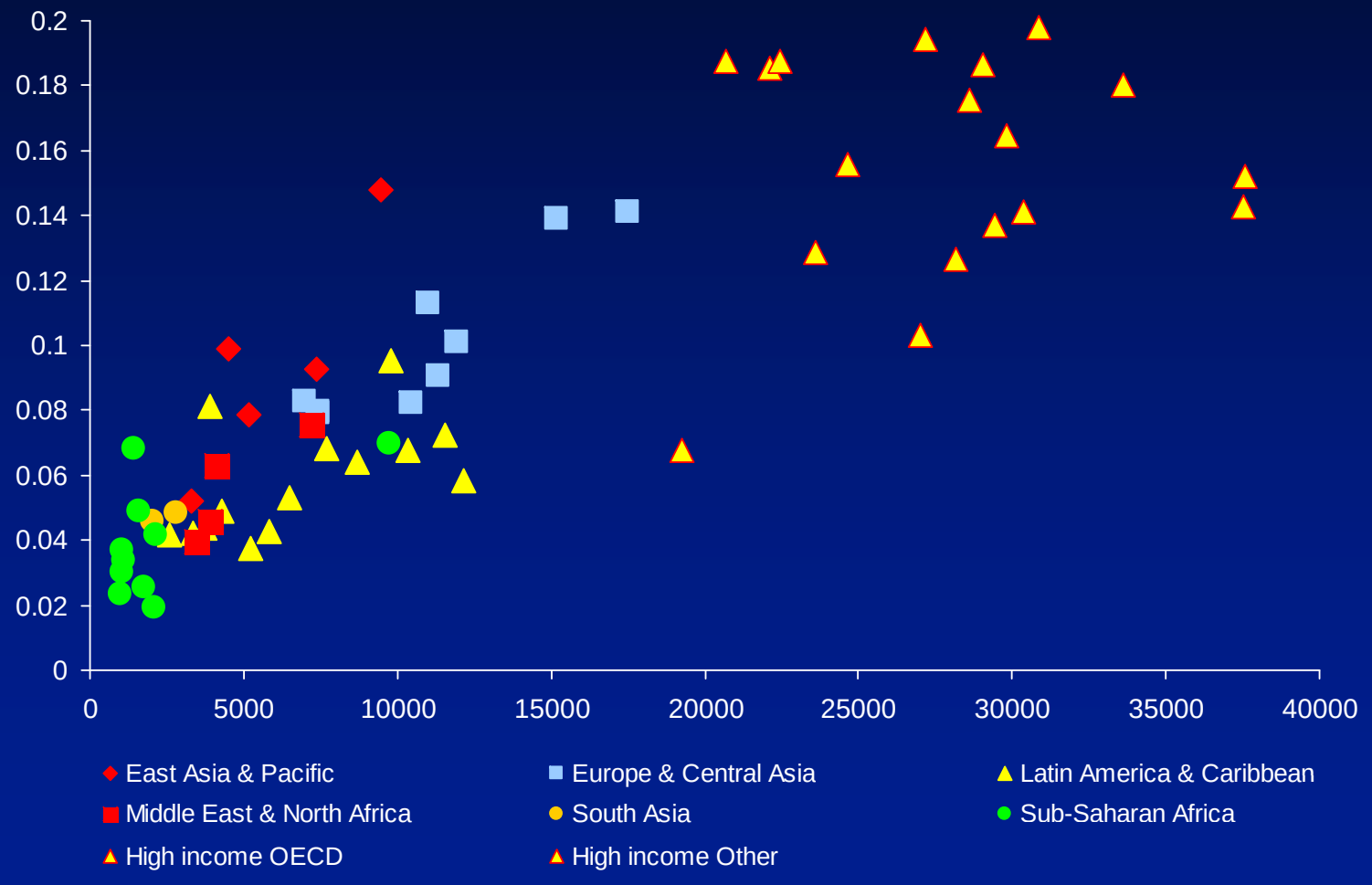


Sources: SACMEQ II (2000), PIRLS (2001), and DHS

DEVELOPMENT PROSPECTS

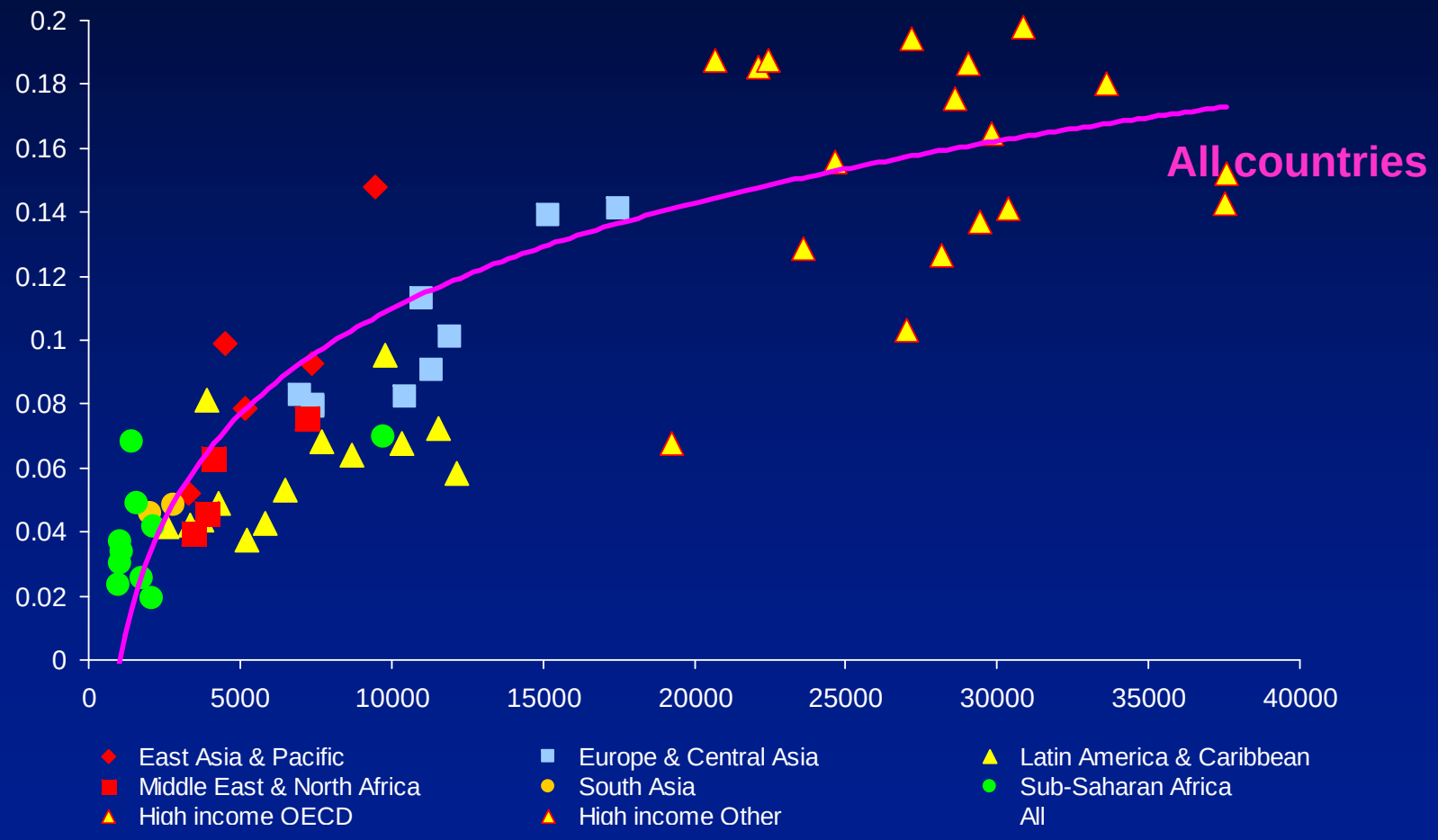
Weak Absorptive capacity may begin to constrain further technological progress

Technological achievement versus per capita income by region



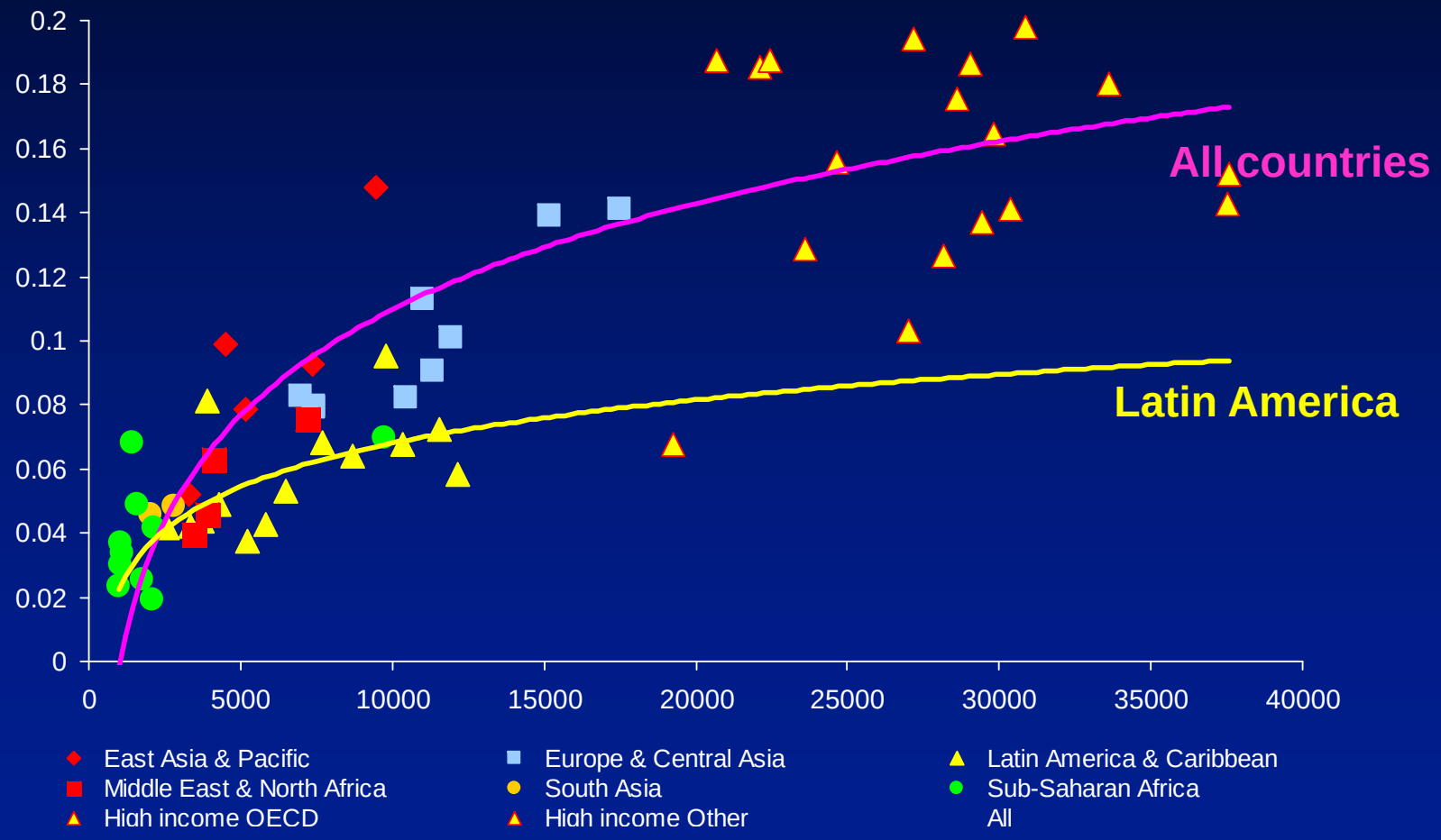
Weak Absorptive capacity may begin to constrain further technological progress

Technological achievement versus per capita income by region



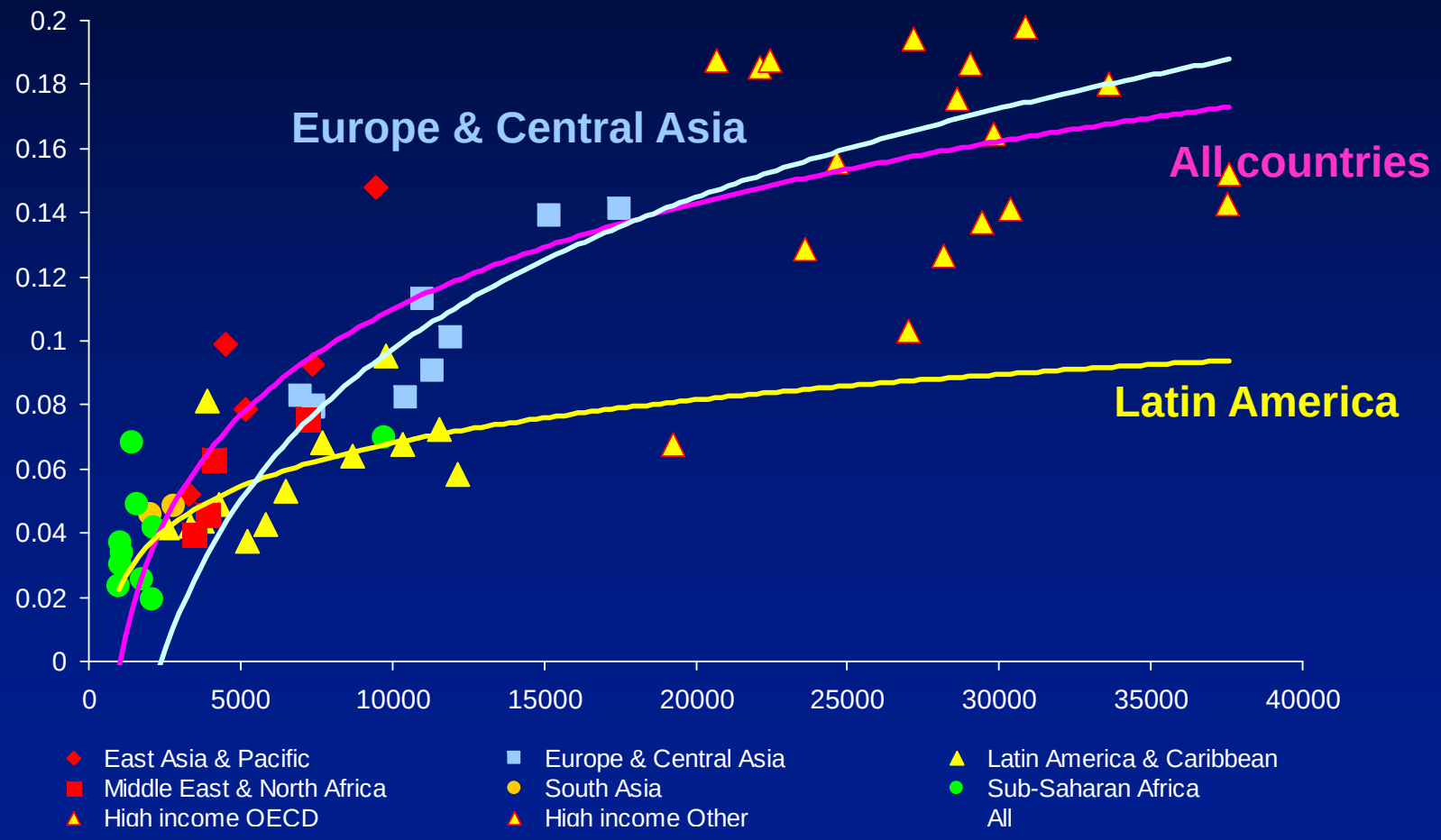
Weak Absorptive capacity may begin to constrain further technological progress

Technological achievement versus per capita income by region



Weak Absorptive capacity may begin to constrain further technological progress

Technological achievement versus per capita income by region

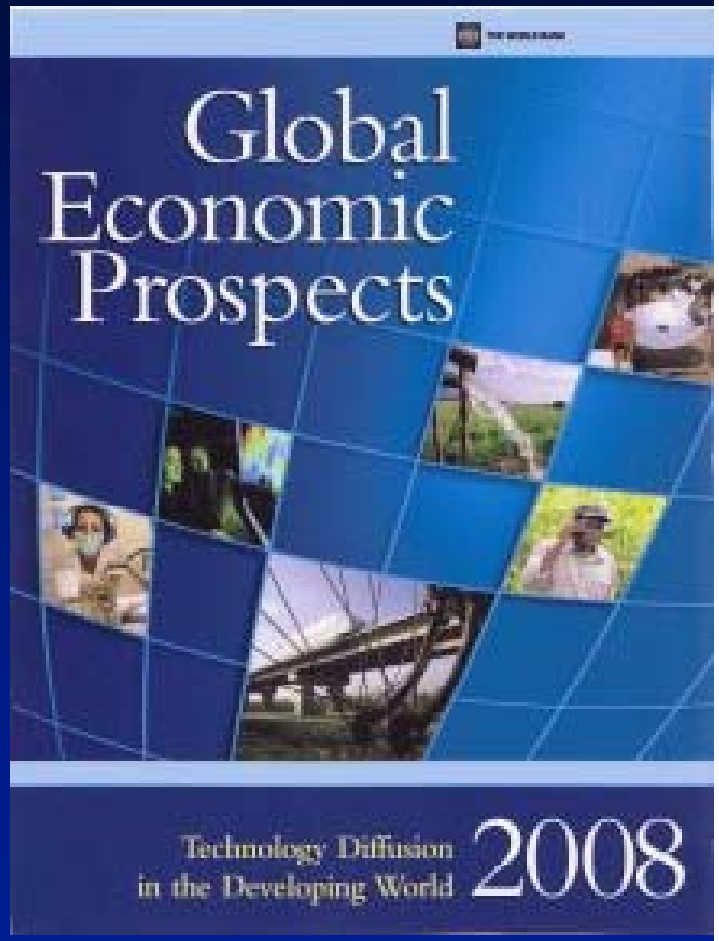


Key features of a pro-technology policy stance

- Strengthen basic technological competencies
- Improve basic infrastructure (roads, electricity, telephony)
- Pay attention to the entire economy not just major centers
- Emphasize technology diffusion by reinforcing dissemination systems and the market-orientation of R&D programs
- Further improve the investment climate so as to allow innovative firms to grow and flourish

DEVELOPMENT PROSPECTS

Technology diffusion in the developing world



Andrew Burns

World Bank

November 18, 2008