# CEE Growth & Development

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# EBRD Report - Schumpeter model

Schumpeter's model of economic growth driven by innovation

$Y_{i,t} = A_{i,t}^{1-\alpha} K_{i,t}^{\alpha}$, where $(0 < \alpha < 1)$;
$A_{i,t}$ is the most recent technology used in industry $i$, in time $t$.
$K_{i,t}$ flow of a intermediate products used in this sector.
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- $A_{i,t}$ is generated by most successful entrepreneur. The entrepreneur in time $t$ displaced an entrepreneur in time $t-1$ by innovating more productive factors of production. (TE: What happens in time $t+1$?)

- Higher economy growth rate implies higher firm turn-over. This is how process of 'creative destruction' generates entry of new and exit of former innovators.

# Designing policies for growth Innovation and Imitation (EBRD Report)

In this framework, countries can increase productivity by imitating or innovating.

Which path will countries choose, depends on the proximity to 'technological frontier'.

Countries can be either at
- 'tech frontier'
- imitators

$\dot{A} = u_n(\gamma - 1)A + u_m(\bar{A} - A)$, where

$\gamma$ is multiplier of pre-existing level of innovation

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$\gamma$ is multiplier of pre-existing level of innovation
$\bar{A}$ global technology knowledge
$u_{n,m}$ frequency of innovation and imitation which are affected by *institutions* built to foster one or another.

## Schumpeter model continued

If we define $g$ as a rate of technology growth in time $t$, then

$$g = u_n(\gamma - 1)A + u_m(a_t^{-1} - 1)$$

TE: Fully derive the above equation.

$a_t = \bar{A}_t/A_t$, inverse measure from distance from 'tech frontier'.

If $a_t$ is lower it implies that country will grow faster.
The country benefits higher knowledge spillovers from more advanced economies. (Historical examples: Japan and Europe after 1945)

# Economic environment has large influence on the usage of technology in the economy

Imitation has tended to occur where:

- Large firms can take advantage of economies of scale
- Small labour mobility
- Limited competition and entry
- Financial markets are limited (bank finance)

# Economic environment has large influence on the usage of technology in the economy

Countries that innovate at the technological frontier have tended to require:

- High labour market mobility
- Intense competition and low barriers of entry
- Focus on graduate education
- Larger role of non-bank finance

# Polices for growth:

1. Competition and entry
2. Education
3. Financial Constraints
4. Financial Reform

# 1.Competition and entry

- Increasing competition increases labour productivity and economic growth.
  - How do we measure competition? By entry rates.
  - What are the reasons for low entry rates? Because of barriers of entry: access to finance, taxation, and regulation.

# Domestic versus foreign competition

**Chart 1: Importance of competition for the innovation of new products**
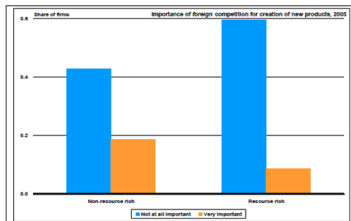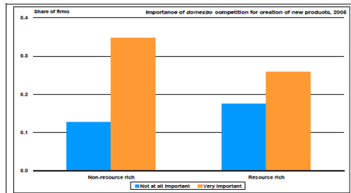




Source: BEEPS, 2005.
Note: The figures show the proportion of firms claiming that domestic or foreign competition is a (i) very important or (ii) not at all important pressure for the creation of new products.

# 1.Competition and entry, continued

- How to increase competition in an economy?
  - Building better institutions (?)
  - Contract enforcement process (?)
  - Property rights, registration procedures (Example of Lithuania - 3 days, versus Bosnia and Herzegovina - 331 days).

  EU accession process helps...

How does competition enhance innovation?

## 2. Education

- With more educated population, technology innovation and imitation are enhanced.
  - How is education measured? By looking at the share of GDP invested in education, or by educational attainment of the population. Recently, quality of education is used as well.

# Correlation between test scores and real GDP



Chart 3: Real GDP per capita growth and average PISA[20] 2006 test scores
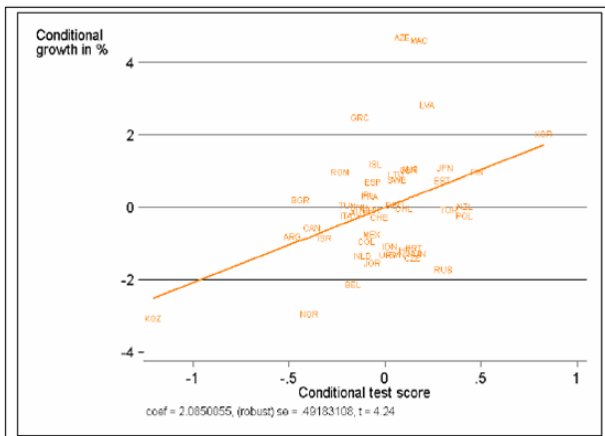
Source: World Development Indicators 2008 (World Bank 2008), OECD (2007), authors' own calculations (regression results).

Increase of 100 points(st. dev) increases GDP for 1.3 to 2%

# Composition of education investment

**Table 2: Expenditure per student at different education levels and gross enrolment rates**

Expenditure per student at different education levels (as % of per capita GDP) and gross enrolment rates

| Country groups | Period Indicator | Primary education | | Secondary education | | Tertiary education | |
|---|---|---|---|---|---|---|---|
| | | 1999-2002 | 2003-2006 | 1999-2002 | 2003-2006 | 1999-2002 | 2003-2006 |
| CEB | Expenditure per student (% of per capita GDP) | 17.4 | 19.2 | 21.9 | 22.9 | 27.8 | 24.9 |
| | Gross enrolment rates | 101.5 | 99.5 | 95.4 | 98.3 | 47.4 | 58.9 |
| SEE | Expenditure per student (% of per capita GDP) | 13.0 | 16.4 | 17.5 | 18.7 | 31.3 | 26.6 |
| | Gross enrolment rates | 100.2 | 99.7 | 83.2 | 87.4 | 28.3 | 33.8 |
| CIS, non-resource rich* | Expenditure per student (% of per capita GDP) | 10.1 | 13.0 | 12.9 | 17.4 | 29.9 | 26.5 |
| | Gross enrolment rates | 102.2 | 98.8 | 82.6 | 87.0 | 35.3 | 41.0 |
| CIS, resource rich** | Expenditure per student (% of per capita GDP) | 8.2 | 8.2 | 14.7 | 9.9 | 14.6 | 10.0 |
| | Gross enrolment rates | 100.6 | 104.5 | 86.5 | 90.9 | 22.7 | 34.6 |
| OECD*** | Expenditure per student (% of per capita GDP) | 18.7 | 19.7 | 24.1 | 25.0 | 35.8 | 34.8 |
| | Gross enrolment rates | 103.2 | 102.9 | 109.8 | 107.6 | 54.1 | 61.6 |
| *Selected countries* | | | | | | | |
| Finland | Expenditure per student (% of per capita GDP) | 17.6 | 18.5 | 25.9 | 29.4 | 38.8 | 37.2 |
| | Gross enrolment rates | 100.7 | 101.0 | 124.2 | 118.7 | 83.6 | 88.3 |
| France | Expenditure per student (% of per capita GDP) | 17.4 | 17.6 | 28.2 | 28.9 | 29.1 | 32.2 |
| | Gross enrolment rates | 106.2 | 106.1 | 109.5 | 110.4 | 53.0 | 55.1 |
| United States | Expenditure per student (% of per capita GDP) | 19.9 | 21.6 | 23.6 | 25.1 | 28.0 | 25.3 |
| | Gross enrollment rates | 100.3 | 98.8 | 94.0 | 93.9 | 73.1 | 81.8 |

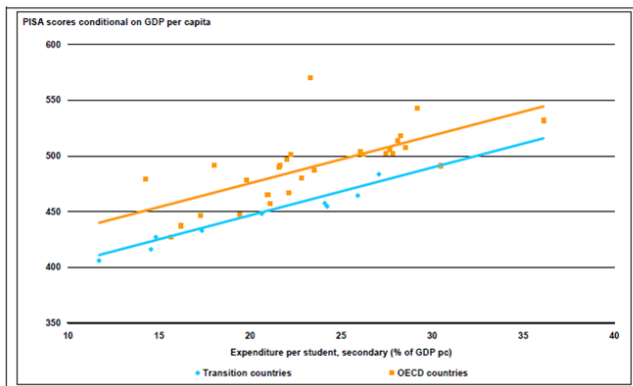Source: Word Development Indicators 2008 (World Bank)

\*    CIS non-resource rich: Armenia, Belarus, Georgia, Kyrgyz Republic, Moldova, Mongolia, Tajikistan, Ukraine

\*\*   CIS resource rich:    Azerbaijan, Kazakhstan, Russian Federation, Turkmenistan, Uzbekistan

Countries closer to tech frontier spend more on tertiary edu.

# Correlation between education investment and test scores



Chart 4: Expenditure per student in secondary education and PISA outcomes

Source: World Development Indicators 2008 (World Bank 2008), OECD (2007), authors' own calculations.
Note: PISA 2006 average country scores in reading, mathematics and science. Graph depicts predicted PISA 2006 results based on a regression of PISA 2006 results on mean expenditure on student (percentage of GDP per capita) 1998-2005 and mean real GDP per capita 1998-2005.

# Tertiary graduates by field of study



Chart 5: Tertiary graduates by field of study (in per cent of total graduates)
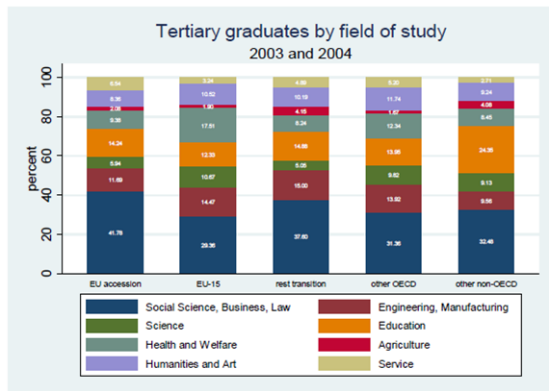
Source: UNESCO Institute for Statistics.

Note: Defined as the number of students graduating in a particular field expressed as a percentage of the total number of graduates of tertiary education.

# 3. Financial Constraints

- Firms face credit constraints due to asymmetric information between financiers and firms.
- Levine (2004) uses two measures of financial development: ratio of bank credit to GDP, and the degree of stock market capitalisation – which are significantly related with growth in the long run.
- Credit constraints act as a main barrier of entry and post-entry growth for small firms, whereas labour market regulations inhibit the entry of large firms.
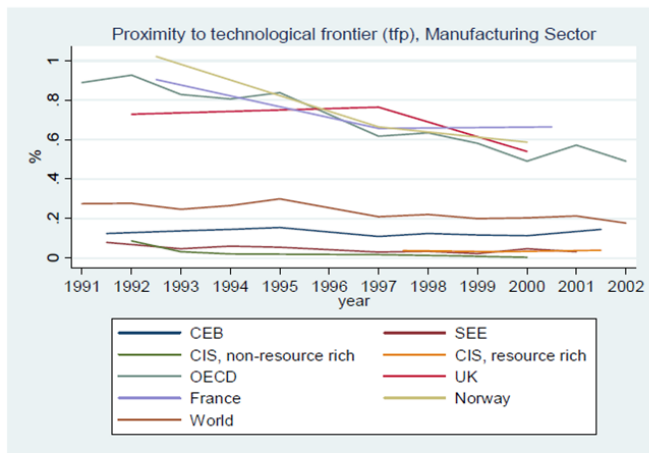
# SME density and GDP growth



Chart 6: SME density and GDP growth
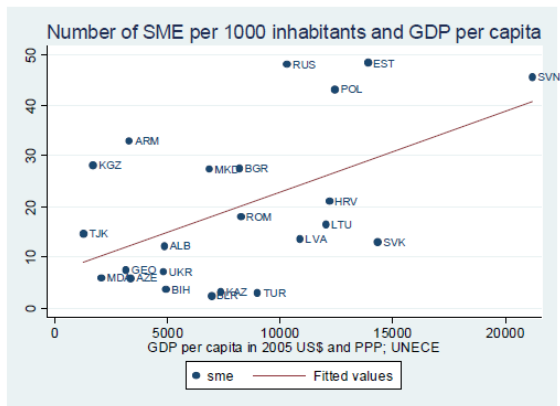
Source: BEEPS, 2005.

# TFP frontier to the manufacturing sector

**Chart 7: TFP frontier for the manufacturing sector**



Proximity to technological frontier (tfp), Manufacturing Sector

Legend:
- CEB
- CIS, non-resource rich
- OECD
- France
- World
- SEE
- CIS, resource rich
- UK
- Norway

Source: Authors' calculations using World Development Indicators, 2008.

# 3. Financial Constraints, continued

- Financial development is a gradual process, it can be speeded up by:
    - setting-up of good banking institutions;
    - elimination of non-performing loans;
    - opening up domestic economies to foreign banks and direct investment.

# 4. Financing reform

This reform is related to the tax reform and inflation control.

**Table 3: Tax reporting across the transition region**

| Year | 1999 | | 2002 | | 2005 | |
|---|---|---|---|---|---|---|
| | % of firms | | | | | |
| Estimated share of sales reported to the tax authorities | CEB+2 | All other transition countries | CEB+2 | All other transition countries | CEB+2 | All other transition countries |
| 100% | 33.64 | 31.43 | 56.55 | 52.28 | 62.61 | 67.34 |
| 90-100% | 13.77 | 12.55 | 5.94 | 2.45 | 4.30 | 2.19 |
| 80-90% | 10.47 | 12.21 | 8.85 | 6.14 | 8.17 | 5.16 |
| 70-80% | 8.24 | 7.74 | 10.49 | 8.65 | 11.55 | 7.30 |
| 60-70% | 5.52 | 5.07 | 5.99 | 6.53 | 4.59 | 5.10 |
| 50-60% | 6.92 | 10.88 | 2.46 | 4.20 | 2.55 | 2.79 |
| 25-50 | 6.51 | 9.50 | 7.88 | 12.43 | 5.39 | 8.06 |
| <=25% | 14.92 | 10.62 | 1.84 | 7.32 | 0.83 | 2.05 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |

Source: BEEPS 1999, 2002, 2005.