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- Different schools create different capabilities. The latter can be combined to produce and export sophisticated products;
- The provision of educational services in developing societies operates relatively far away from the efficiency frontier (Hanushek (1995), Glewwe (2002));
- Formal tests: PISA (2012) results indicate that a vast majority of developing economies perform below the OECD averages as far as scores in reading, mathematics and science are concerned.

Policy to Improve Education Standards

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- International organizations: the World Bank (2001) argues that investment in education is a policy priority;
- Academia:
 - ▶ Adjust teaching methods: Glewwe (2002) studies which cognitive skills are more relevant for individual income growth;
 - ▶ Increase the level of transparency at schools: Reinikka and Svensson (2007) show how to reduce the level of corruption in education.

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- Suppose that a politician discovers that the standards of education in a particular emerging society (such as Russia) are low;
- Does this necessarily imply that an educational policy will result in a higher human capital stock and faster economic growth?
- No, not necessarily.

Why?

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- Assume that this reform results in a higher level of supply of education: $E_{new}^S > E_{old}^S$;
- However, the level of demand for education can instead remain low, i.e. $E^d < E_{old}^S$.

Why the Demand for Education Remains low?

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- This paper: inaccurate growth diagnostics (Rodrik, 2007);
- Human capital (as a capability) is combined with technology (another capability) to produce output.

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- National technological frontier might be a more binding constraint than the level of education.

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- The latter is (was?) true for an oil-exporting country (Russia);
- However, corruption/corporate mismanagement/fraud can eliminate this advantage.

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- What to do?
- Complementarity between reforms. Remove the most binding constraint: reduce the level of corruption, privatize state-owned assets to improve the quality of management;
- The race between education and technology starts: improve education standards .

Literature: Complementarity of Production Factors

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 - ▶ Acemoglu and Autor (2010).

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- Partial equilibrium model, does not consider external factors which can affect the level of investment into a new technology.

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 - ▶ $A_{t,j}$ - the level of technology which is identical for every firm;
 - ▶ $h_{t,j}$ - the amount of human capital per employee, m - the number of employees in a firm.

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- Period $j = 2$: the firm uses the following technology:
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 - $0 \leq \eta(\alpha_t) \leq 1$, $\eta'(\alpha_t) > 0$, $\eta''(\alpha_t) < 0$, $\eta(0) = 0$;
 - Alternatively, the firm can invest its profits in a storage technology, then $A_{t,2} = A_{t,1}$.

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- She can invest a fraction $0 \leq \varphi_t \leq 1$ of her capital endowment $h_{t,1}$ to increase her human capital stock;
- Period $j = 2$: an employee receives $(1 + \varphi_t)h_{t,1}$ in case she invested $\varphi_t h_{t,1}$ in $j = 1$.

Optimization

- The firm maximizes the following payoff function:
- $W_o = (1 - \alpha_t) \theta A_{t,1}^\theta (h_{t,1} (1 - \varphi_t) m_t)^{1-\theta} + \theta A_{t,2}^\theta (h_{t,1} (1 + \varphi_t) m_t)^{1-\theta}$ with respect to α_t ;

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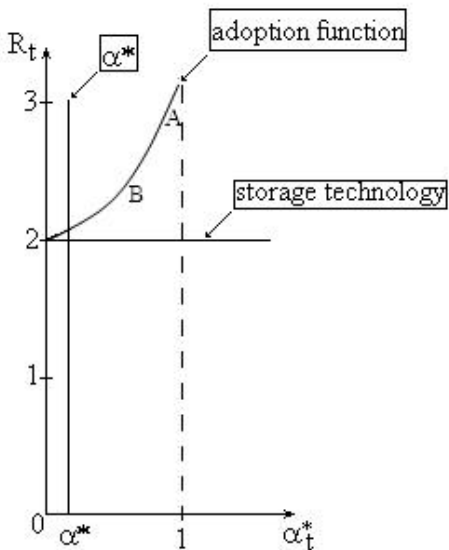
Static Optimum, Technology and Education

- Technology, static optimum (FOC): $\eta'(\alpha_t^*) = \frac{1}{\theta \left(\frac{A_{t,1}^L}{A_{t,1}} - 1 \right)}$;

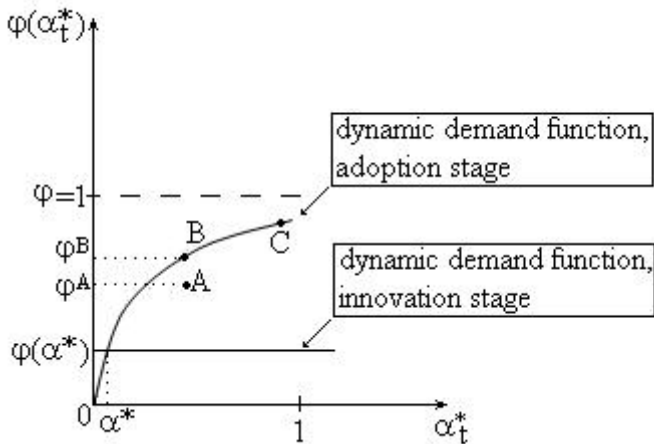
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Dynamic Optimum, Technology



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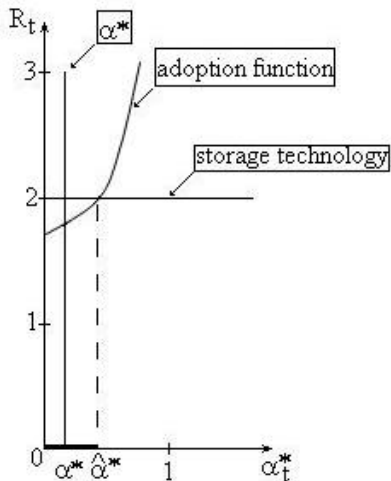
Corruption

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- $W_o = (1 - \gamma) \left[(1 - \alpha_t) \beta A_{t,1}^\theta (h_{t,1} m_t)^{1-\theta} + \beta A_{t,2}^\theta (h_{t,2} m_t)^{1-\theta} \right]$.

Corruption/Mismanagement, Dynamic Optimum, Technology



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 - ▶ management;
 - ▶ something else?

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Russia: Education

- PISA: Russia is a low achiever in all three categories that the OECD considers when it evaluates students' performance, which are mathematics, reading and science;
- The United States perform even worse than Russia, but it possesses the largest collection of world-class universities, while Russian universities are at best of regional importance;
- Therefore, the system of education in Russia provides a weak opportunity to acquire advanced skills, and is more oriented to transfer medium (bureaucratic) skills to its students.

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- Therefore, a low level of property right protection remains a serious constrain that should be relaxed.

Russia: Management

New York Times:

"The state-owned oil giant Rosneft has requested \$21.3 billion. Gazprom, the dominant natural gas player, has asked for \$3.2 billion for a subsidiary.

The list goes on: Russia's railroad monopoly, which is also the largest employer in the country; an owner of Moscow's airports; a venture capital firm investing in nanotechnology; and a company exporting Russian nuclear power plants.

So far, companies have requested at least \$37 billion, a figure that is likely to rise much higher"

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- Privatization is needed to improve the quality of management.

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Should Russia Reform as much as possible?

- Reforms are costly (in many contexts);
- It is necessary to identify the most binding constraints and to relax them at the first place;
- A challenging task.

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- Sometimes yes.

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- Easterly (2001), knowledge leaks.