

# MATHEMATICAL SKILLS AND ECONOMIC DEVELOPMENT

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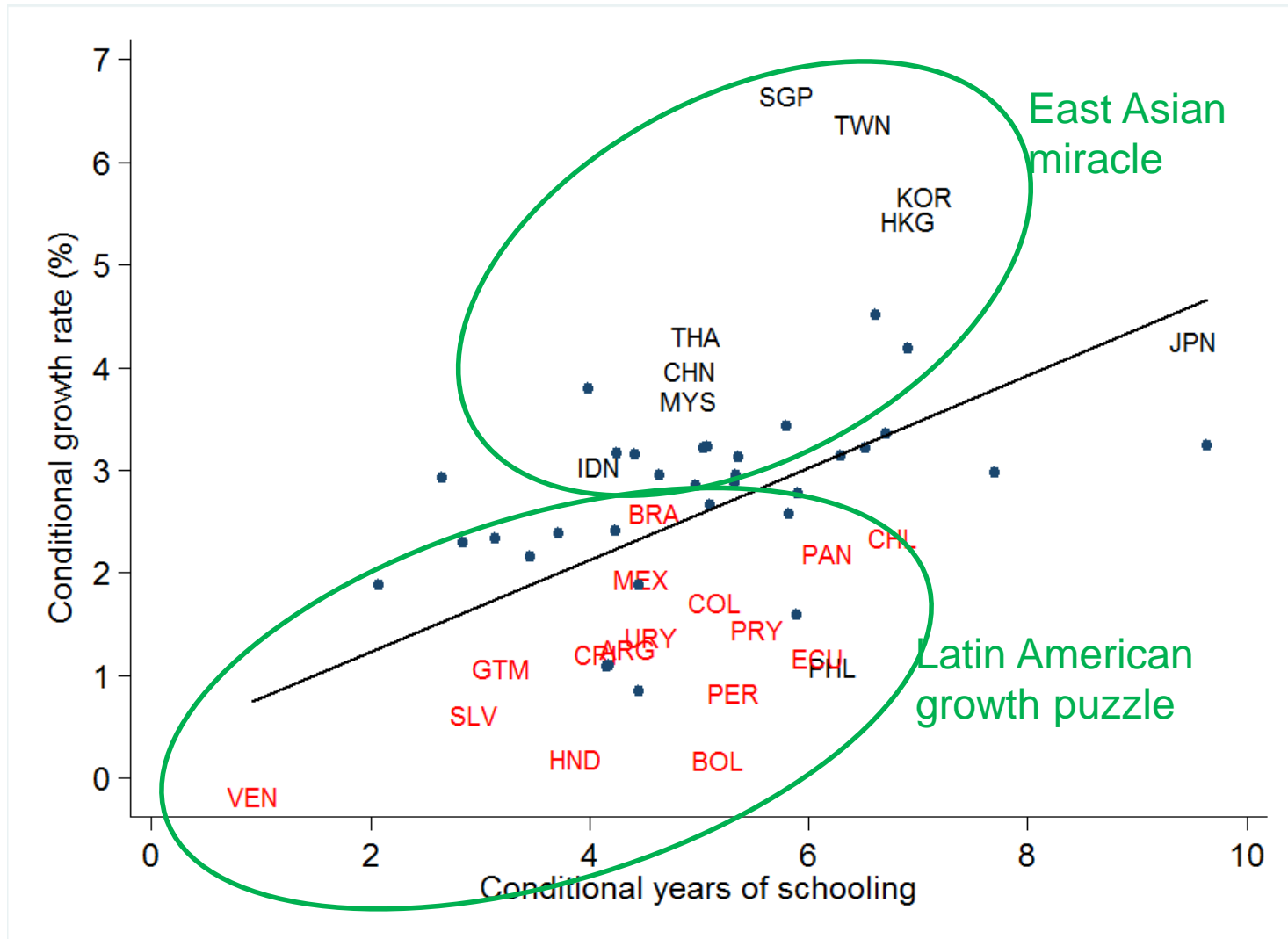
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Achievements and Opportunities (MENA0) Symposium  
Seoul, Korea*

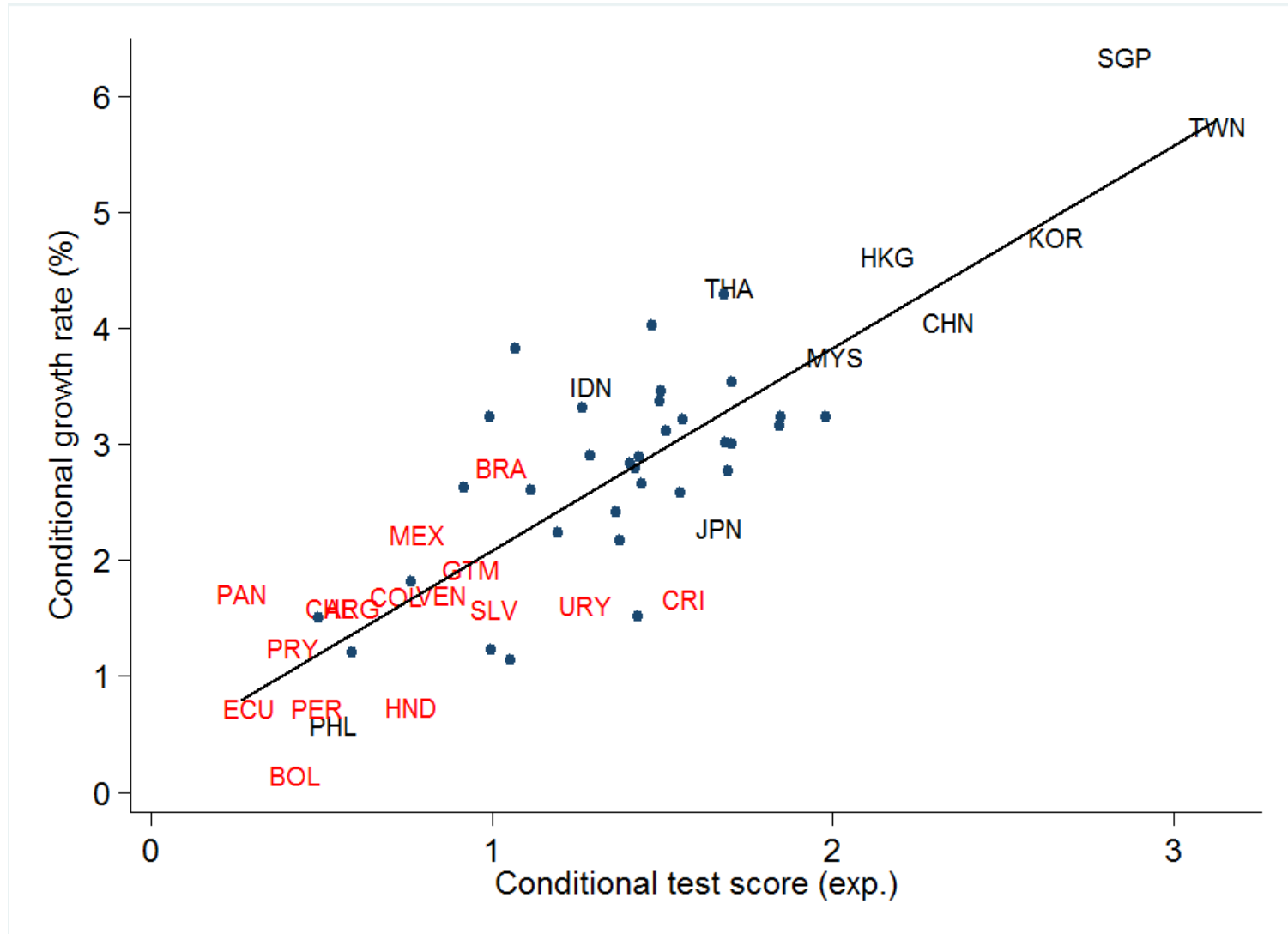
# Introduction

- Development = growth
- LR growth is not a secret: skills or human capital
- Start with challenges and go to solutions

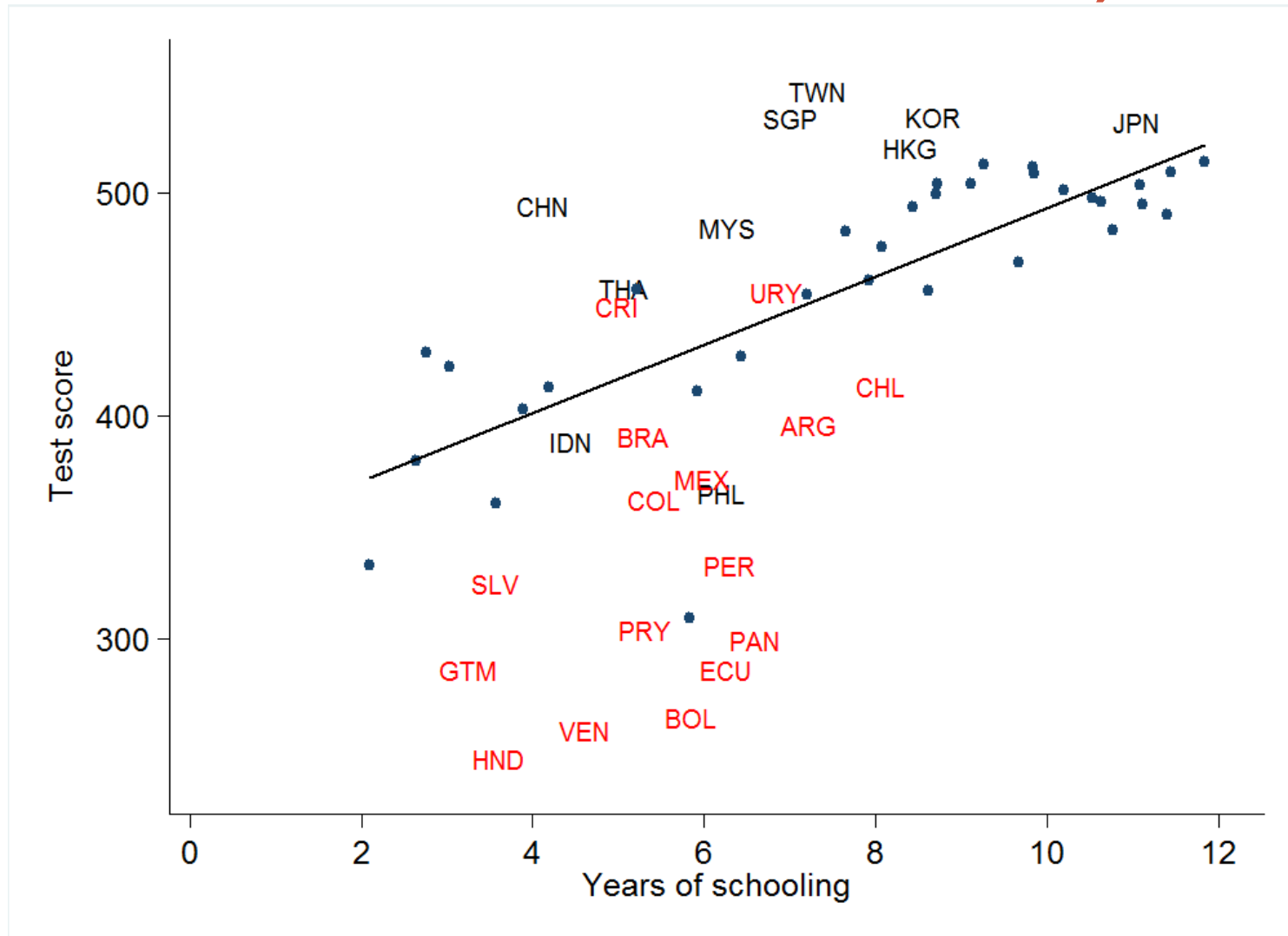
# Growth and years of schooling, 1960-2000



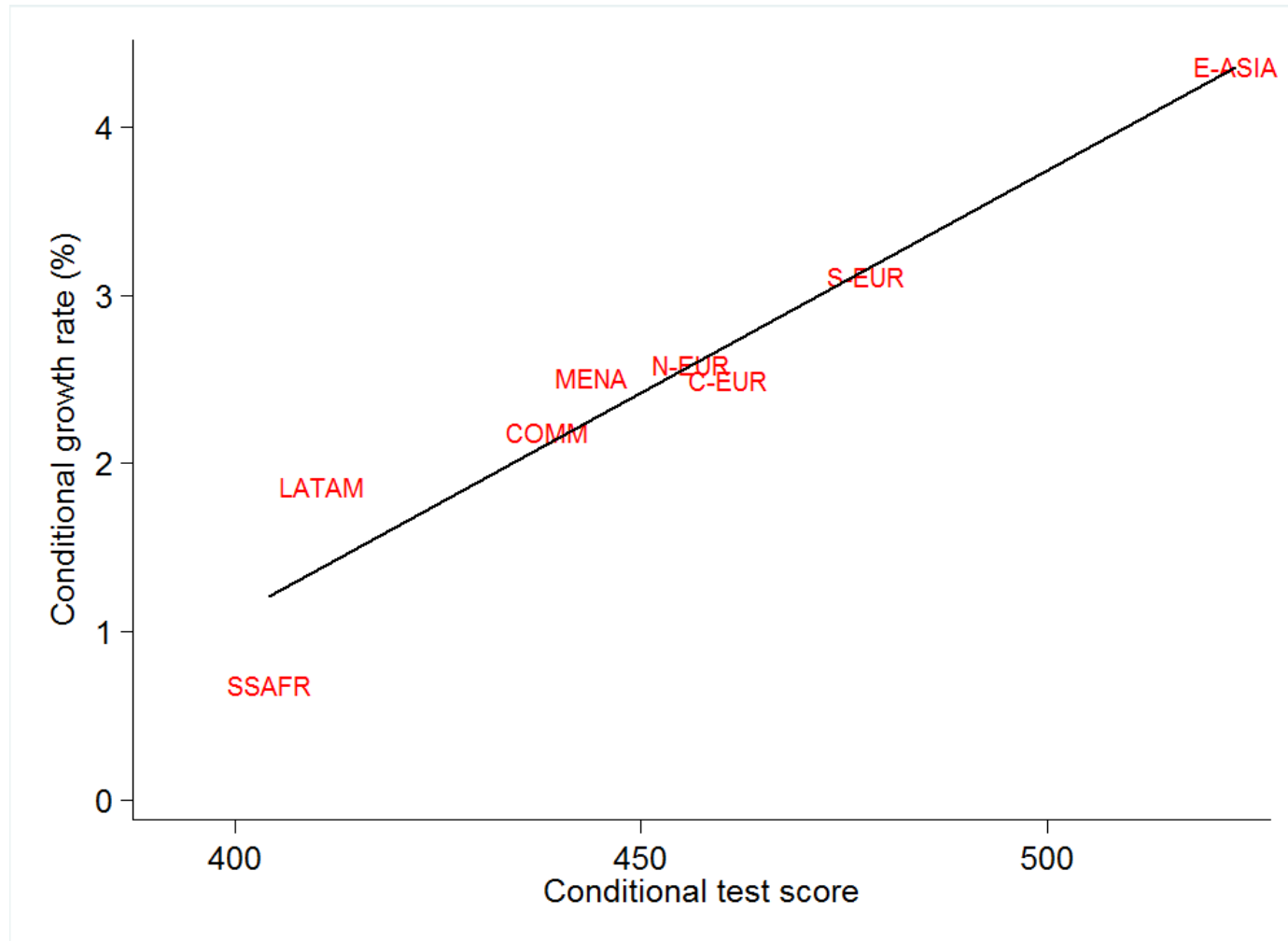
# Growth and test scores



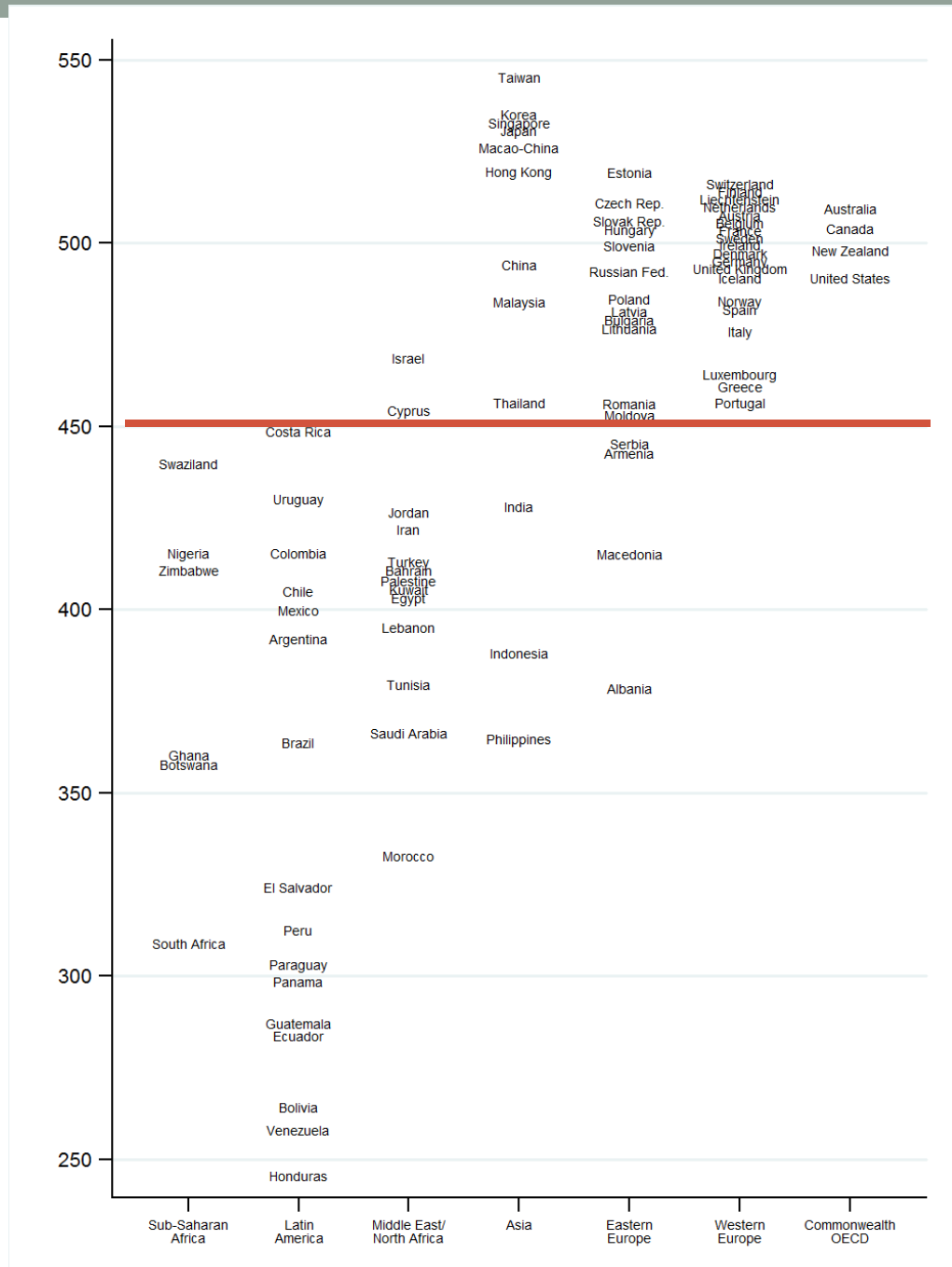
# Schooling and achievement (Latin America, East Asia, and the world)



# Knowledge capital and economic growth rates (GDP per capita, 1960-2009)



# Average performance on international student achievement tests by region

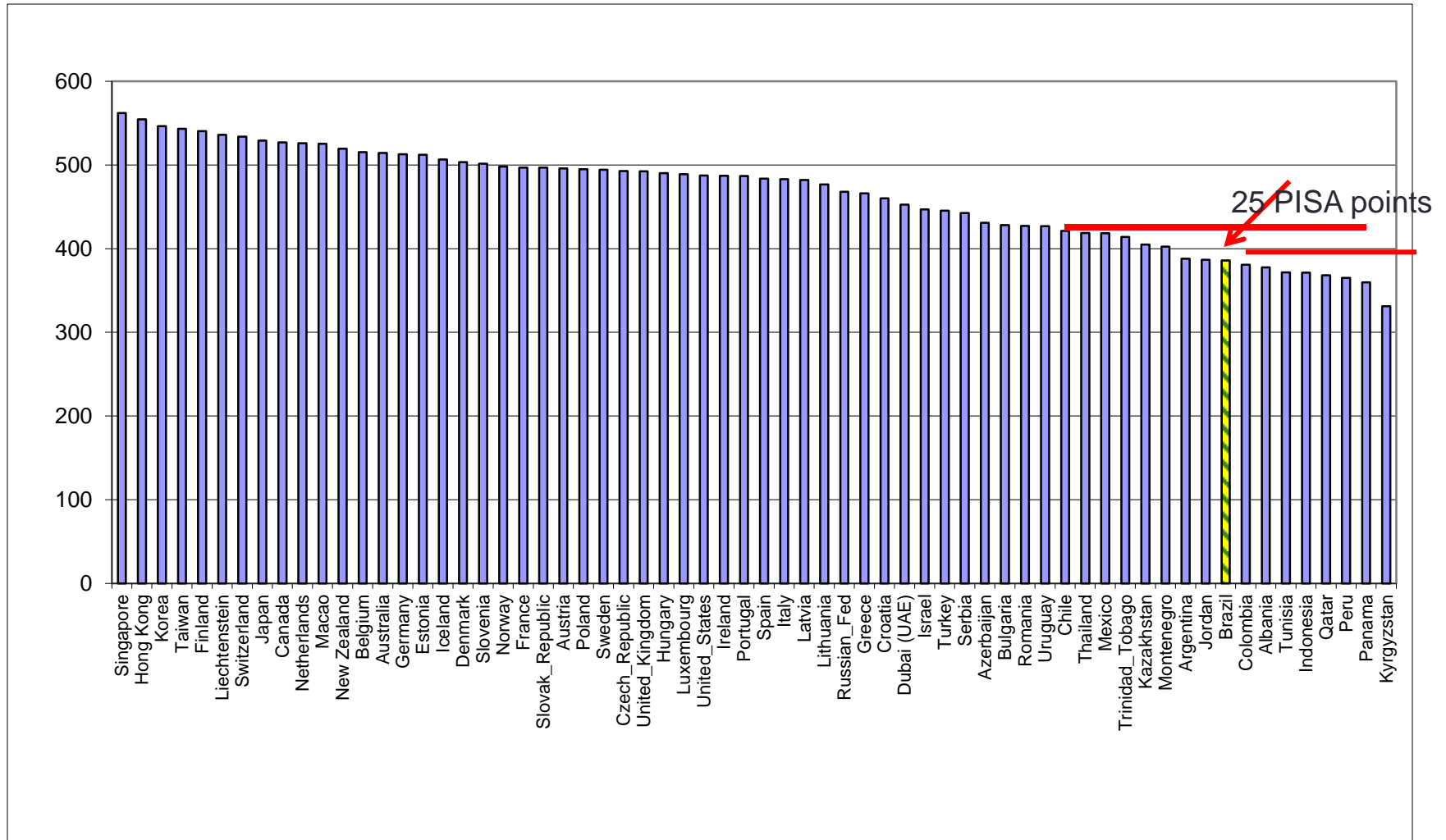


# Example of Value of Improvement

- Assuming historical patterns hold
- Present value over 80 years
- Brazil moves to Trinidad-Tobago, Mexico level



# PISA Math Performance 2009



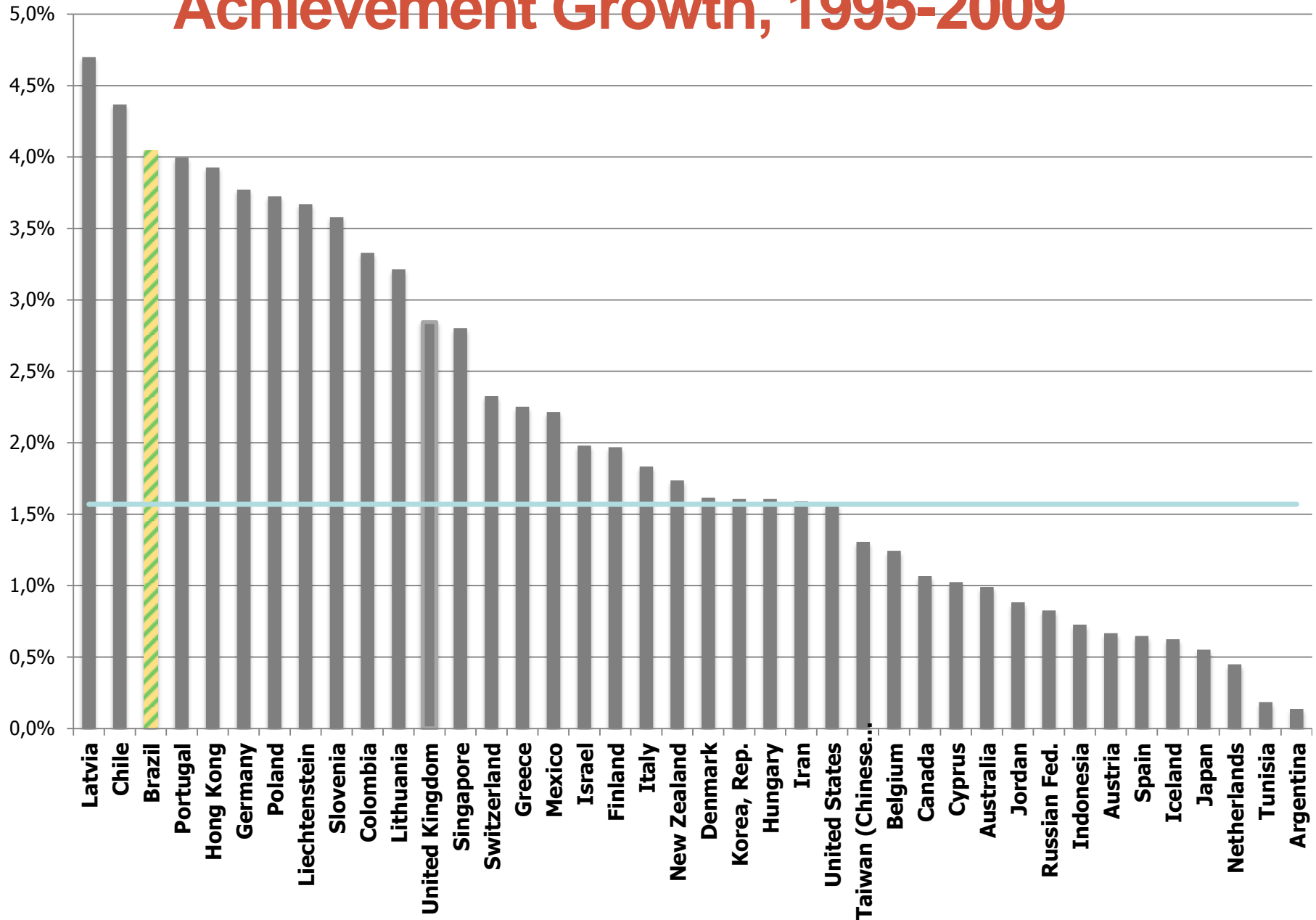
# Example of Value of Improvement

- Assuming historical patterns hold
- Present value over 80 years
- Brazil moves to Trinidad-Tobago, Mexico level
  - Present value of 270% of GDP
  - Average 6% higher GDP/pop for 80 years
  - 12% higher paychecks for all workers every year

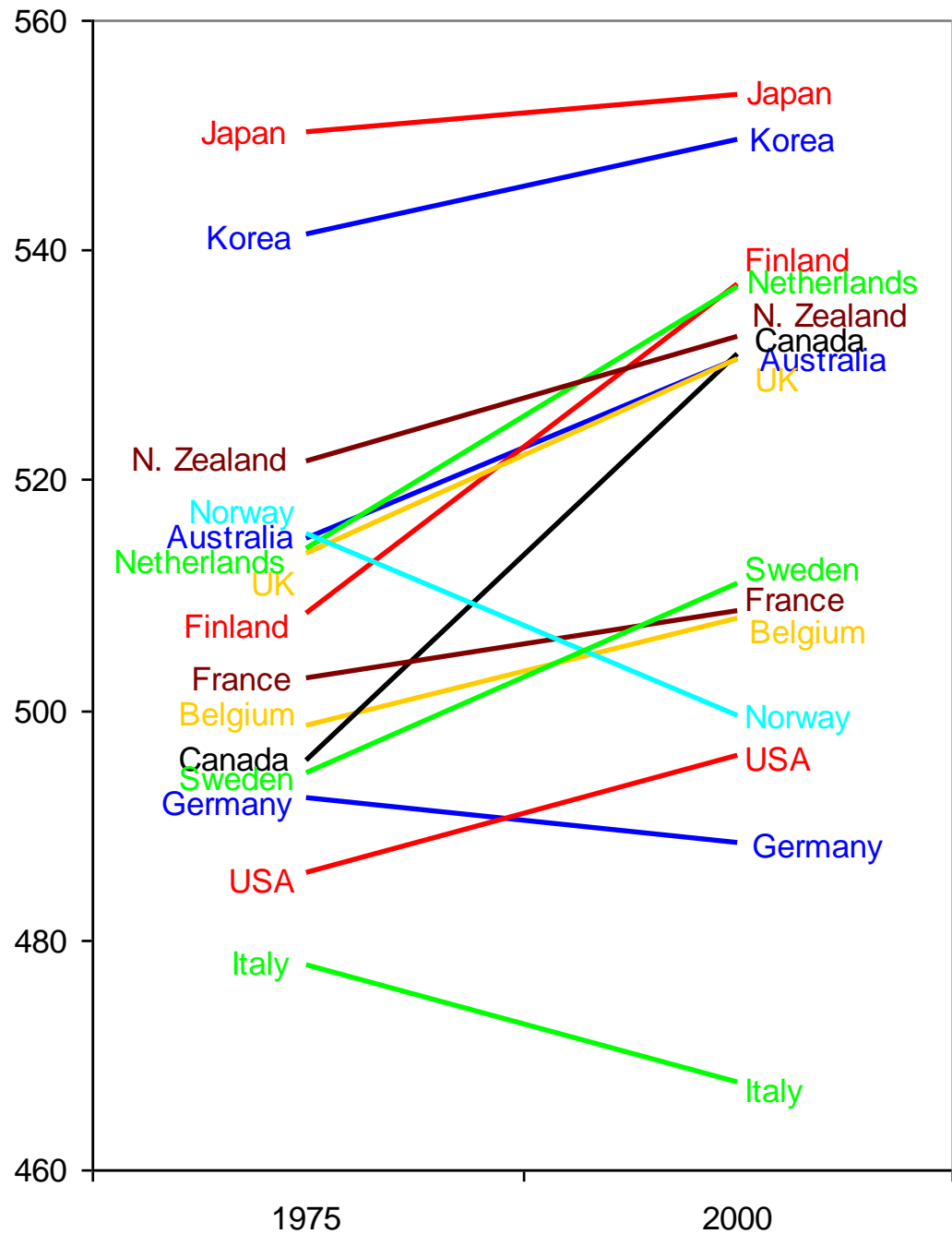
# Improvement is Possible

- Feasible: Brazil and Chile have made these gains in past
- Other countries have improved

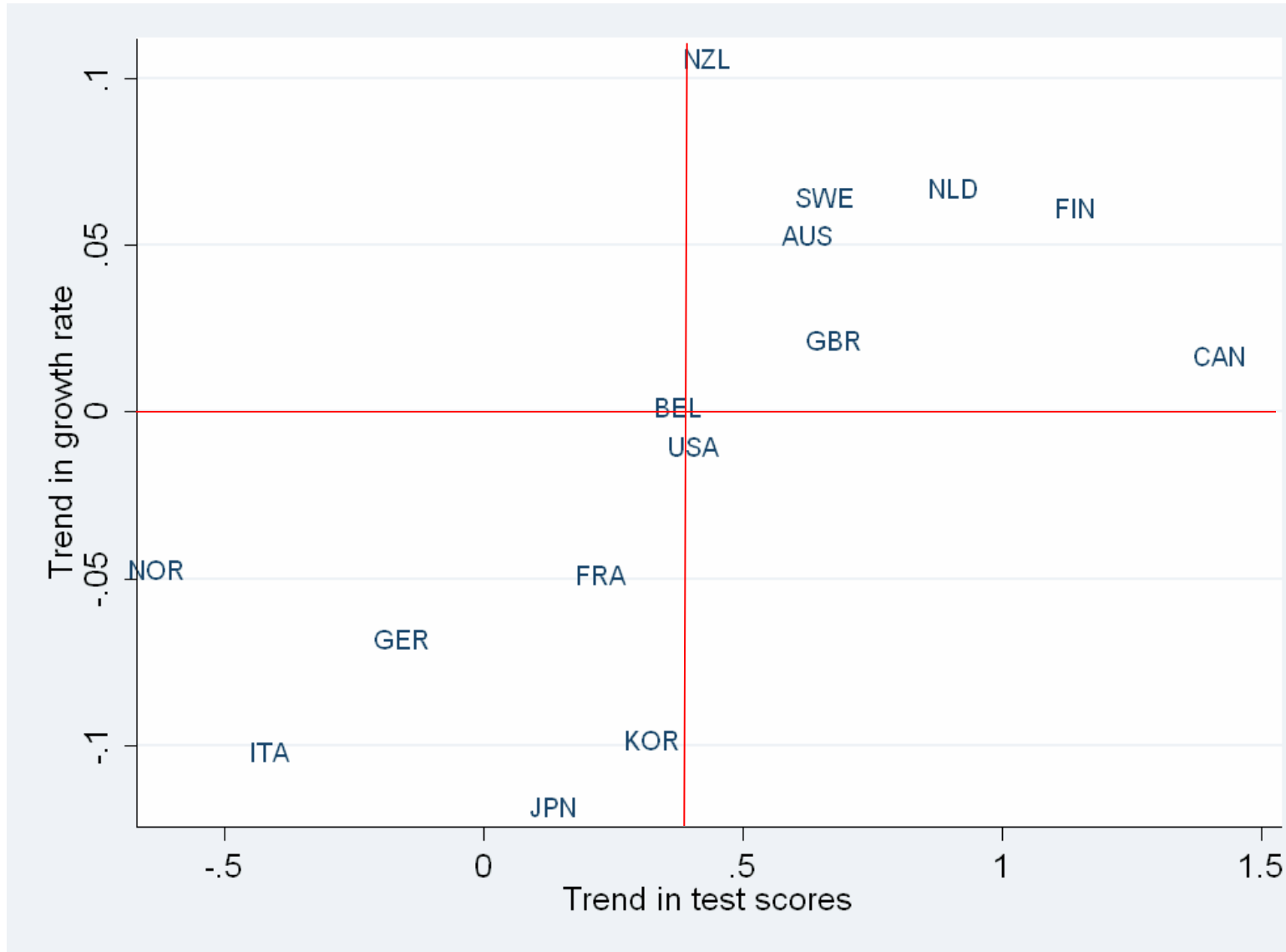
# Achievement Growth, 1995-2009



# Trends in Test Scores



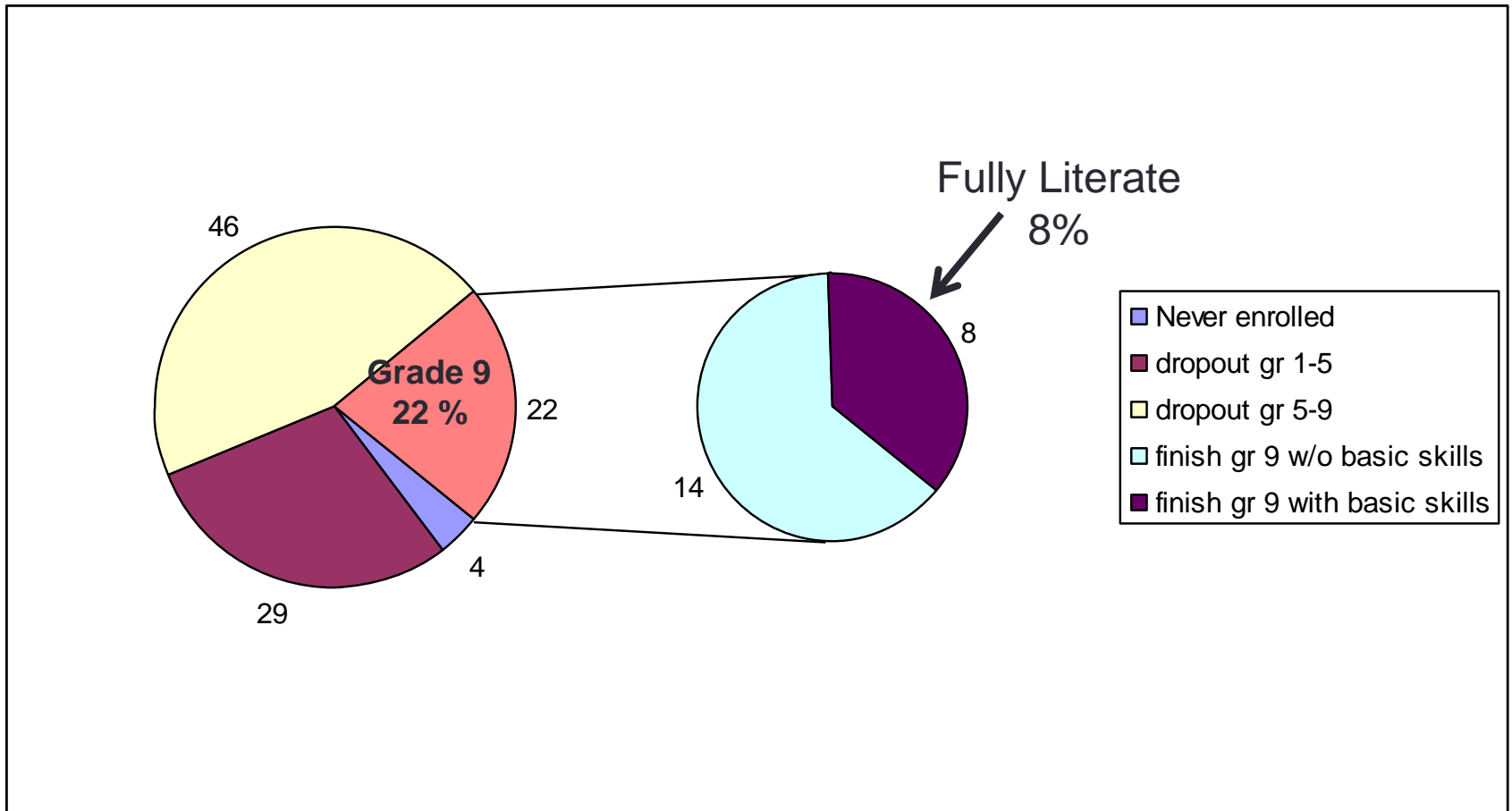
# Trends in Growth Rates vs. Trends in Test Scores



# Conclusions on Economic Impacts

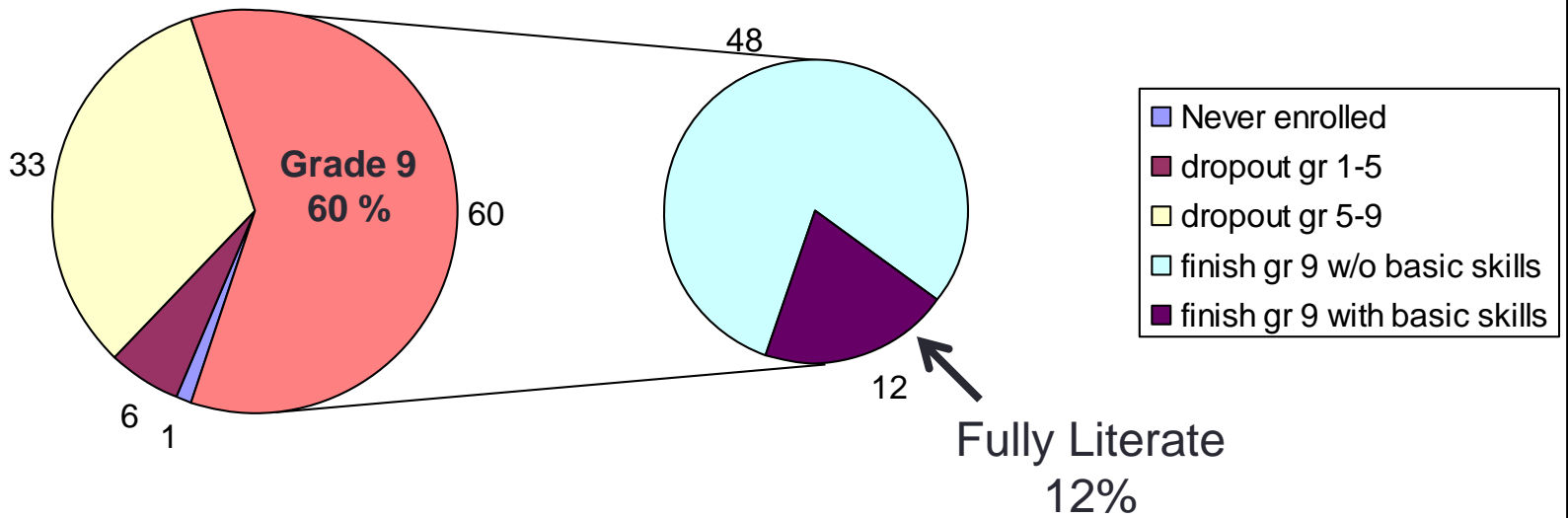
- Powerful effects of cognitive skills
  - Support for causal interpretation
- Developing countries is much worse than generally pictured

# Schooling and Literacy: Brazil

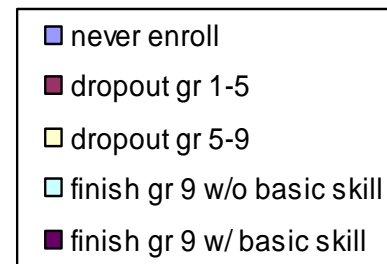
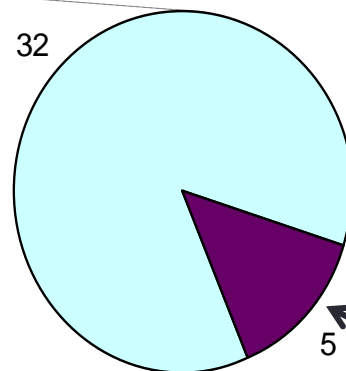
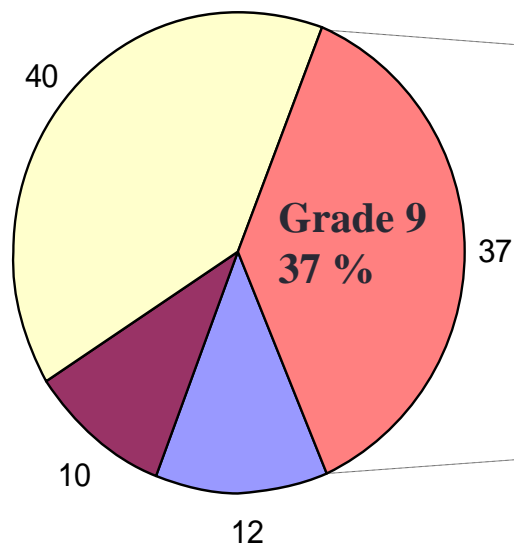




# Schooling and Literacy: Peru

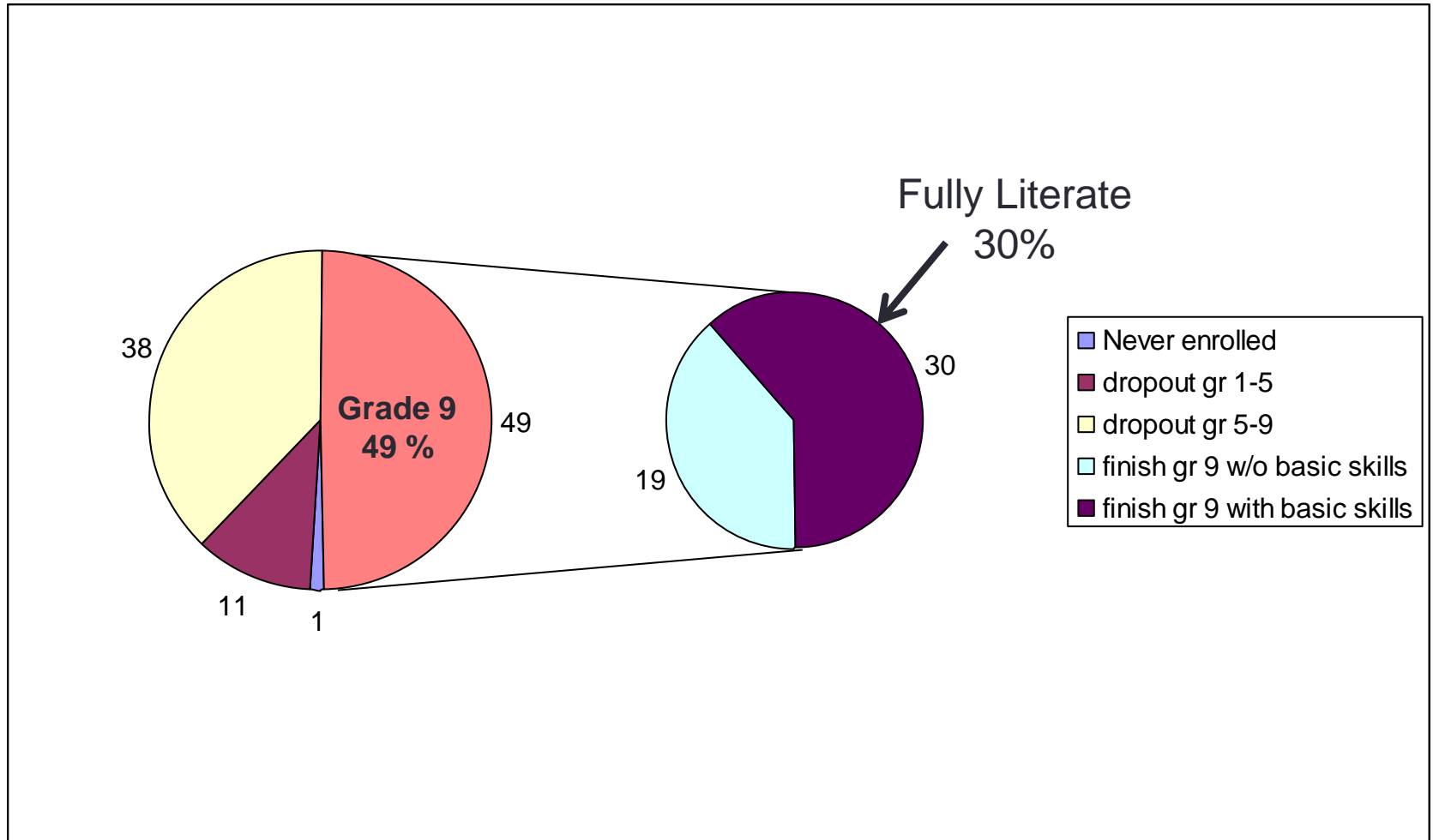


# Schooling and Literacy: Ghana



Fully literate  
5%

# Schooling and Literacy: Columbia

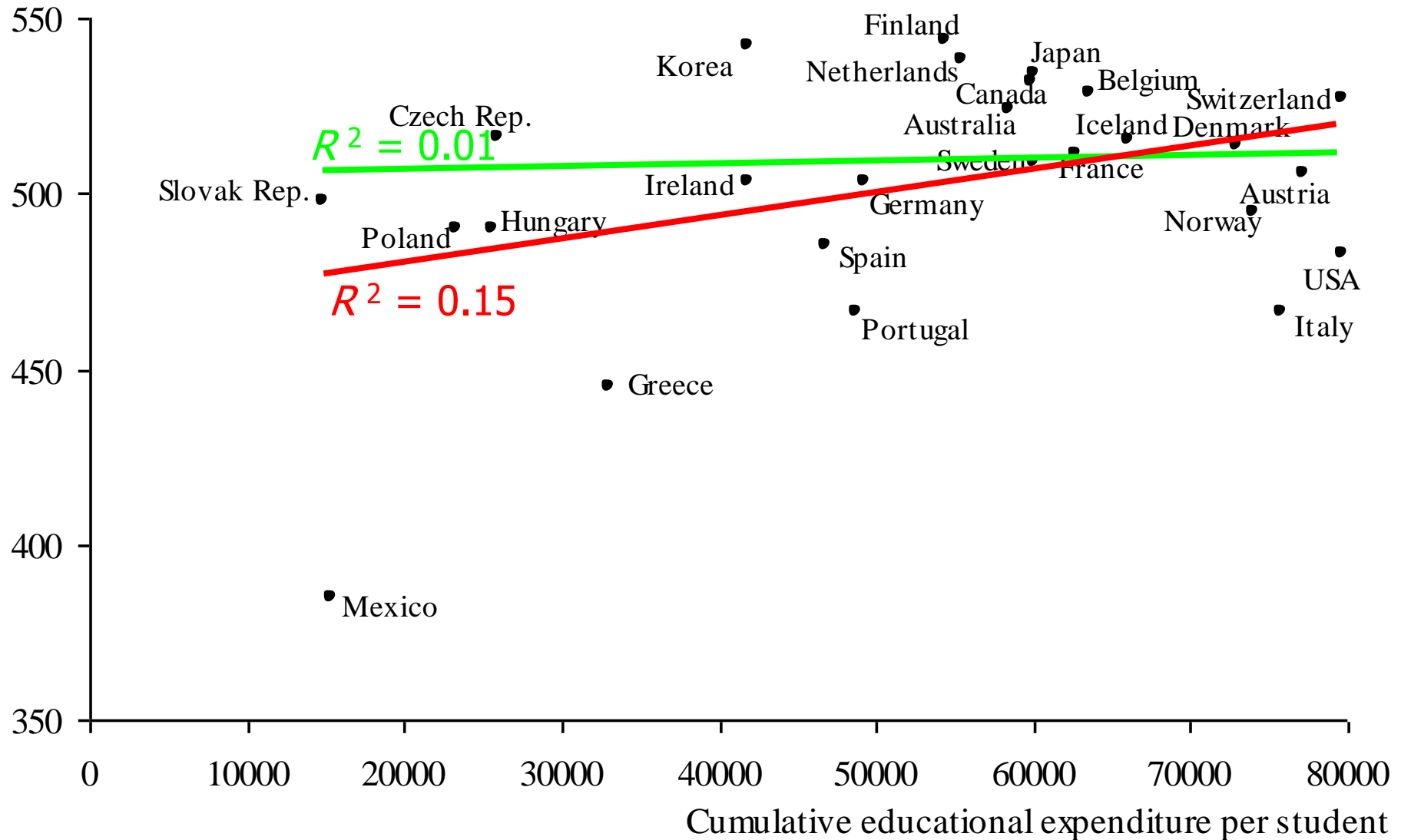


# Resource Policies

- Little evidence of success
  - Cross country evidence
  - Within country – developed
  - Within country – developing

# Resources and Performance across Countries

Math performance in PISA 2003



# Resource Policies

- Little evidence of success
  - Cross country evidence
  - Within country – developed
  - Within country – developing
- Does not say “resources never have effect”
- Does not say “resources cannot have effect”

***No expectation within current incentive structure***

# Teacher Quality

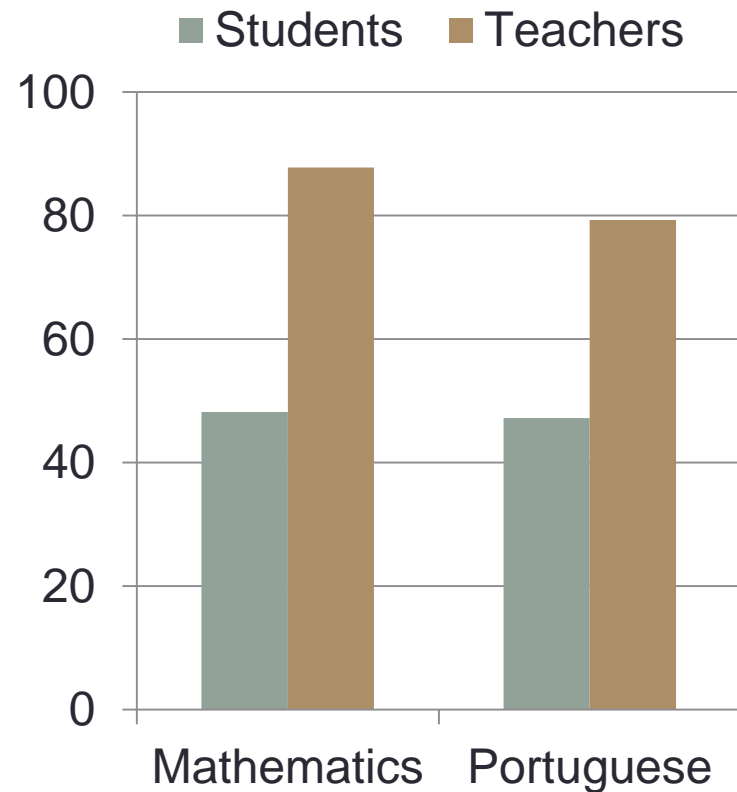
- Teachers most important input
- No identifiable characteristics
  - Master's degrees
  - Experience\*
  - Certification
  - Preparation
  - Professional development
- Observable through both student performance *and* supervisor ratings
- Cannot regulate and pay on characteristics

# Mathematics Instruction in Rural N.E. Brazil

## Subject Matter Knowledge

- Higher teacher subject matter knowledge is important
- More important in math
- But not everything!

## Math and Portuguese Scores





# Key Element – Focus on Outcomes

- Input policies ineffective (spending, attendance, iPads, etc)
- Cash transfers and demand side
  - “success” unclear
- Must measure outcomes
  
- Substantial evidence on teacher effectiveness
  - Not easily regulated (degrees, experience, certification)
  - U.S. debate: evaluations and teacher contracts (e.g., DC)
  
- Hard to change teachers directly

# Incentives and institutions

- Accountability
- Competition and choice
  - Urban markets
  - Private options
- Performance rewards
  
- Autonomy (??)

# Technology and innovation

- Differing views
  - Complement teachers
  - Substitute for teachers
  - Replace teachers
- Do not understand incentive structure well
  - Getting teacher buy-in
  - Getting policy maker support
- Potential importance of local circumstances
- Importance of evaluation

# Conclusions

- Must focus on achievement and outcomes
- Long run economic future linked to skills
- Improvements are possible
- Improvements are difficult
  
- Key is incentives
  - To obtain and retain effective teachers
  - To introduce new innovations and technology
  
- Need evaluation to promote continuous improvement