



### Research and Development by business groups in Brazil (Percent of sales)

	Sector	2009	2010	Average
Vale	Mining	4.1	1.9	3.0
Odebrecht/Brasem	Construction & Petrochemicals	.39	.31	.35
Itaú (Duratex +Itautec)	Building materials & informatics	3.4	2.2	2.8
Oi/Telemar	Telecommunications	.06	.04	.05
Gerdau	Steel	.48	.68	.58
Camargo Correa	Diversified	.09	.11	.10
Cosan	Sugar & Ethanol	.04	.04	.04
Usiminas	Steel	.08	.16	.12
Median		.24	.24	.23

### Percentages of Employees of Selected Business Groups in Brazil with Primary, Secondary, and Tertiary Education, 2005–6

	Sector	Primary	Secondary	Tertiary	Employees
<b>Labor Intensive</b>					
Camargo Corrêa	Diversified	58	33	9	57,000
Andrade Gutierrez	Diversified	62	24	14	13,000
Sadia	Meatpacking	58	36	6	52,000
Perdigão	Meatpacking	47	42	11	45,000
<b>Capital Intensive</b>					
Gerdau	Steel	12	68	19	37,000
Votorantim (cellulose)	Pulp & paper	10	54	36	~3,000
<b>Services</b>					
Unibanco	Banking	2	50	48	33,000
Bradesco	Banking	--	17	82	83,000
Itausa	Banking	--	53	46	78,000
Telemar	Telecoms	--	25	72	100,000

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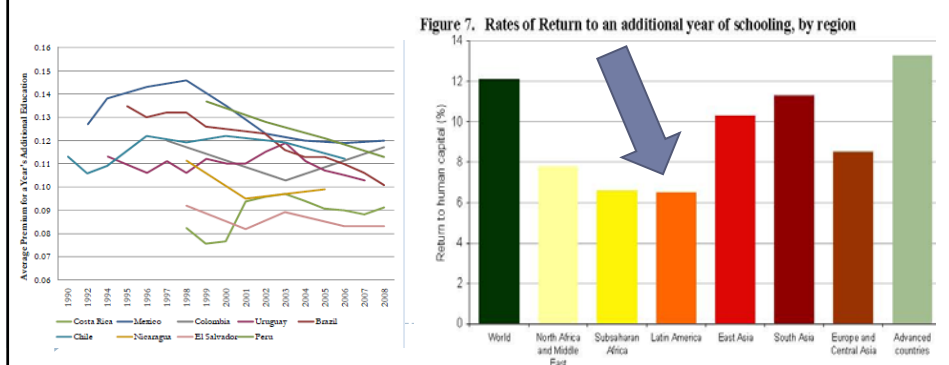
Weakness of individual demand in low skill  
equilibrium

- ▶ Higher returns for middle class than poor families (opposite of Asia)
  - ▶ For poor, education is higher cost and higher risk investment
- ▶ On the job training
  - ▶ Workers look for jobs that will get them education rather than education that will get them jobs



## Lack of Individual Demand for Skills and weakness of market solutions

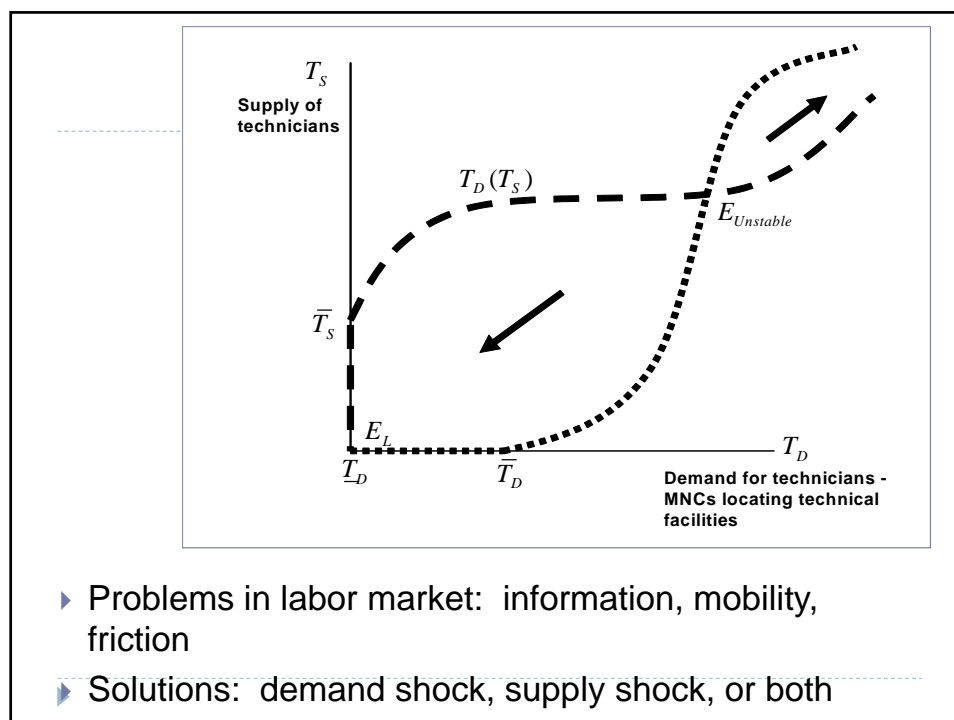
- ▶ Comparatively low returns to education in Latin America
- ▶ Returns to education declined in 2000s



## Why are education and skills lagging?

- ▶ Low skill equilibrium
  - ▶ Firms do not invest in activities requiring skilled labor, because pool of skilled workers not available
  - ▶ Individuals do not invest in education because firms do not hire skilled workers





## Brazil: Demand-led Escape?

- ▶ Gradual shift in business demand
  - ▶ Growing medium sized higher tech Mittelstand
  - ▶ Some business groups spending a lot on R&D (Vale)
  - ▶ More technology intensive commodities
    - ▶ Oil, ethanol, precision agriculture
- ▶ Influx of MNCs in higher skilled production
  - ▶ Most MNC R&D in Latin America is in Brazil
- ▶ Skills shortages in several areas in last few years

▶

## Brazil: State-promoted demand shock

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- ▶ Industrial policies to favor higher technology sectors
  - ▶ Pharmaceuticals, software, oil exploration
- ▶ Strong government investment in science and technology
  - ▶ Total R&D over 1% of GDP
    - ▶ 60% of all R&D in Latin America
- ▶ Partial supply side shock
  - ▶ 10,000 PhDs per year
  - ▶ But not engineers and technical education
  - ▶ 16% of cohort in tertiary education



## Chile: Supply-led Escape?

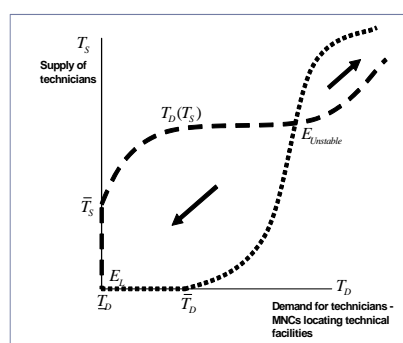
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- ▶ Massive expansion in education (7% of GDP)
  - ▶ 50% of college age cohort in university
  - ▶ Highest Pisa scores in the region
- ▶ But weak demand side
  - ▶ Business groups concentrated in low end commodities and services
  - ▶ Little private R&D
    - ▶ total R&D less than 1% of GDP
  - ▶ Some, weak demand side policies
    - ▶ Mining royalties and technology investment
- ▶ 40% of graduates do not earn enough to warrant investment in university



## Benefits of pact for skills

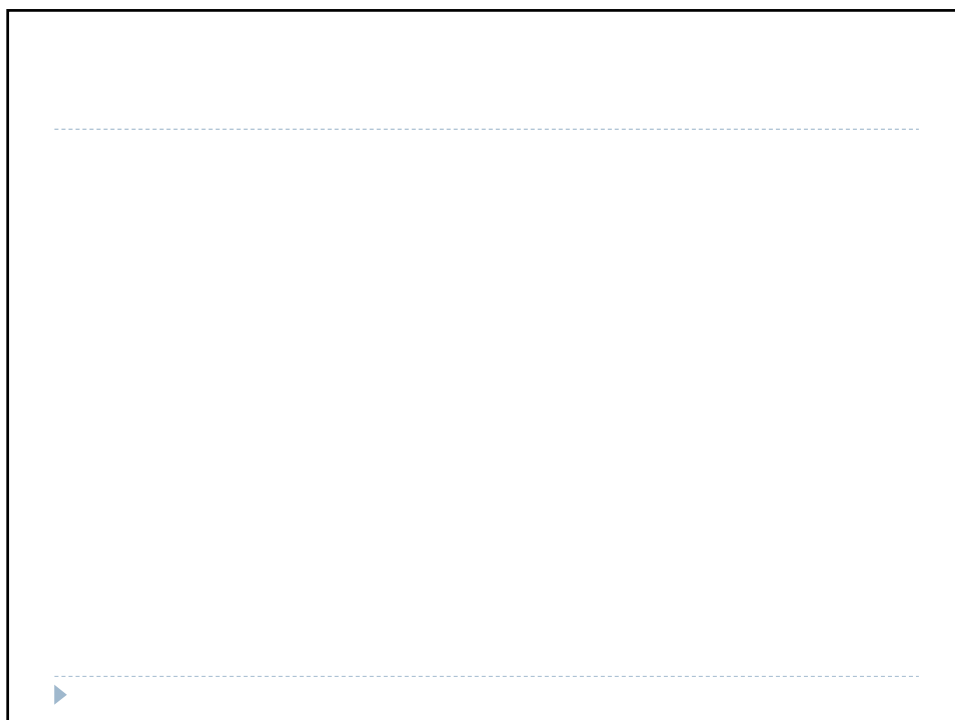
- ▶ Labor markets are characterized by high information costs, friction, and coordination failures
  - ▶ Pacts provide ideal coordination response
  - ▶ Pacts necessary among government (supply), business (demand), and labor
  - ▶ Compress curves
- ▶ Few signs of skill pact in Brazil
  - ▶ Business generally not engaged in education policy
  - ▶ Senai training stays close to low equilibrium
  - ▶ CDES?



## Does the institutional technology exist?

- ▶ Korea, Taiwan, Ireland, Finland, and Singapore
- ▶ World leaders in education improvement (top of the Pisa rankings), R&D, and expansion of high skilled employment
  - ▶ All had pacts between business and government (and sometimes labor) to push education and skills
- ▶ Science and Technology Council of Finland (established 1987)
  - ▶ Prime minister, 7 ministers, and 9 representatives of civil society (2 business, 1 labor, 7 science community)
- ▶ But, easier in small countries than large, so might work better by sector or region in large country
- ▶ Pactos: Feasible, with great potential





## Conclusion

- ▶ **Escape from low skill equilibrium seems possible**
  - ▶ But requires sustained government investment in skills, education, and promotion of R&D
  - ▶ increasing private investment in R&D and productivity
- ▶ **And creation of abundant high skill jobs**
- ▶ **Demand shock likely more effective than exclusively supply shock**



## Student demonstrations: Why Chile?



- ▶ Best conditions in Latin America?
  - ▶ Highest GDP per capita
  - ▶ Among the highest growth rates
  - ▶ Highest PISA scores for educational achievement
  - ▶ Highest enrollment rate for college age population
- ▶ But also
  - ▶ Highest family payment and debt for tertiary education
  - ▶ 40% of graduates do not earn enough to warrant investment in university
- ▶ Why is Chilean growth not generating more good jobs?

## Education, R&D, and Researchers in Latin America and Selected Reference Countries

	Average years of education	R&D (percent of GDP)	Researchers (per thousand)
Korea	10.5	3.0	3.8
Taiwan	8.5	2.5	8.9
Finland	10.1	3.5	7.6
Ireland	9.0	1.3	2.8
New Zealand	11.5	1.2	4.2
Costa Rica	6.0	.4	.1
Argentina	8.5	.5	.8
Chile	7.9	.7	.8
Latin America	5.9	.3	.3