



Institute of Economic Growth



RIS

Research and Information System
for Developing Countries

Seminar on
India and Globalization
[A Seminar in Honour of Professor N.S. Siddharthan]

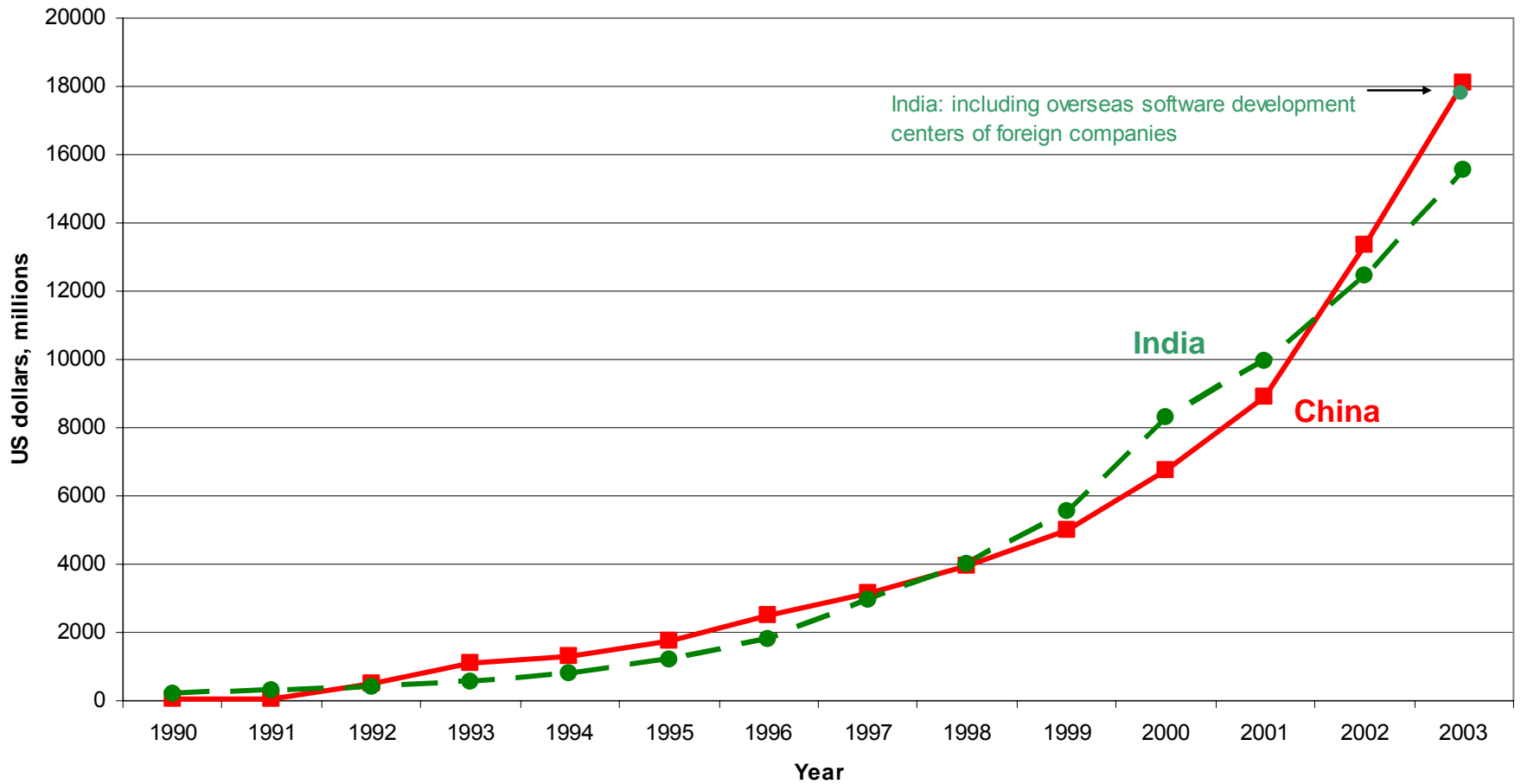
RIS Conference Hall, India Habitat Centre, New Delhi on 1 February 2007

Software Industry Performance in India and China

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This research was conducted jointly with N.S. Siddharthan.
This paper is adapted from an unpublished book manuscript
co-authored with Neil Gregory and Stoyan Tenev of the International Finance Corporation.
We acknowledge with gratitude financial support from the World Bank.

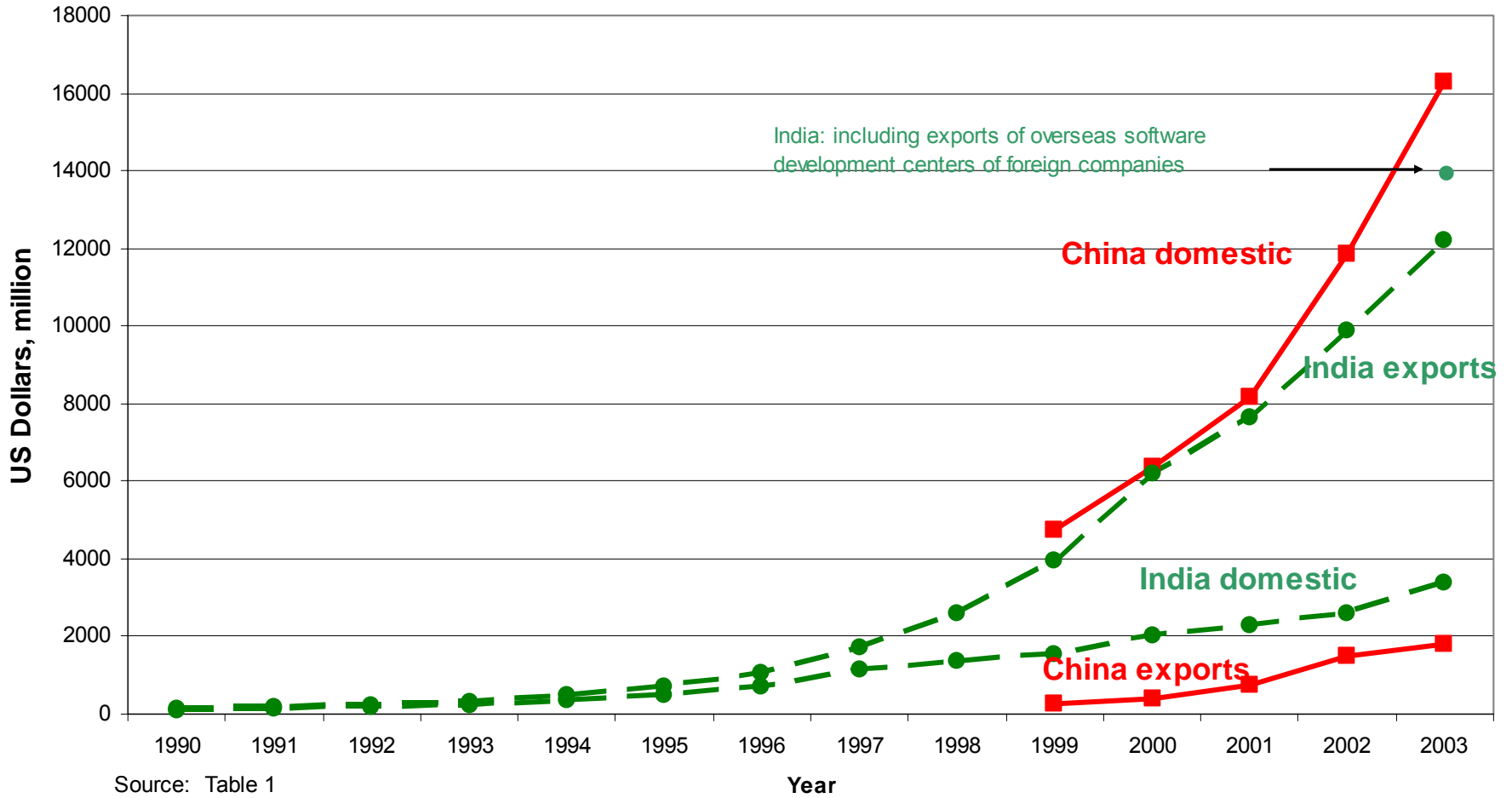
Chart 1. **China and India**
Software Services & Products Sales Revenue
in US Dollars, 1990-2003



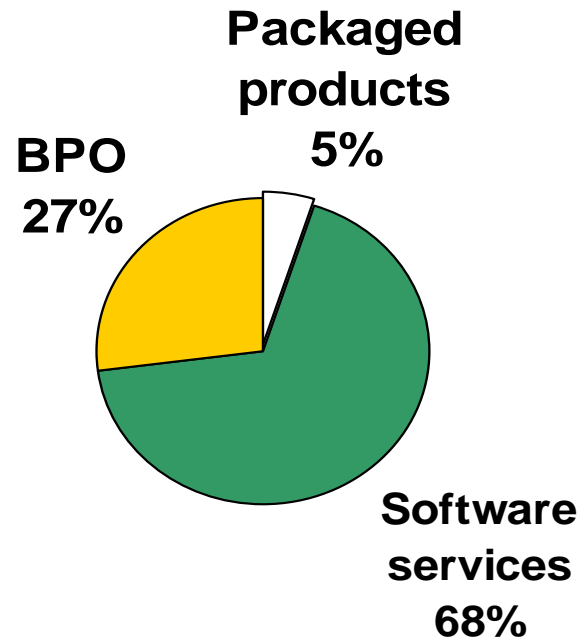
Source: Table 1

India and China

Software Services & Products Domestic and Export Sales in US Dollars, 1990-2003



Indian Software: Types of Products and Services



Source: *Dataquest*, July 2005. The data refer to year 2004-05

Research Question

- **Why has the Indian software industry achieved rapid export-oriented growth while the equally fast-growing Chinese software industry has not?**

Research Approach

- Measure and compare features of software firms in each country
 - Variable set informed by economics of production functions, international trade theory, and competitive advantage of nations
 - Add analysis of short-term revenue growth of firms
 - Extend findings with insights about the business climate and government policies in each country
-

Findings are based on multivariate statistical analyses of new survey data at the firm level

Database from New Survey Research

Sample of 179 Software Firms

INDIA - 168 Software Firms

- Sample drawn from industry associations' membership lists and trade magazine's annual review
- Personal interviews by Confederation of Indian Industry in Bangalore, Chennai, Delhi, Hyderabad, Mumbai, and Pune
- Response rate 62%; covers 90% of software industry revenue but does not represent population of all firms

CHINA - 60 Software Firms

- Sample drawn from government statistical report for Beijing and Guangzhou plus interviewers' judgement for firms in Shanghai
- Personal interviews by Renmin University survey research unit
- Response rate 31%; covers small part of industry's revenue but represents industry by size of firm

Survey research managed by EconAnalysis, Oslo; supported by World Bank Trust Funds from Norway

1st Analysis: Logistic regressions

<i>Dependent variable</i>	<i>Independent variables</i>
Country of firm: India=0 China=1	Factors of production <ul style="list-style-type: none"> ➤ Labor and management skill and effectiveness: professional intensity, education, experience, labor productivity, wages, quality certification, national culture, clustering ➤ Capital: physical & financial ➤ Infrastructure: electric power, transport, telecom ➤ Technology: inputs (R&D) & outputs (new products, patents)
	International linkages <ul style="list-style-type: none"> ➤ Non-equity strategic alliances ➤ Foreign ownership ➤ Non-residents
	Business environment <ul style="list-style-type: none"> ➤ Institutions: legal ➤ Government policies that promote or hinder firm growth: tax, trade, investment, industrial

2nd Analysis: Seemingly unrelated regressions from a model of simultaneous determination of growth and profits

<i>Dependent variable</i>	<i>Independent variables</i>
Sales revenue growth in 2002	Factors of production <ul style="list-style-type: none"> ➤ Labor and management skill and effectiveness: labor productivity, manager's experience, quality certifications ➤ Capital ➤ Technology: output (new products)
1) India 2) China	International linkages <ul style="list-style-type: none"> ➤ Non-equity strategic alliances ➤ Foreign ownership ➤ Non-residents role

Values of variables that distinguish Indian from Chinese software firms and their effects on firm growth - 1

Services vs. products difference between Indian and Chinese software firms accounted for

<i>Labor and Management</i>	<i>India</i>	<i>China</i>
Professional employment (median share of total employment)	69%	29%
Entry level qualification for professional employees	Post-graduate degree (≥ 17 years)	Diploma or 1 st University degree (13-16 years)
Contribution of one more year of top manager's experience to revenue growth	+7%	-26%
Labor productivity (output per worker)	USD 25,567	USD 29,625

Values of variables that distinguish Indian from Chinese software firms and their effects on firm growth - 2

<i>Labor and Management-2</i>	<i>India</i>	<i>China</i>
Quality certification (share of firms with CMM certification)	47%	7%
Effect of CMM certification on revenue growth	90% faster	No effect
Independence of action * entrepreneurial orientation (scale score with range 0-15)	10.4	6.9

Values of variables that distinguish Indian from Chinese software firms and their effects on firm growth - 3

<i>Technology</i>	<i>India</i>	<i>China</i>
Technology input: R&D spending (% of firms with R&D)	72%	93%
Technology out: New product introductions (number in the last year)	2.2	2.7

Values of variables that distinguish Indian from Chinese software firms and their effects on firm growth - 4

<i>International Linkages</i>	<i>India</i>	<i>China</i>
Foreign non-equity strategic alliances (% of firms with)	60.2%	11.9%
Effect of one more foreign alliance on revenue growth	6%	No effect
Foreign ownership (average stake, all firms)	23%	29%
Contribution of 10% greater foreign ownership stake to revenue growth	No effect	19%
Non-residents' role: contribution of 10% greater importance of role to revenue growth	No effect	25% faster

Values of variables that distinguish Indian from Chinese software firms and their effects on firm growth - 5

Seriousness of problem figures are scale scores where 1=no problem and 5=serious problem

<i>Infrastructure</i>	<i>India</i>	<i>China</i>
Electric power		
Power cuts: seriousness of problem	3.1	1.9
Have own electric power generation facilities (% yes)	87%	23%
Transportation		
Public transport failures: seriousness of problem	2.6	1.6

Values of variables that distinguish Indian from Chinese software firms and their effects on firm growth - 6

Figures in cells are scale scores where 1=not important and 5=very important

<i>Government Policies</i>	<i>India</i>	<i>China</i>
Policies that promote growth		
> Marketing support	2.6	3.7
> Infrastructure provision	3.8	3.0
> Liberalization of import policies	3.5	1.4
Policies that hinder growth		
> Bureaucracy & paperwork	3.6	2.5
> Travel & visa restrictions	3.9	2.5

Two Potential Qualitative Influences that Favor Indian Firms as Software Exporters

English language

**ALL EDUCATED INDIANS ARE
ENGLISH SPEAKERS, AND THE
LARGEST SOFTWARE MARKETS ARE
ENGLISH LANGUAGE**

**But some countries with English-
speaking professionals are not
major software exporters
(Philippines, South Africa) and
some countries without many
English-speaking professionals are
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**China doesn't lack software engineers
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Chance: Y2K

THE NEED TO REPROGRAM COMPUTER SYSTEMS WHEN 1999 CHANGED TO 2000 BOOSTED INDIAN SOFTWARE FIRMS BECAUSE THEIR ENGINEERS KNEW OLD CODE, IT WAS LOW-END AND LABOR INTENSIVE, AND COULD BE DONE OFF-SHORE VIA TELECOM LINKS

But Y2K work was only 12-16% of total revenue, and revenue growth accelerated after Y2K

The Y2K boost was to increase exposure and spread quality reputation

Conclusions:

Why Indian Software Firms Were More Export Successful than Chinese Firms

Indian firms ...

- Made greater use of more educated professionals and more experienced managers without incurring higher labor cost
 - Achieved quality certifications to overcome liability of foreignness
 - Established non-equity strategic alliances with foreign firms
 - Received direct and targeted assistance from government, mainly via software technology parks and tax concessions from export earnings
- ... Technology lag was not important for software services firms in the past, and weak infrastructure was overcome