

Economic Growth in the Digital Era

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A Preview

- ◆ The Characteristics of the Digital Era
- ◆ Interactions with Long-Term Economic Trends
 - ◆ Increasing de-verticalization or fragmentation of production
 - ◆ Rising globalization
- ◆ Economic Implications of the Digital Era
- ◆ The Sources of East Asian Economic Growth
- ◆ Government Policies for Economic Growth in the Digital Era

Internet Users in the Asia/Pacific Region

Internet Users in the Asia/Pacific Region (millions)								
	1999	2000	2001	2002	2003	2004	2005	Annual Rate of Growth
China	16.5	27.2	40.4	59.4	84.5	111.6	141.3	43.0
Hong Kong	1.9	2.5	3.0	3.2	3.8	4.6	5.4	19.0
India	3.2	6.2	11.0	18.9	30.3	42.3	62.5	64.1
Indonesia	1.0	1.4	1.9	2.5	3.6	5.2	7.3	39.3
South Korea	5.3	8.1	10.7	14.1	17.7	22.1	26.8	31.0
Malaysia	1.2	1.7	2.4	3.5	4.7	6.2	8.1	37.5
Philippines	0.6	1.1	1.6	2.7	4.1	6.3	8.6	55.9
Singapore	0.8	1.0	1.3	1.5	1.7	1.9	2.4	20.1
Taiwan	4.4	5.5	6.9	8.6	10.8	12.4	15.8	23.7
Thailand	1.0	1.5	2.3	3.5	4.6	6.5	8.7	43.4
Asia/Pacific Region	66.2	94.5	128.0	173.3	231.5	295.7	374.4	33.5

Note: 1999 figures estimated and 2000-2005 figures projected by the Yankee Group.

Penetration Rates in the Asia/Pacific Region

Penetration Rates in the Asia/Pacific Region (percent)							
	1999	2000	2001	2002	2003	2004	2005
China	1.3	2.0	2.9	4.2	5.8	7.4	9.2
Hong Kong	26.9	35.6	40.6	42.5	49.6	57.7	65.3
India	0.3	0.6	1.0	1.7	2.7	3.6	5.2
Indonesia	0.5	0.6	0.9	1.1	1.5	2.1	2.9
South Korea	11.2	17.0	22.3	29.3	36.2	44.8	53.9
Malaysia	5.3	7.4	10.0	13.9	18.1	23.3	29.8
Philippines	0.8	1.4	2.1	3.3	4.8	7.2	9.5
Singapore	24.2	29.0	37.7	42.5	47.9	54.0	66.1
Taiwan	19.9	24.7	30.5	37.8	46.8	53.3	67.4
Thailand	1.6	2.4	3.5	5.1	6.6	9.1	11.7
Asia/Pacific Region	2.4	3.3	4.5	6.0	7.8	9.6	11.9

Note: 1999 figures estimated and 2000-2005 figures projected by the Yankee Group.

The Digital Era

- ◆ The “Digital Era” refers to a time in which there is widespread, ready and easy access to, sharing of, and use of information (knowledge) in electronically accessible, i.e., digitized, form, in economic activities.

Characteristics of the Digital Era:

(1) Reductions in the Costs of Information

- ◆ The cost of information (knowledge) may be divided into two parts: the cost of creation and analysis of information (e.g., research), and the costs of collection, processing, storage, retrieval, and transmission of information--both parts are subject to increasing returns to scale.
- ◆ The “Digital Era” is characterized by the information and communication technology (ICT) revolution and its rapid international diffusion, which has led to
 - ◆ (1) huge declines in the costs of computation and information storage coupled with the huge increases in the speed of computation;
 - ◆ (2) huge declines in the cost of communication coupled with the huge increases in both speed and throughput volume—greatly enhancing the capacity for accurate analysis and real time response;
 - ◆ (3) huge increases in the degree of precision of the information due to digitization but without a corresponding increase in costs.
- ◆ The retrieval and transmission of information is greatly facilitated by the “Internet”
 - ◆ The communication, transmission and distribution of information are no longer limited by space and time, and in particular, are not limited by national boundaries.
 - ◆ Information can be accessed, analyzed and transmitted in real time and at low marginal cost.
 - ◆ Much information has become a public good.
 - ◆ Information flow can be targeted at (both to and from) specific individuals and audiences.
- ◆ Over time, more and better information has become available faster and cheaper and to a vastly greater number of people.

(2) Increases in Timeliness of Information

- ◆ Significant increases in the timeliness of economically relevant information (sales, inventory, competitor's prices and new products, etc.); in some cases, there is real-time availability.
- ◆ Corresponding and significant decreases in potential response times.

The Information and Communication Technology Revolution

- ◆ Example: The semiconductor manufacturing technology has been improving exponentially in terms of number of components on a chip whereas the cost per component has also been declining exponentially (Moore's Law).
- ◆ Example: The price of a computer, holding the size of memory and the speed of the microprocessor constant, has been declining at 14% p.a. since the 1960s.
- ◆ Example: Both the speed and ubiquity of data availability have greatly increased because of Internet access, the packets transmission technology, and the presence of more and more wireless local area networks.
- ◆ Example: There is significant broad-band over-capacity in the world.

(3) Reductions in Transactions Costs

- ◆ Significant reductions in the transactions costs (due to more, faster, better and cheaper information), including search costs and the costs of intra-firm and inter-firm coordination:
 - ◆ The costs of internal management, monitoring and control are significantly reduced, resulting in an expansion of the span of control by the management and a flatter organization.
 - ◆ However, the timely availability of information and the capacity for a speedy response have also, somewhat paradoxically, enabled greater autonomy and devolution of decision-making downward and outward.
 - ◆ The costs of inter-firm coordination have also been greatly reduced—coordination can become almost “seamless”
 - ◆ The ICT revolution enhances predictability and reliability of division of labor across firms and thus shifts the advantage to “De-verticalization”, “Out-sourcing”, and “Globalization” of supply chains.
 - ◆ Reductions in transactions costs enable the exploitation of efficiencies in specific segments, or links, of the design, manufacturing, marketing and distribution process.
 - ◆ Many heretofore untraded services have become highly tradable or potentially highly tradable and can be “outsourced” globally rather than just locally
 - ◆ e.g., software, back-office paper work, design, quality assurance, entertainment, long-distance surgery.
 - ◆ Unbundling of products and services becomes feasible/necessary/desirable.
 - ◆ Even the transactions costs to consumers are lowered because of the convenience factor, e.g., Amazon.com.
- ◆ Governments can make use of the internet to lower the costs of government operations and to enhance the efficient delivery of government services (e-Government).

(4) Increases in Precision, Resolution and Quality

- ◆ Digitization greatly expands the speed and volume of information available as well as the sophistication and reliability of its use—information is money and information is power.
- ◆ Digitization enables much greater precision in the information and hence much greater discriminatory power and much finer details. This can lead to potential quantum improvement in the qualities of the products, e.g., design, high-definition television, miniaturization, music, photographs, replication.
- ◆ Digitization greatly reduces the cost and enhances the accuracy of replication, and thus helps to increase the degree of economies of scale. (“Digital capital,” unlike tangible capital, does not depreciate, but it does become obsolete from time to time.)
- ◆ Digitization also greatly facilitates R&D.

(5) Reductions in Costs of Market Formation

- ◆ Significant reductions in the costs of market creation, expansion, differentiation, and segmentation--markets are no longer bounded by physical space and time limitations.
 - ◆ Aggregation of users/consumers to create new and diverse markets consisting of consumers who may be geographically dispersed or socioeconomically stratified
 - ◆ e.g. vegemite for Australians; vegetarians; exceptionally large and small sizes of clothing; tools for left-handed individuals.
 - ◆ Vast expansion of consumer choice
 - ◆ The ease of customization through the internet (e.g. many different choices are possible (Dell))
 - ◆ Products are built to order rather than on speculation; the economy is therefore less likely to have large unintended inventory accumulation or decumulation.
- ◆ The rise of new markets, products, services, and business models on the basis of the new information and communication technologies that are not previously available
 - ◆ e.g., GPS links for emergency road service; satellite-based auto-pilot systems for automobiles
 - ◆ e.g., “Cuusoo” (Japan)Lawrence J. Lau, Stanford University--consumer participation in the design of new products

The “New Economy” is an “Information” or “Knowledge” Economy

- ◆ The efficiency and optimality of the competitive market economy depends on the availability of information to all economic agents on a timely basis. The information and communication technology revolution reduces the asymmetry of information among different economic agents—it thus helps to level the playing field for all economic agents and makes the competitive market more efficient, resulting in higher real output than previously possible.
- ◆ Moreover, with better and more and more timely information and communication, the speed of response to changes in economic circumstances and adjustment to a new optimum can be significantly increased.
- ◆ The benefits of lower transactions costs and increasing returns to scale of information/knowledge capital can be realized through increasing de-verticalization and rising globalization with the help of the new information and communication technologies
- ◆ The reductions in transactions costs can more than offset the increased costs of transportation and communication due to globalization.
- ◆ Complementarity of information with tangible and intangible capital--the increased availability and timeliness of information greatly enhance and multiply the benefits of and returns to tangible as well as intangible capital (such as human capital, R&D capital, and knowledge capital), and vice versa.
 - ◆ Example: the installation of new software or new database on existing computers; comparison shopping through the internet

Long-Term Economic Trends: De-Verticalization of Production

- ◆ A vertically integrated enterprise is one which does not purchase any intermediate goods from outside vendors. It purchases only primary raw materials from the outside. A fully integrated automobile manufacturing firm will make its own steel and its own tires. De-verticalization or fragmentation is the process through which a firm purchases more and more intermediate goods from the outside instead of manufacturing them inside.
- ◆ Hence, “De-Verticalization” or “Fragmentation” means the vertical division of labor—the separation and contracting out of design, manufacturing, marketing, inventory, transportation and distribution functions (generalized out-sourcing) both within and across national boundaries.
- ◆ Logistics and supply chain management--managing a production process not all of which lies within a single firm (in fact, most of which lie in different firms).
- ◆ Successful de-verticalization depends on
 - ◆ (1) the possibility of standardization (uniform grading), existence of common platforms (degree of precision, resolution, communication protocol, software and other compatibility requirements, etc.).
 - ◆ (2) accurate, precise, reliable and timely communication;
 - ◆ (3) quality assurance (possibly by impartial third parties) and timely performance--reputational capital is key here.
- ◆ The “Digital Revolution” facilitates and encourages de-verticalization (out-sourcing) and division of labor.
- ◆ However, a long-term collaborative relationship is still indispensable in sectors with rapid innovation (repeated game)

De-Verticalization or Fragmentation of Production

- ◆ Further specialization and division and sub-division of labor with emphasis on “core competence”--the need to identify, improve and sharpen “core competence” in order for a firm to survive; productivity of a firm can actually be enhanced by taking advantage of the opportunities for “de-verticalization” (“out-sourcing”).
 - ◆ e.g., the choice amongst being a designer, manufacturer, or a marketer
- ◆ The focus on core competence in turn helps to add value.
- ◆ De-verticalization enables the alignment of incentives within each link of the supply chain so that the reward is tied directly to the specific performance of each link and the exploitation of economies of scale, if any, in the performance of tasks in each of the separate links.
- ◆ De-verticalization also facilitates competition through lowering the barriers to entry (lower capital requirements) to the different links (an integrated firm will face much higher capital requirements)
 - ◆ e.g., semiconductor design firms can exist and prosper without their own capital-intensive fabrication facilities because there are semiconductor manufacturing firms specializing in the foundry business

The Concept of De-Verticalization is NOT New

- ◆ Vertical division of labor--subcontracting
 - ◆ e.g., the construction industry in developed market economies--all the “trades” (services) are traditionally performed by specialist subcontractors
- ◆ “Original Equipment Manufacture” (OEMs) in developing economies
 - ◆ Nike, Polo, Dell, Compaq, brand name products, all use contract manufacturers in developing economies
- ◆ “Fabless” semiconductor companies and contract manufacturing
 - ◆ e.g., Taiwan Semiconductor Manufacturing Corporation, Solectron, Flextron
- ◆ “Original Design and Manufacture” (ODMs)
- ◆ Outsourcing of services
 - ◆ e.g., processing of credit cards (many credit card issuers are nominal issuers only); information processing for financial institutions

De-Verticalization:

Logistics Revolution and the Supply Chain

- ◆ Just-in-time inventory system has been used very effectively by Japanese manufacturers (mostly captive suppliers)
- ◆ Savings can come from consolidation and/or out-sourcing of transportation, inventory and warehousing, reduction in the transactions cost of communication, and increased timeliness of delivery. It can also come from the reduction in the transactions cost of marketing and distribution. Most importantly, de-verticalization can result in a significant reduction in the fixed costs of a firm (e.g., no warehouses, no fleets of trucks with their drivers).
- ◆ Competition among suppliers and potential suppliers can further lower costs.
- ◆ What is new is that the transactions costs have come way down and that one can out-source globally rather than just locally, thanks to the “digital revolution.”
- ◆ Question: Can the design and marketing and manufacturing functions of the automobile firm be separated in the future?

The Benefits of De-Verticalization or Fragmentation of Production

- ◆ De-verticalization and out-sourcing encourage specialization (in tasks rather than the products)
 - ◆ Blurring the boundary between manufacturing and service
- ◆ De-verticalization and out-sourcing permit efficient sharing of resources and thus
 - ◆ Reduces the fixed costs of and hence lowers the barriers to entry--promotes competition
 - ◆ Example: the rise of “fabless” semiconductor design firms
 - ◆ Enables the realization of economies of scale and learning-by-doing effects through specialization in particular tasks (rather than products)
 - ◆ e.g., firms do not typically generate their own electricity; the semiconductor foundry business; delivery services such as United Parcel Service (UPS) and Federal Express
 - ◆ Allows the realization of the benefits (efficiency gains) of targeted incentives in specific tasks or segments of the traditional business
 - ◆ Much duplication of efforts--“rediscovering the wheel”--can be avoided

Long-Term Economic Trends: Rising Globalization and Growth of World Trade

- ◆ Falling barriers (legal, technical, and institutional) to movements of goods, services and factors (particularly capital (including foreign direct investment), but also human capital); more expeditious and impartial cross-border resolution of commercial disputes.
 - ◆ Reduction and/or elimination of tariff and non-tariff barriers
 - ◆ WTO, European Union, NAFTA, ASEAN Free Trade Area, other free trade areas
- ◆ The increasing acceptance of the concept of national treatment
- ◆ Falling costs of (international) communication and transportation
 - ◆ The rise of English as a global medium of communication
- ◆ Falling transactions costs in terms of both money and time brought about by the information and communication technology (ICT) revolution
- ◆ Benefits of economies scale create large global niche players.
- ◆ Global competition has also brought down the costs of out-sourcing.

Global Out-Sourcing Draws New Players into the Global Market (China, Russia and India)

- ◆ Re-alignment of comparative advantages
 - ◆ Both existing and new players can benefit
 - ◆ Comparative advantages will change
 - ◆ Adjustments will be necessary
 - ◆ There should be sufficient gain for everyone to more than compensate all the losers
- ◆ There will be increased demands for goods and services (aircrafts, cell phones, computers and tourism services)
- ◆ There will be little upward pressure on the wage rate of unskilled labor for many years to come

Implications of Rising Globalization

- ◆ A new impetus for the growth of world trade
 - ◆ The finer division of labor increases the gross volume of world trade, even if total value-added grows much more slowly
 - ◆ Over time, both exports and imports as percentages of GDP will tend to rise worldwide; however, net exports, and value-added from exports as a percent of GDP will tend to rise much more slowly
 - ◆ Trade in “Intermediate Inputs” and “Services” rather than finished “Products”
 - ◆ A substantial proportion of world trade is intra-company trade
 - ◆ Many services not previously traded have become tradable—e.g., back office work, call centers.
 - ◆ Tourism is one of the few non-tradable services left because it is location-specific
- ◆ An expansion of potential world output

Implications of Rising Globalization

- ◆ The importance of large markets
 - ◆ Leveraging intangible capital--economies of scale in the utilization of intangible capital implies that the rate of return depends on reaching as large a market as possible
 - ◆ Standardization and standard setting and establishment of brand names generate market economies of scale (the higher the market share, the higher the profit margin)
 - ◆ Leaving large markets alone gives potential competitors an opening to establish themselves
- ◆ The importance of openness—global subdivision of the production process implies that an economy must be ready to take any link or links of the global supply chain in which it has a comparative advantage—sometimes a product may have to go in and out of the same economy four or five times undergoing different processing before being shipped to the final consumers (import quotas and arcane country of origin rules have much to do with back and forth movement of goods in process across economies). A free trade policy on both the export and the import side helps enterprises rationalize and optimize their position(s) in the global supply chain.

The Complementarity of De-Verticalization and Globalization

- ◆ Specialization in tasks rather than products by firms—finding a niche in the global supply chain that maximizes value-added based on “core competence”; higher-value-added parts of the supply chain have much less competition (Intel, Microsoft, TSMC)
- ◆ Specialization in tasks enables the realization of economies of scale and learning by doing effects—It is more efficient for firms to expand horizontally (to supply multiple customers around the globe) rather than to integrate vertically

Interactions with Increasing De-Verticalization and Rising Globalization

- ◆ The advent of the “Digital Era” greatly facilitates and accelerates the process of de-verticalization through not only local out-sourcing but global out-sourcing.
- ◆ The demands for de-verticalization and globalization in turn create demand on even greater digitization.
- ◆ Globalization permits the realization of large economies of scale through de-verticalization and specialization in a particular segment or link of the global supply chain.
- ◆ The “New Economy” further facilitates globalization through the international diffusion of the information/communication technology

Impacts on the Macroeconomy

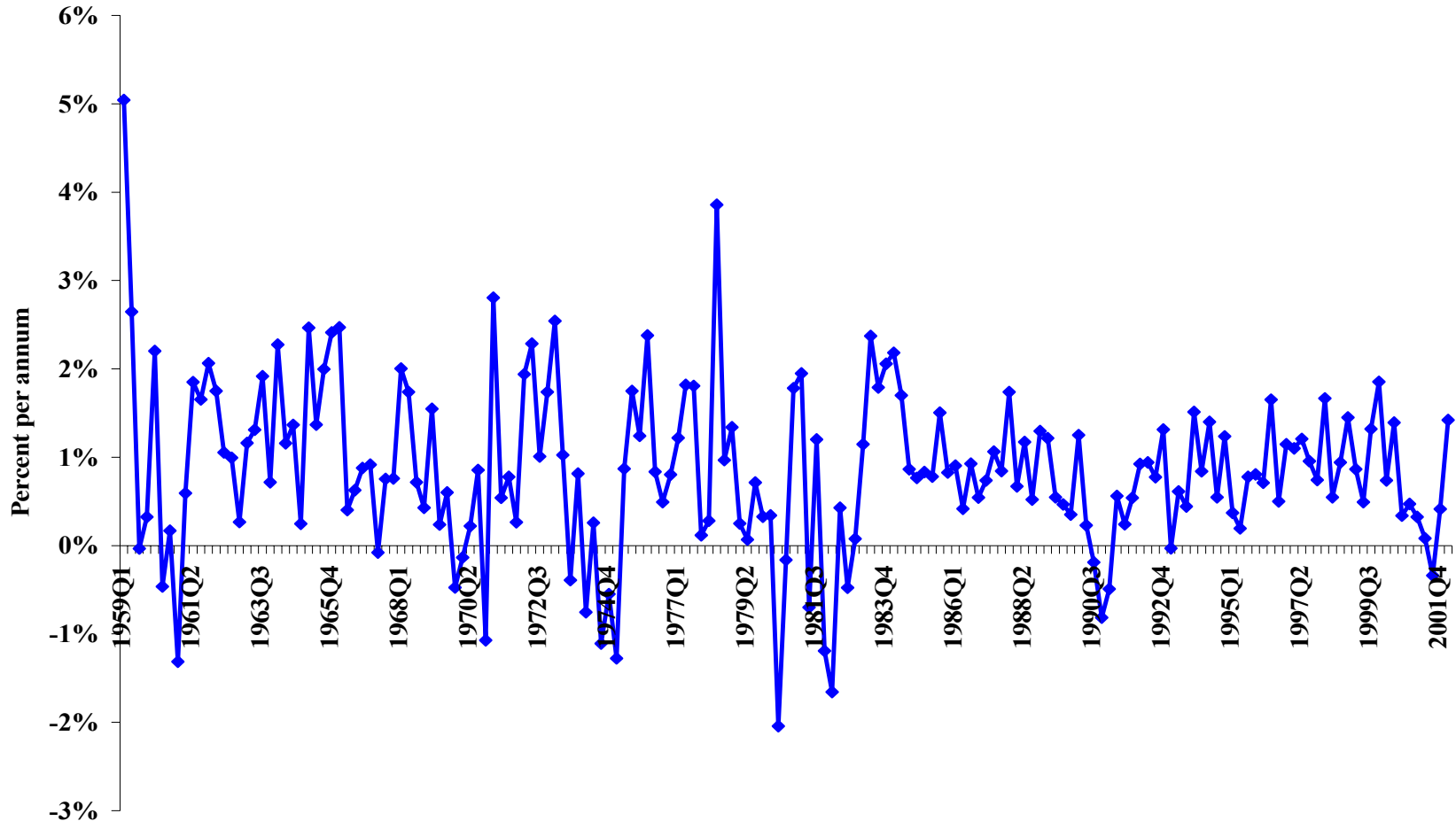
- ◆ The advent of the “Digital Era” can bring about a one-time permanent increase in potential output, hence, productivity—by taking advantage of reduction in costs brought about by the ICT revolution—a greater output can be produced with the same inputs.
- ◆ It will, however, take time for the full benefits to be realized. Thus, in the movement to the new frontier of the set of production possibilities, the rate of growth of real output and the rate of growth of technical progress (total factor productivity) are likely to be higher than previously.
- ◆ The increase in the rate of measured technical progress in the U.S. over the decade of the 1990s arose not so much from an increase in the rate of innovation given the rate of R&D investments but from the increased rates of diffusion and adoption. However, this acceleration in the rate of measured technical progress is likely to be transient. It will return to a steady-state rate once the new frontier of the set of production possibilities is reached.
- ◆ Specialization and division and subdivision of labor can result in lower prices, greater output, and more new varieties of products and services
- ◆ Reductions in costs translate directly into increases in productivity which in turn reduces the upward pressure on prices and keeps the rate of inflation low
- ◆ Competition from new entrants bring down prices

Impacts on the Macroeconomy

- ◆ Existing demands for goods and services are supplied by new entrants into the businesses, most of them small and medium-sized start-up firms, using new technology—these firms are typically less tangible-capital-intensive but more intangible-capital-intensive.
 - ◆ e.g., internet bookstores wipe out real brick and mortar bookstores; internet securities trading knock out traditional stock brokerages (however, there is still a role to play--assurance of fulfillment, assumption of credit and performance risks--reputation and brand name are still important)
 - ◆ The new firms will take away the business from the old firms--”Creative Destruction”
- ◆ However, an environment that encourage new businesses must be created and maintained, so that new jobs can be created as old ones are destroyed.
- ◆ The new jobs are likely to be higher-paying but require better skills
- ◆ The rise of completely new businesses

Rates of Growth of Total Factor Productivity in the United States--Quarterly Data

Rates of Growth of Total Factor Productivity of the United States

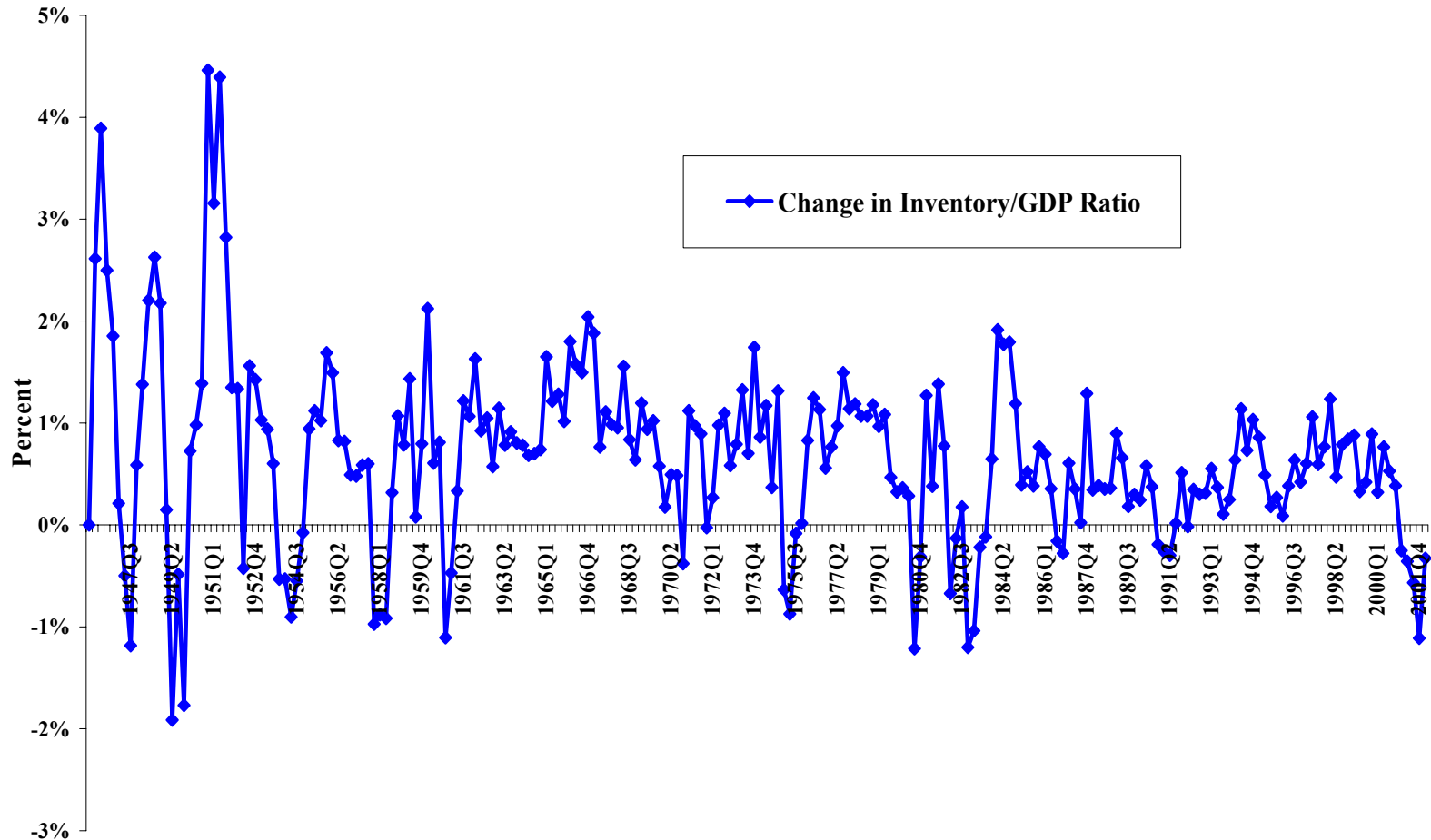


Rapid Economic Response and Adjustment— Manifestation in the United States

- ◆ The more rapid response and adjustment to changes in economic information in the Digital Era makes it possible to moderate the amplitude of the business cycles through:
 - ◆ Better management of the monetary policy (e.g., Taylor's rule)
 - ◆ A decline in the average level of changes in inventory (stocks) relative to GDP as well as in its volatility. Changes in inventory used to be a major source of business cycle fluctuations in the United States. The improvement may be attributed in part to better inventory management due to more, more timely, better and cheaper information available, resulting in faster responses to changes in demand conditions.
 - ◆ A significant decline in the volatility of new housing starts in recent years, which used to be a major source of business cycle fluctuations in the United States, reflecting better information and faster adjustments, and institutional changes such as the introduction of adjustable-rate mortgages and securitization of mortgages and the resulting sharing of the interest rate risks by the mortgage lenders to other investors. New housing starts are no longer as sensitive to changes in the rates of interest. Financial derivative instruments, which are products of the digital era, play a significant role in enabling the risk-sharing of long-term residential mortgages.

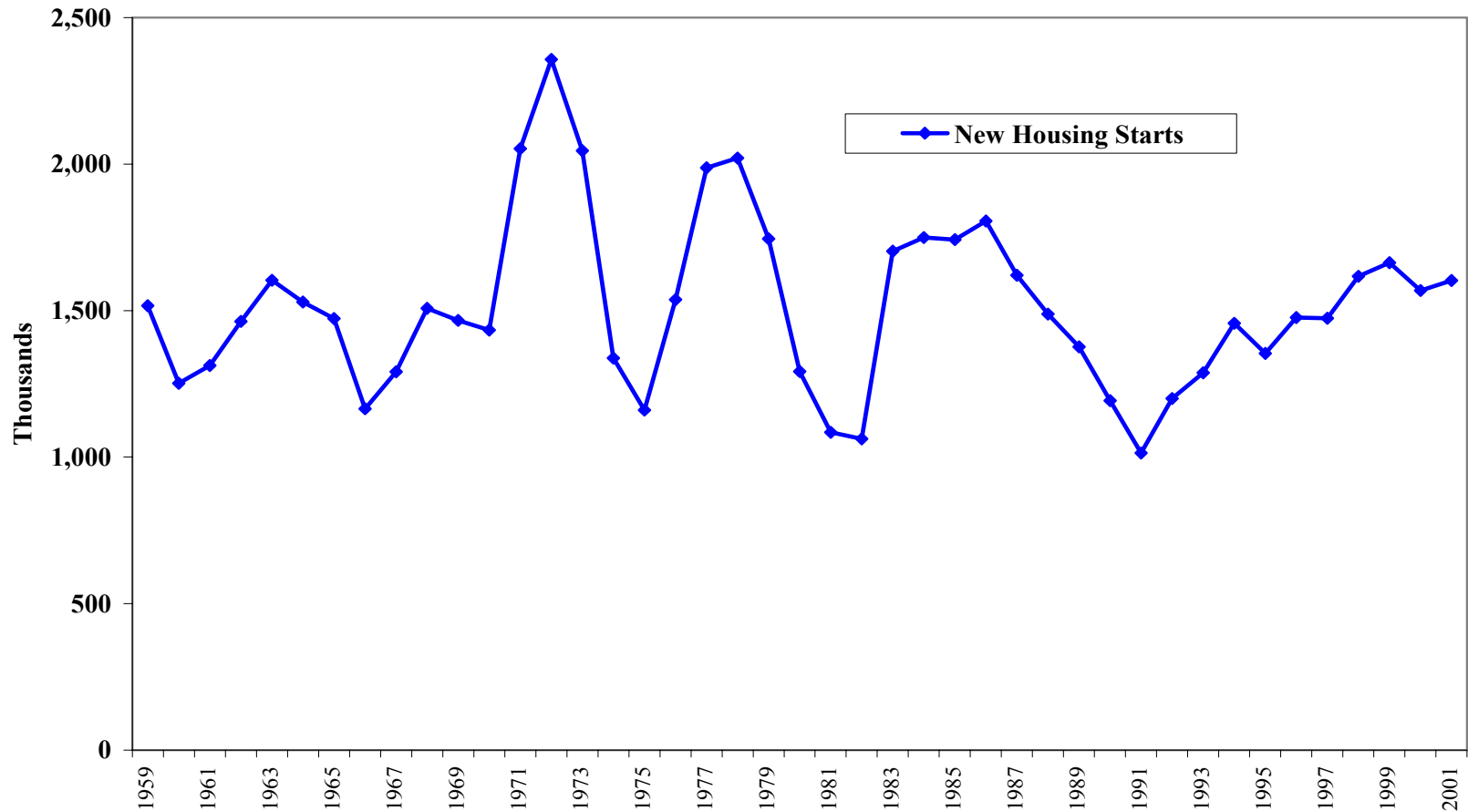
The Change in Inventory/GDP Ratio in the United States--Quarterly Data

Change in Inventory/GDP Ratio



New Housing Starts in the United States

New Housing Starts (thousand units)

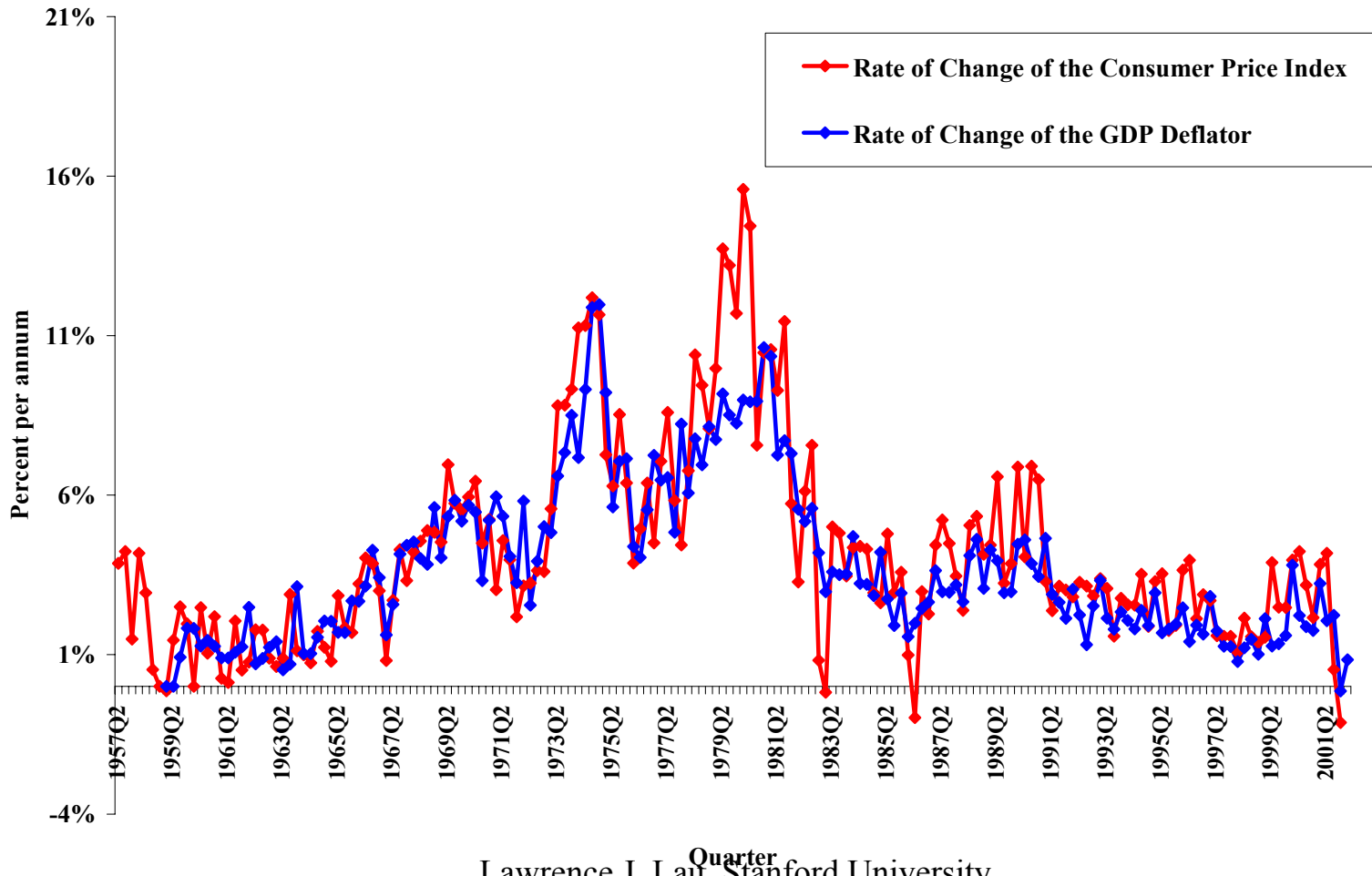


Rapid Economic Response and Adjustment— Manifestation in the United States

- ◆ The rate of inflation in the United States has remained low during the past decade (to levels unseen since the 1960s—it has since risen again).
 - ◆ This has been made possible, in part, through the productivity gains due to the information and communication technology revolution--Increases in productivity lower the unit cost of production and hence reduce the upward pressure on prices and keep the rate of inflation low.
 - ◆ This has also been made possible, in part, because of better management of the monetary policy (by Dr. Alan Greenspan, Chairman of the Federal Reserve Board) based on better and more timely information and better and faster analysis and response (e.g., Taylor's rule).
 - ◆ The U.S. has been the beneficiary of the East Asian currency crisis
 - ◆ The price of imports has remained low, helping to keep inflation down
 - ◆ Its status as a safe haven for capital has allowed the rate of interest in the U.S. to remain low.
 - ◆ The foreign central banks have to re-build their foreign exchange reserves by purchasing and holding U.S. dollars.
 - ◆ Low unemployment has been achieved without kindling high inflation

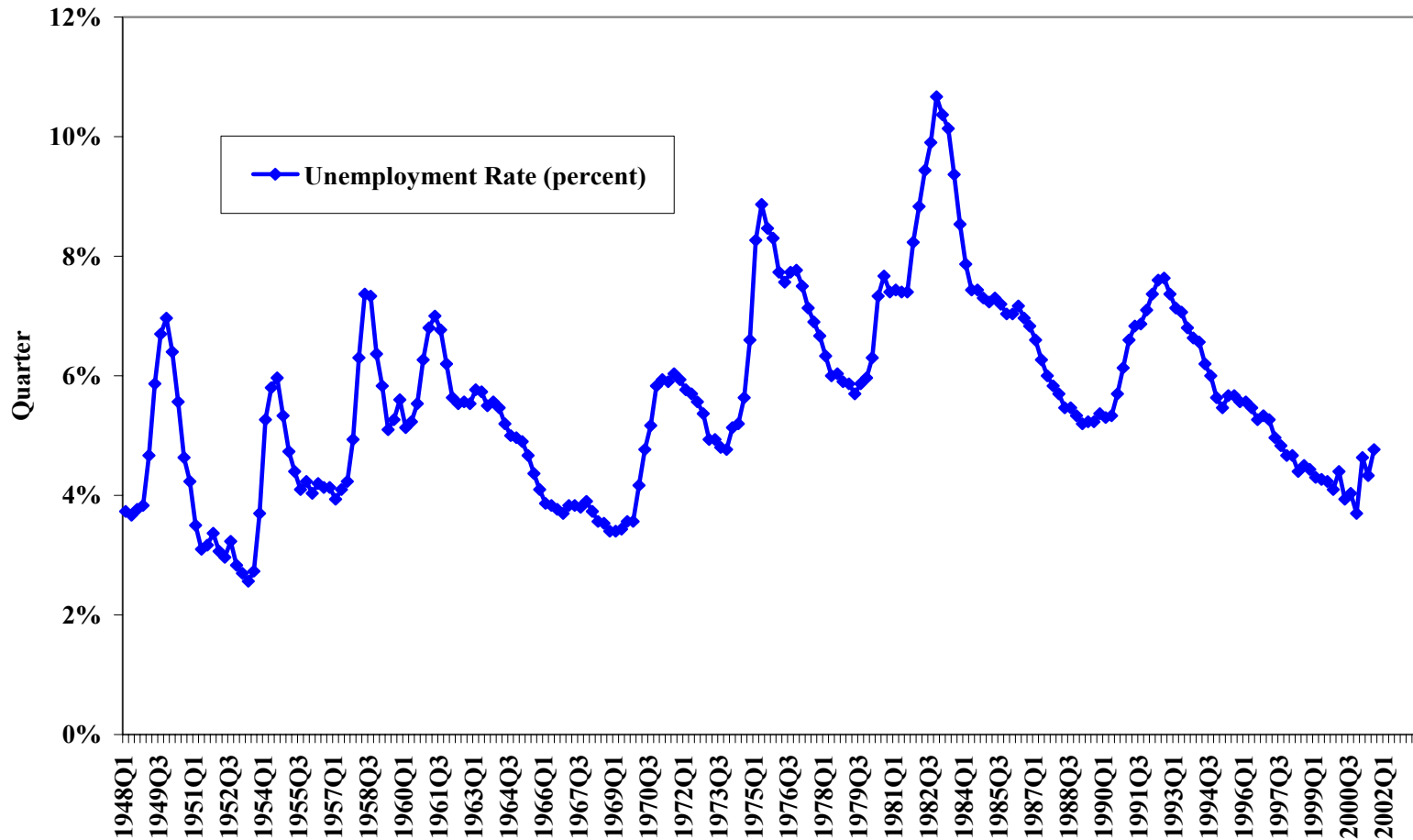
The Rates of Inflation of the United States

Rates of Inflation in the United States



The Unemployment Rate of the United States

Unemployment Rate of the United States (percent)



The Effects of the “New” Economy in the United States

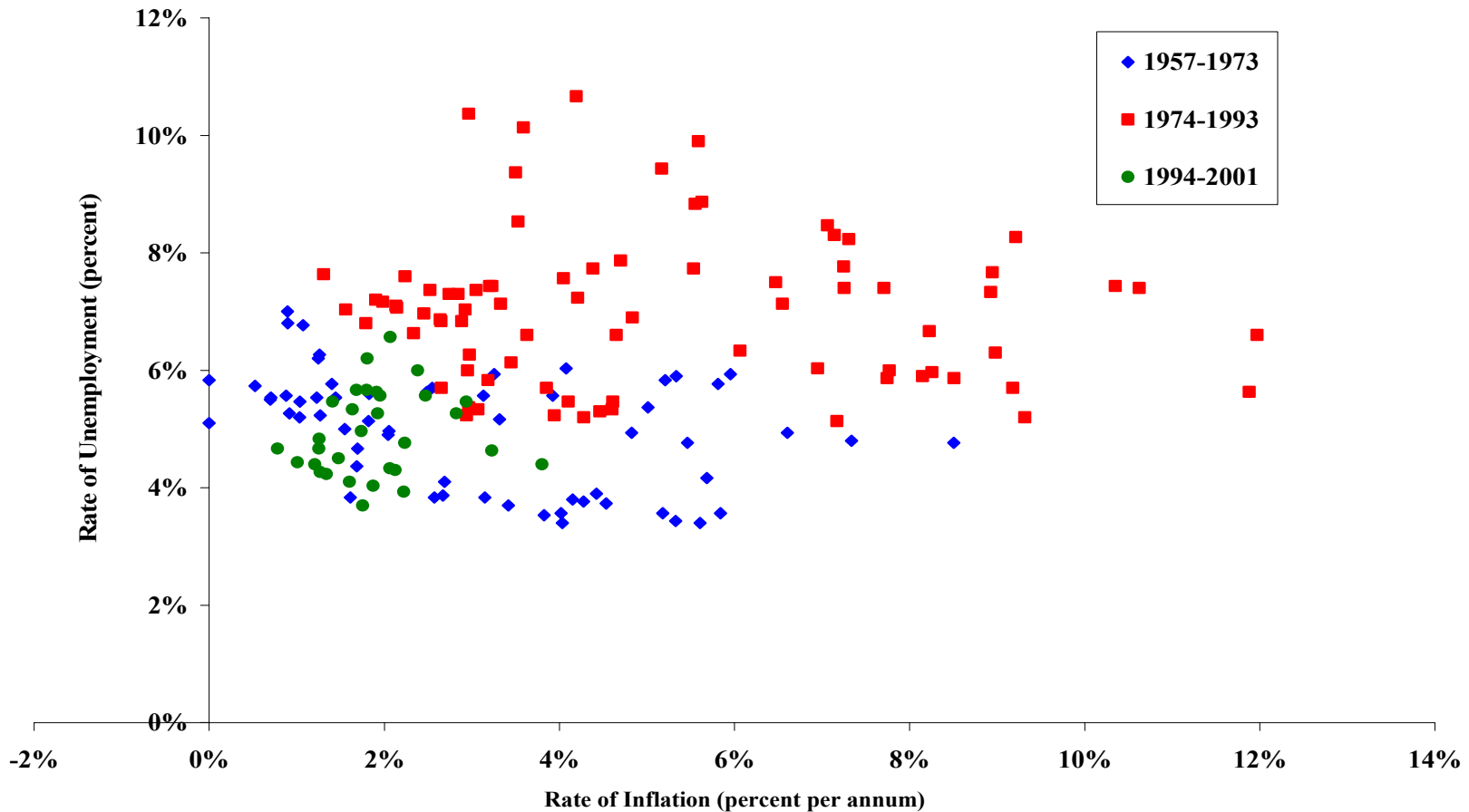
	Average Rate of Growth of TFP	Average Inventory Change-GDP Ratio	Average Absolute Inventory Change-GDP Ratio	Average Unemployment Rate	Average Rate of Growth of GDP Deflator
1951-60		0.69%	1.09%	4.55%	
1961-70	1.05%	0.95%	1.00%	4.72%	2.83%
1971-80	0.82%	0.68%	0.84%	6.44%	7.00%
1981-90	0.76%	0.43%	0.63%	7.12%	3.97%
1991-2001	0.77%	0.40%	0.53%	5.53%	2.29%

Rapid Economic Transformation and Adjustment— Manifestation in the United States

- ◆ The labor market has also benefited from the rapid economic transformation and adjustment and from the de-verticalization and fragmentation—the rapid adjustment implies that the labor force is kept lean at any one time so massive layoffs become unnecessary; the de-verticalization and fragmentation imply that new and more specialized and hence better jobs are continually created as old ones are destroyed.
- ◆ The rate of unemployment has declined to levels unseen since the late 1960s, even below the so-called “natural” rate of unemployment.
- ◆ There appears to have been a shift of the so-called Phillips Curve inward towards the origin (in the southeast direction).
- ◆ Has there been a permanent lowering of the “natural” rate of unemployment? At any rate of inflation, the lowest feasible unemployment rate appears to be now lower.
- ◆ The increase availability of information may have reduced the cost and time of job search and reduced the so-called frictional unemployment
- ◆ The severity of the business cycles seems to have been considerably moderated.

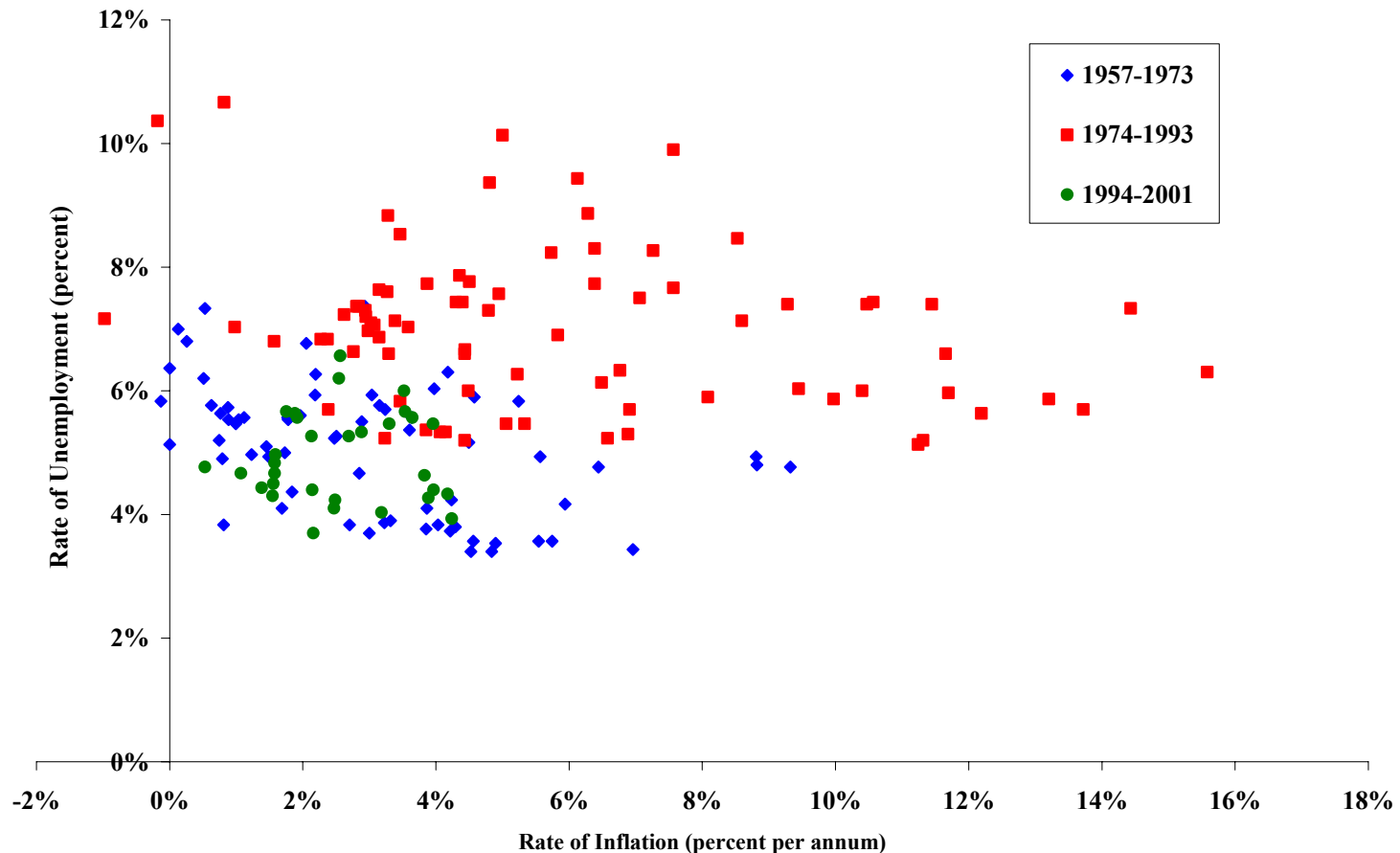
The Relationship between the Unemployment Rate and the Rate of Change of PGDP

The Relationship between Unemployment and Inflation



The Relationship between the Unemployment Rate and the Rate of Change of the CPI

The Relationship between Unemployment and Inflation



De-Verticalization, Fragmentation and Outsourcing—Manifestation in the United States

- ◆ The “New Economy” facilitates and encourages the process of “de-verticalization” or “fragmentation” and out-sourcing.
- ◆ The need for every firm to identify, improve and sharpen “core competence” in order to survive; productivity can actually be enhanced by taking advantage of the opportunities for “de-verticalization” and “out-sourcing”
 - ◆ e.g., the choice amongst being a designer, manufacturer or a marketer (Nike, Taiwan Semiconductor Manufacturing Corporation)
- ◆ Down-sizing as well as proliferation of firms
 - ◆ Outsourcing
 - ◆ Reduction of middle management
 - ◆ Small and medium-sized firms can have access to high quality services previously unavailable on the market
 - ◆ Small and medium-sized firms can specialize in niche markets
- ◆ The innovations connected with the Internet have been made mostly by small- and medium-sized start-up firms rather than large, established corporations.
- ◆ Small and medium-sized firms are more nimble, and hence can adjust much more quickly
- ◆ Specialization results in lower prices, greater output, and more new varieties of products and services

Impacts on the Microeconomy

- ◆ However, the availability of real-time data and the possibility of rapid response also imply that the “Product Cycle” will be shortened--creating new opportunities but also competitive challenges.
- ◆ The shortening of the “Product Cycle”--reduction in “time to market”--mandates a reduction in fixed costs as well as timely responses, and hence de-verticalization and out-sourcing. The average product cycle has shortened from 5 years to between 12 and 18 months--because
 - ◆ More and more timely information is available
 - ◆ There is less vested interest (e.g., fixed costs, inventory, labor contracts) in prolonging a product’s life time and because of competition; these fixed and quasi-fixed costs are reduced by de-verticalization and out-sourcing
 - ◆ The ease of customization and continuous improvement of the product
 - ◆ The product cycle may be manifested as substitutions and rearrangements of the links of the supply chain, e.g., shifting from metal to plastics
 - ◆ Strategic alliances of the moment made possible by timely and reliable exchange of information

Implications of a Shortened Product Cycle

- ◆ De-verticalization and out-sourcing are also good strategies for achieving rapid responsiveness and risk sharing, especially in an uncertain environment.
- ◆ The “first-move advantage” is magnified by the shortened product cycle as well as the expanded possibilities for the realization of both technological and market economies of scale.
- ◆ Traditional life-time employment in the same industry and product segment (not to mention the same firm) is no longer possible.

Impacts on the Microeconomy

- ◆ De-verticalization and out-sourcing permit efficient sharing of resources and thus enable the realization of economies of scale and learning-by-doing effects in particular tasks
 - ◆ e.g., firms do not typically generate their own electricity; the semiconductor foundry business; delivery services such as United Parcel Post (UPS) and Federal Express
- ◆ Realization of the benefits of targeted incentives in specific tasks or segments of the traditional business
- ◆ Significant reductions in the costs of market creation, expansion differentiation, and segmentation --a market without geographical boundaries.

Human Capital Becomes Even More Important in the New Economy

- ◆ The “New Economy” depends on both tangible and intangible capital--the importance of complementarity of different forms of capital (tangible, infrastructural, human, R&D, knowledge)
- ◆ Human capital is critical for a number of reasons:
 - ◆ Complementarity between human capital and tangible capital
 - ◆ Complementarity between human capital and R&D and knowledge capital
 - ◆ Network externalities (e.g., the benefits of Ph. D.’s depend on having a critical mass and on externalities generated by their interactions—the whole is more than the sum of its parts)
 - ◆ The network of entrepreneurs, engineers, scientists and venture capitalists themselves is a form of human capital itself, especially valuable under conditions of de-verticalization
- ◆ Investment in human capital is needed to exploit the potential presented by the “New Economy”—the “New Economy” has much higher skill requirements--“IC”s (Indians and Chinese) are critical to the continued success of the Silicon Valley
- ◆ The impossibility of any employer to honor a life-time employment contract places even greater emphasis on the accumulation of human capital by the workers—on investment in general, flexible human capital rather than firm-specific human capital. Workers must strive to be flexible and adaptable and capable of learning so as to maximize the probability of re-employment.
- ◆ Human capital can be enhanced through digital means through customized individual distance learning via the internet
- ◆ Revolution in higher education with the teaching of methods of analysis as opposed to facts

Developing Economies in the Digital Era: The Advantages of Backwardness and Size

- ◆ The possibility of leap-frogging--there are no vested interests to protect; no existing businesses to be cannibalized; there can be “creation without destruction”
 - ◆ e.g., facsimile machines instead of telexes; video compact discs instead of VCRs; a new keyboard layout; mobile and wireless telephones instead of fixed lines; debit and credit cards instead of checks; internet trading of stocks and bonds;
 - ◆ E-commerce rather than traditional commerce (B2B and B2C, e.g., books and magazines)
- ◆ The possibility of influencing/setting standards--the markets are potentially large enough in China and India for the benefits of economies of scale to be realized and for it to have a significant influence on future standards and on the distribution of royalties and license fees
 - ◆ e.g., Linux operating system; 3G mobile telephone standards (TD-SCDMA); digital TV; digitization of audio-video signals (AVS as a substitute for MPEG-4); Promotion of experiments with other, non-PC-based access devices to the internet--television sets, web TV type devices, digital set-top boxes, screen phones and wireless

The Possibility of Local Adaptation

- ◆ The possibility of local adaptation--taking advantage of local conditions
 - ◆ e.g., the Legend story
 - ◆ language
 - ◆ local supply and demand conditions, e.g., stability of the voltage of the electric power supply
 - ◆ The Chinese language is uniquely suited to communication based on a graphic interface (the experience of the fax machine)
 - ◆ Set-top boxes on television sets with point and click device and numeric pad can link 400 million households to the internet

The Global Digital Divide—The Internet as an Equalizer

- ◆ There is, first of all, the question of equalization of access to the Internet. The great divide is in the probability of access—in some economies there is almost universal access, in others, access remains quite limited especially among poorer, more rural regions.
- ◆ However, given access, the Internet has the ability of leveling the playing field between large and small firms
 - ◆ Small firms can have access to services and supplies heretofore only available to large firms
 - ◆ E.g., Charles Schwab and E-trade benefit small investors by bringing down their cost of securities trading proportionally much more than that of large investors
 - ◆ Rapid delivery services and warehousing facilities, e.g., FedEx, are available to both large and small firms
 - ◆ Small firms can also become more accessible to their customers and potential customers through the Internet with only marginal expenditures on advertising and public relations
 - ◆ Small firms have access to large firms as potential suppliers and customers in a global supply chain
 - ◆ Small firms have access to large firms as potential suppliers in a global supply chain
- ◆ The East Asian economies with its high and potentially even higher concentration of smaller firms and more primitive information infrastructure (and thus the potential for leap-frogging) may benefit much more from the new economy than other economies
 - ◆ E.g., B2B dot.coms seem to have relatively greater success in East Asia than in the United States

The Risks of Increased Responsiveness

- ◆ The increased speed of diffusion of information and responsiveness enhances the likelihood of instantaneous herd-like behavior, which may lead to the instability and possibly unintended systemic failure of markets and institutions
 - ◆ For example, in the absence of capital controls, funds can be exchanged from one currency into another instantaneously; this has the potential of causing great havoc in the foreign exchange market if the buying or selling is one-sided as may be the case if there is a rumored or real currency crisis
- ◆ This heightens the risks of rumors, mis-information and incorrect information and the necessity of some kind of information filter and “circuit breaker,” especially in thin markets

Sources of East Asian Economic Growth with 3 Inputs and Technical Progress-Breaks in 1973, 1985

Table 7.5a: Growth Accounts: Contributions of the Sources of Growth (3 Sub-Periods)
(Three-Input Model with Human Capital and Shifts in the Rates of Capital-Augmentation)
: Full Sample for 4 NIEs and G-5

	Sample period	Tangible Capital	Labor	Human Capital	Technical Progress
(1) Pre-1973					
Hong Kong	66-73	57.58 (9.67)	32.35 (3.10)	10.07 (5.57)	0.00
South Korea	60-73	55.66 (11.58)	27.99 (4.14)	16.35 (7.70)	0.00
Singapore	64-73	48.87 (12.73)	36.87 (7.56)	14.26 (9.17)	0.00
Taiwan	53-73	65.56 (13.21)	22.20 (2.63)	12.24 (6.73)	0.00
Japan	57-73	44.02 (11.43)	9.14 (0.82)	3.24 (2.87)	43.59
Non-Asian G-5 Countries	57-73	33.94 (4.62)	9.65 (4.24)	4.42 (1.70)	51.99
(2) 1974–1985					
Hong Kong	74-85	53.79 (9.58)	36.76 (3.40)	9.46 (5.67)	0.00
South Korea	74-85	62.33 (13.28)	25.99 (2.83)	11.68 (6.41)	0.00
Singapore	74-85	56.19 (9.94)	31.86 (3.42)	11.96 (5.48)	0.00
Taiwan	74-85	65.51 (11.89)	25.04 (2.23)	9.44 (4.98)	0.00
Japan	74-85	31.26 (6.73)	14.44 (0.93)	2.83 (1.69)	51.46
Non-Asian G-5 Countries	74-85	28.49 (2.65)	-10.90 (-0.42)	7.62 (1.90)	74.79
(3) Post-1986					
Hong Kong	86-95	36.82 (7.56)	9.65 (0.53)	5.32 (3.10)	48.21
South Korea	86-95	34.82 (11.90)	19.28 (2.76)	5.26 (4.15)	40.65
Singapore	86-95	33.62 (8.50)	29.39 (4.32)	5.26 (3.38)	31.73
Taiwan	86-95	35.15 (9.01)	13.71 (1.34)	4.32 (3.13)	46.82
Japan	86-94	29.84 (4.86)	14.86 (1.00)	3.42 (1.44)	62.05
Non-Asian G-5 Countries	86-94	21.08 (2.70)	18.42 (5.37)	4.68 (1.36)	55.81

Sources of East Asian Economic Growth with 3 Inputs and Technical Progress-Breaks in 1973, 1985

Table 7.5b: Growth Accounts: Contributions of the Sources of Growth (3 Sub-Periods)
(Three-Input Model with Human Capital and Shifts in the Rates of Capital-Augmentation)
Full Sample for 4 NIEs, 4 ASEAN, China and G-5

	Sample period	Tangible Capital	Labor	Human Capital	Technical Progress
(1) Pre-1973					
Hong Kong	66-73	68.37 (9.67)	28.50 (3.10)	3.13 (5.57)	0.00
South Korea	60-73	72.60 (11.58)	21.87 (4.14)	5.53 (7.70)	0.00
Singapore	64-73	55.59 (12.73)	40.18 (7.56)	4.22 (9.17)	0.00
Taiwan	53-73	80.63 (13.21)	15.45 (2.63)	3.91 (6.73)	0.00
Indonesia	70-73	73.09 (11.90)	9.37 (2.15)	17.54 (19.50)	0.00
Malaysia	70-73	59.97 (9.56)	29.99 (4.32)	10.05 (12.64)	0.00
Philippines	70-73	39.79 (5.12)	49.97 (7.36)	10.24 (11.51)	0.00
Thailand	70-73	82.11 (10.96)	7.67 (0.57)	10.22 (11.44)	0.00
China	65-73	85.29 (13.51)	10.36 (3.19)	4.35 (7.01)	0.00
Japan	57-73	55.01 (11.43)	4.85 (0.82)	1.06 (2.87)	39.09
Non-Asian G-5 Countries	57-73	41.50 (4.62)	6.00 (4.24)	1.43 (1.70)	51.07
(2) 1974-1985					
Hong Kong	74-85	64.31 (9.58)	32.73 (3.40)	2.96 (5.67)	0.00
South Korea	74-85	78.08 (13.28)	18.10 (2.83)	3.81 (6.41)	0.00
Singapore	74-85	64.68 (9.94)	31.72 (3.42)	3.60 (5.48)	0.00
Taiwan	74-85	78.91 (11.89)	18.12 (2.23)	2.97 (4.98)	0.00
Indonesia	74-85	77.69 (12.22)	13.55 (2.65)	8.76 (10.20)	0.00
Malaysia	74-85	61.39 (10.76)	33.61 (4.94)	5.00 (8.15)	0.00
Philippines	74-85	62.59 (7.29)	29.28 (3.53)	8.13 (8.07)	0.00
Thailand	74-85	67.53 (8.69)	25.02 (3.55)	7.46 (8.96)	0.00
China	74-85	80.46 (9.44)	14.64 (2.53)	4.90 (6.37)	0.00
Japan	74-85	40.65 (6.73)	10.22 (0.93)	0.96 (1.69)	48.17
Non-Asian G-5 Countries	74-85	36.29 (2.65)	-14.55 (-0.42)	2.53 (1.90)	75.73
(3) Post-1986					
Hong Kong	86-95	41.81 (7.56)	6.46 (0.53)	1.58 (3.10)	50.14
South Korea	86-95	44.54 (11.90)	14.98 (2.76)	1.75 (4.15)	38.73
Singapore	86-95	37.01 (8.50)	31.30 (4.32)	1.52 (3.38)	30.17
Taiwan	86-95	43.00 (9.01)	10.46 (1.34)	1.38 (3.13)	45.16
Indonesia	86-94	62.79 (8.88)	15.91 (2.31)	5.69 (6.94)	15.61
Malaysia	86-95	42.87 (8.53)	33.41 (4.83)	3.25 (6.15)	20.47
Philippines	86-95	52.18 (3.77)	41.63 (2.96)	6.23 (5.09)	-0.03
Thailand	86-94	51.01 (11.27)	13.32 (2.72)	2.36 (5.25)	33.31
China	86-94	38.21 (4.86)	2.47 (0.11)	1.17 (1.44)	58.14
Japan	86-94	27.14 (2.70)	13.83 (5.37)	1.58 (1.36)	57.45
Non-Asian G-5 Countries	86-94	27.14 (2.70)	13.83 (5.37)	1.58 (1.36)	57.45

Sources of East Asian Economic Growth with 4 Inputs and Technical Progress

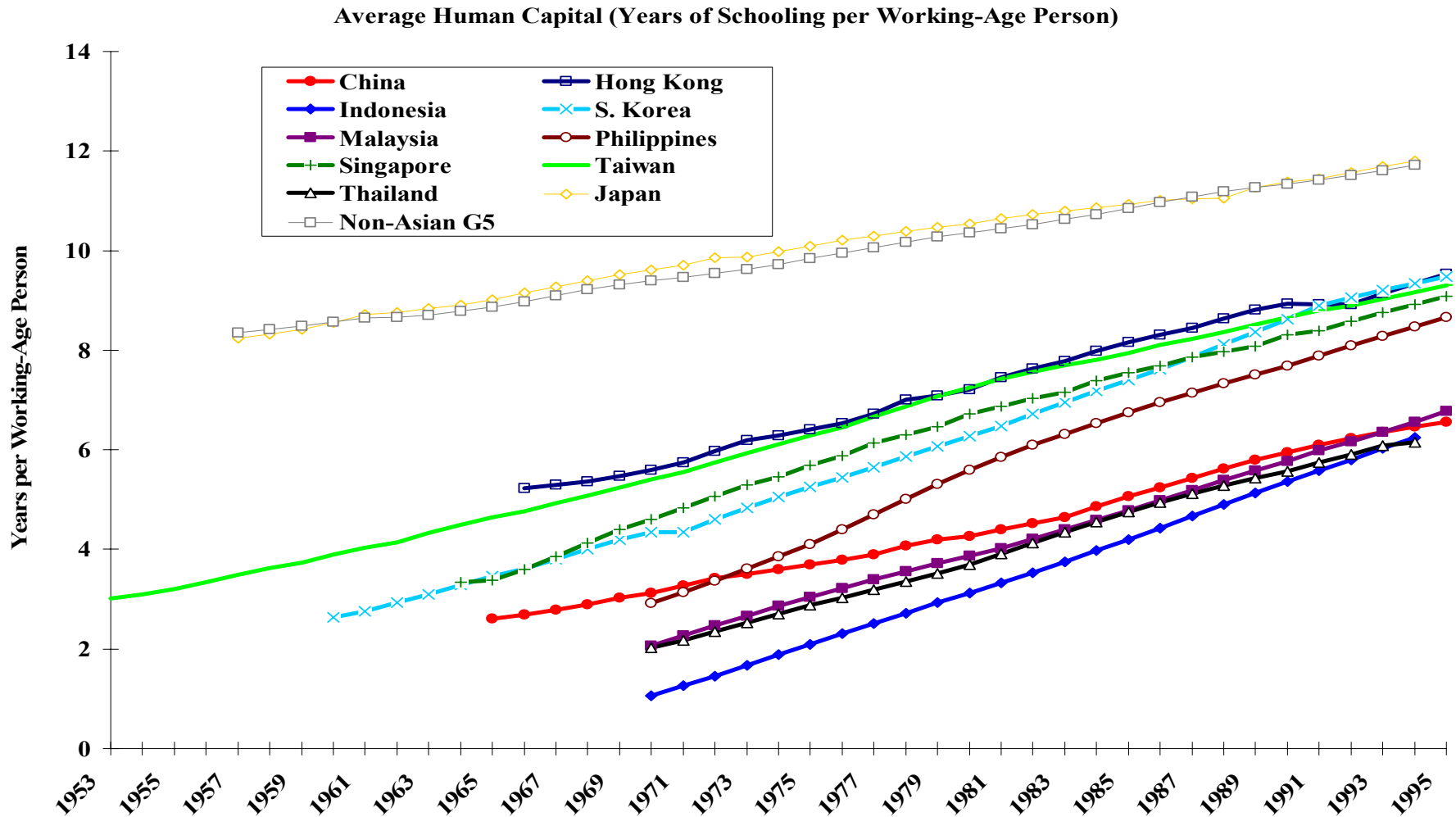
Table 8.4 Growth Accounts: Contributions of the Sources of Growth (Percent)
(Four-Input Model with Human Capital and R&D Capital)

	Sample Period	Tangible Capital	Labor	Human Capital	R&D Capital	Technical Progress
South Korea	67-95	60.12	14.23	1.75	23.90	0.00
Singapore	77-95	50.44	23.90	1.30	24.35	0.00
Taiwan	78-95	55.85	11.25	1.14	31.76	0.00
Japan	64-94	42.40	5.24	0.72	17.08	34.56
Non-Asian G-7 Countries	65-94	32.52	3.72	1.16	14.90	47.69

Interpretation of Technical Progress (Growth of Total Factor Productivity)

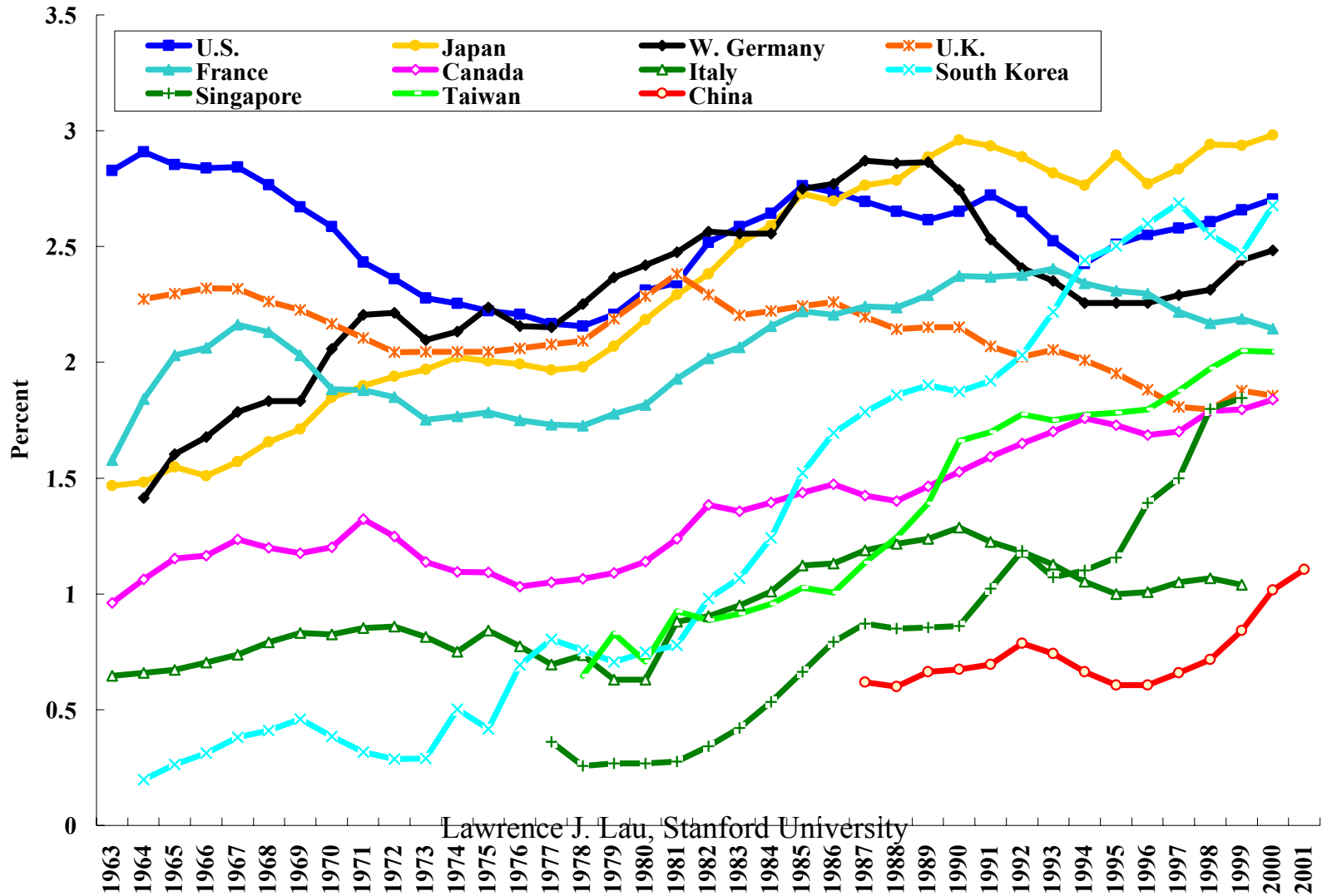
- ◆ Not “Manna from Heaven”
- ◆ The effects of growth in unmeasured “Intangible Capital” (Human Capital, R&D Capital, Goodwill and Reputational Capital (Advertising, Branding and Market Development), Information System, Software, Business Methods, etc.)
- ◆ The effects of growth or degradation and depletion in other omitted and unmeasured inputs (Land, Natural Resources, Water Resources, Environment, etc.)
- ◆ The effects of improvements in technical and allocative efficiency over time, e.g., learning-by-doing
- ◆ “Residual” or “Measure of Our Ignorance”

Average Human Capital (Years/Working-Age Person: Selected Economies)



R&D Expenditures as a Ratio of GDP: G-7 Countries, 3 East Asian NIES & China

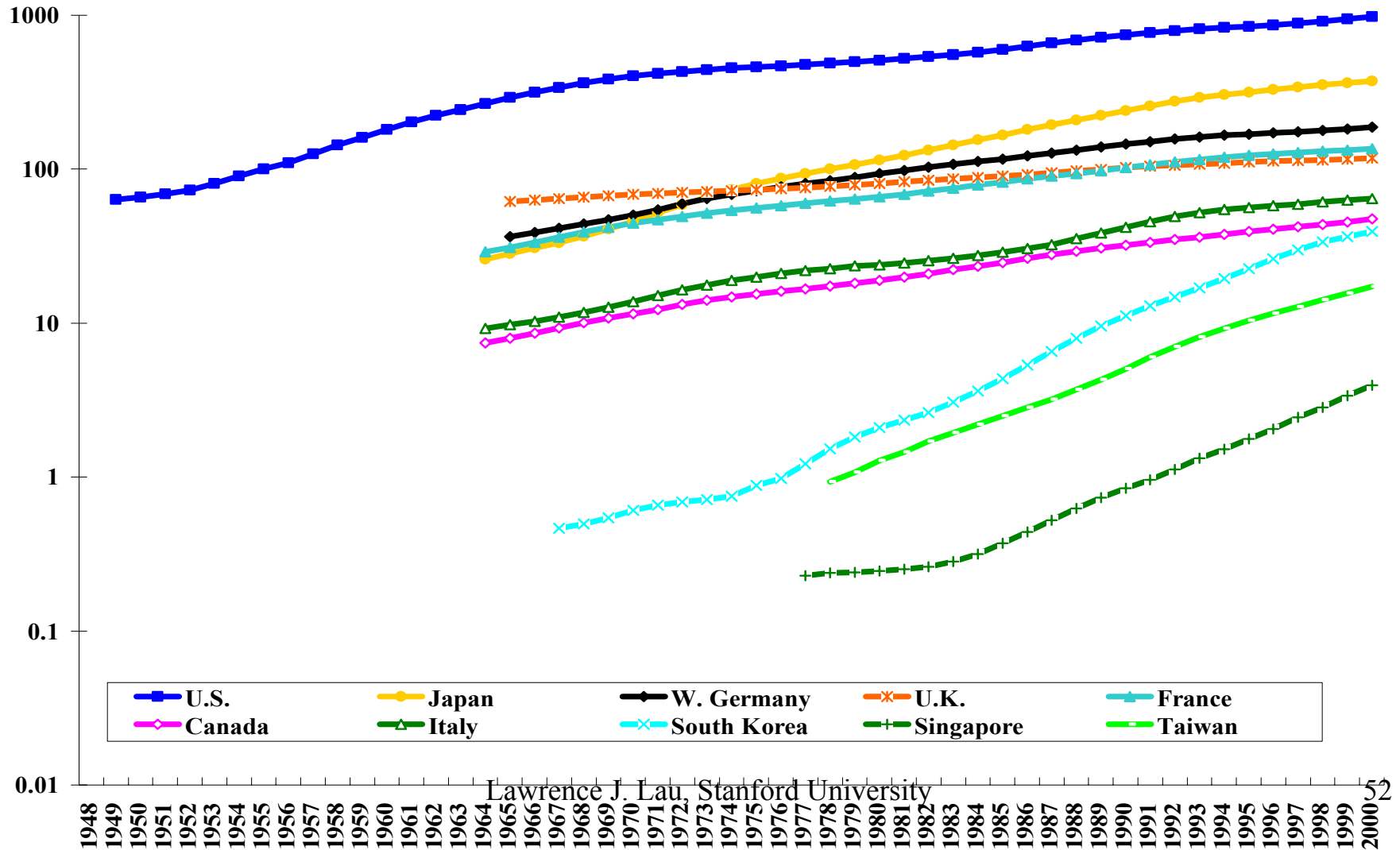
Figure 8.1: R&D Expenditures as a Percentage of GDP: G-7 Countries, 3 East Asian NIEs and China



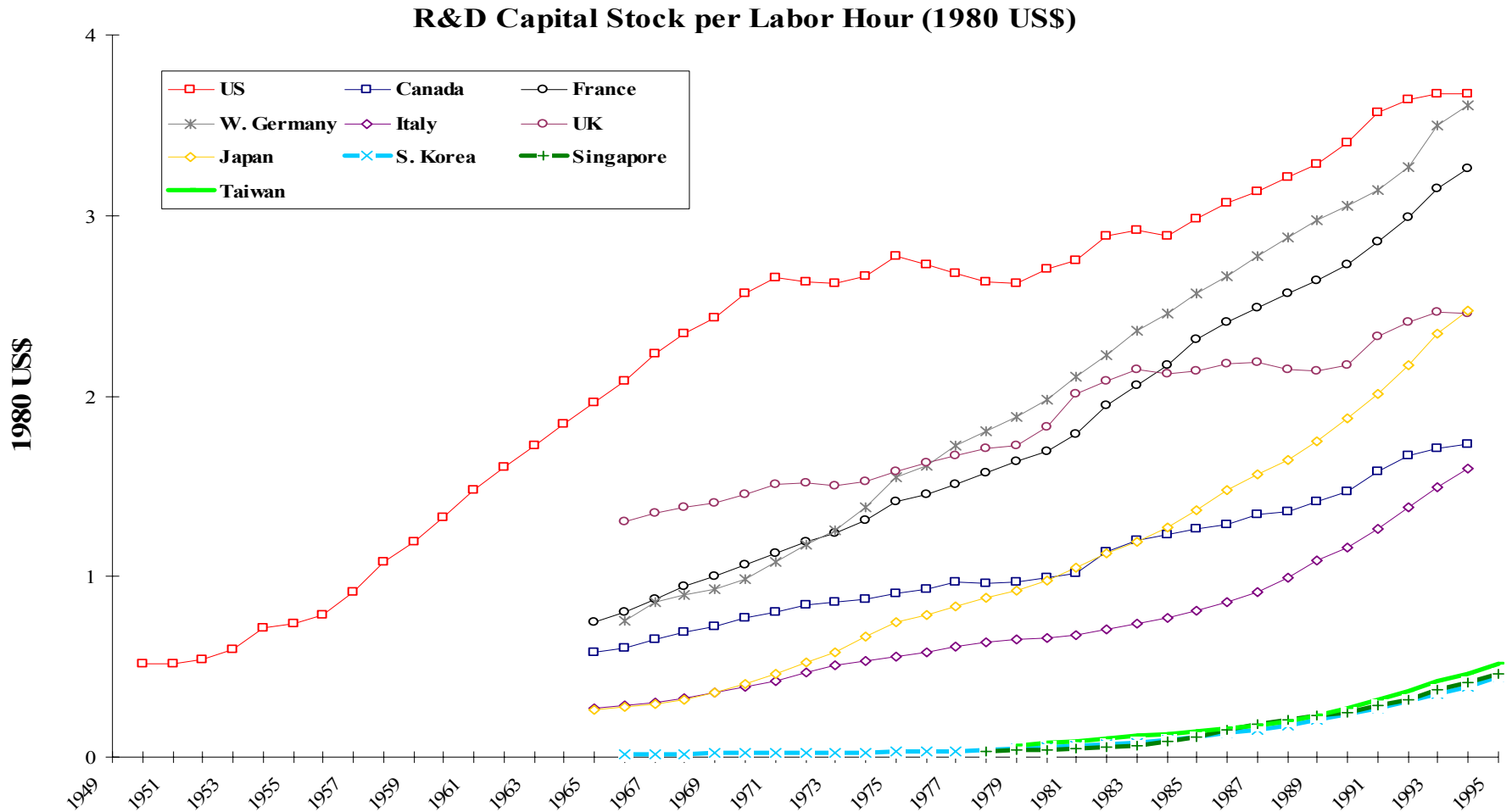
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R&D Capital Stocks: G-7 Countries and 3 East Asian NIEs

Figure 8.2: R&D Capital Stocks in Billions of 1980 U.S. Dollars

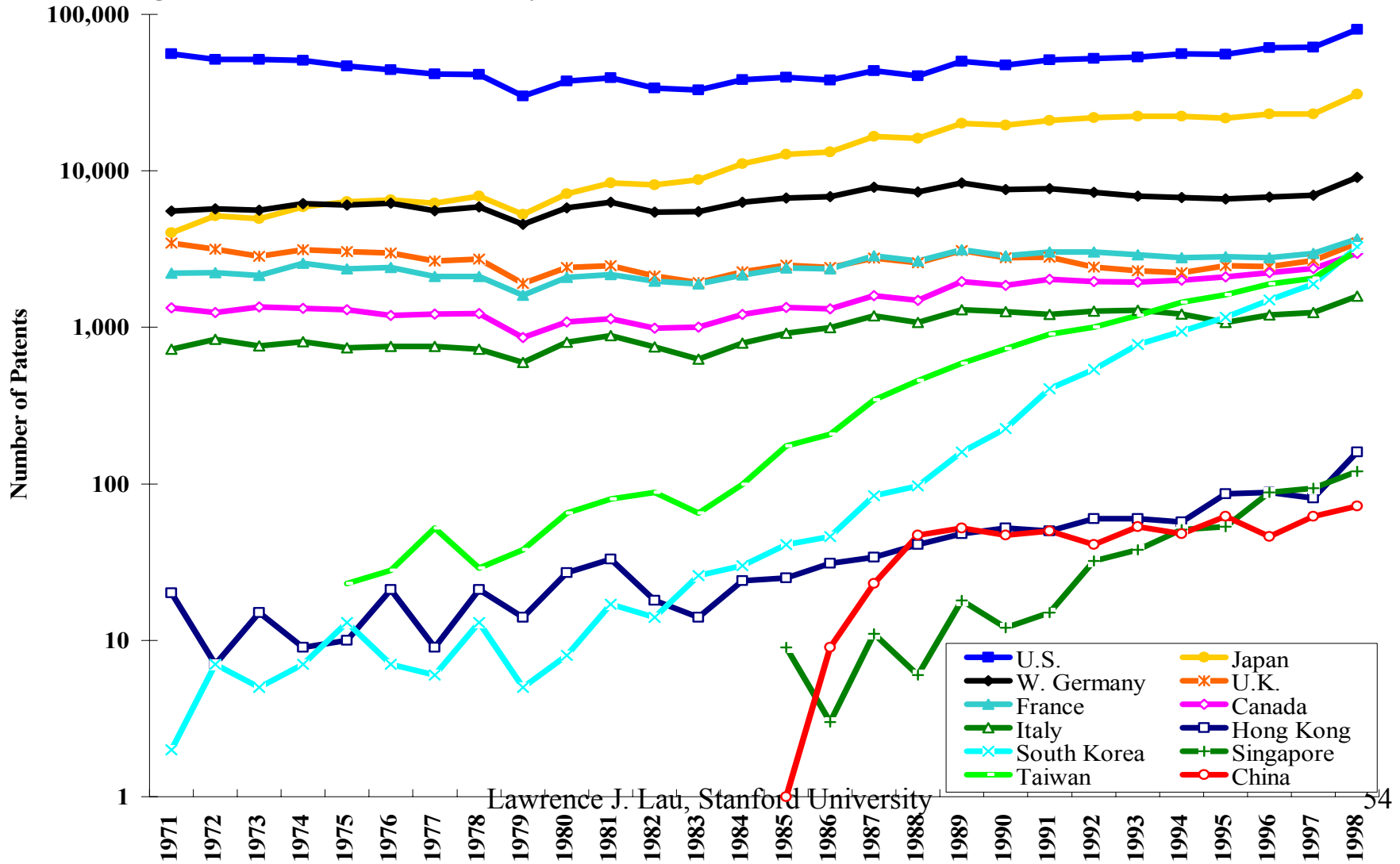


R&D Capital Stock per Unit Labor



Patents Granted in the United States: G-7 Countries, 4 East Asian NIEs & China

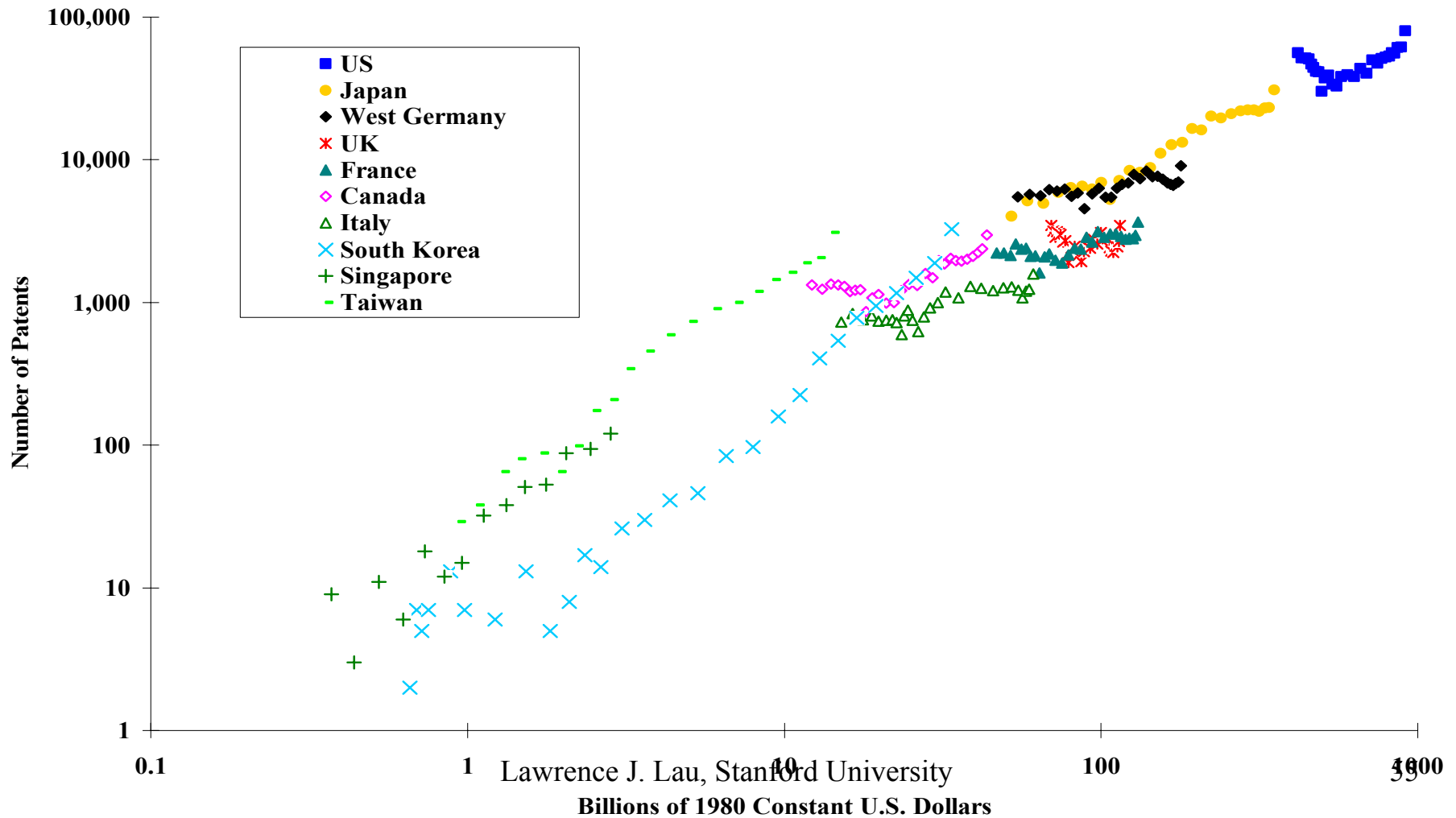
Figure 8.3: Patents Granted Annually in the United States: G7 Countries, 4 East Asian NIEs and China



Lawrence J. Lau, Stanford University

Patents Granted in the United States and R&D Capital Stocks, Selected Economies

Figure 8.4: The Number of U.S. Patents Granted Annually vs. R&D Capital Stocks



The Sources of Economic Growth-- Developing Economies

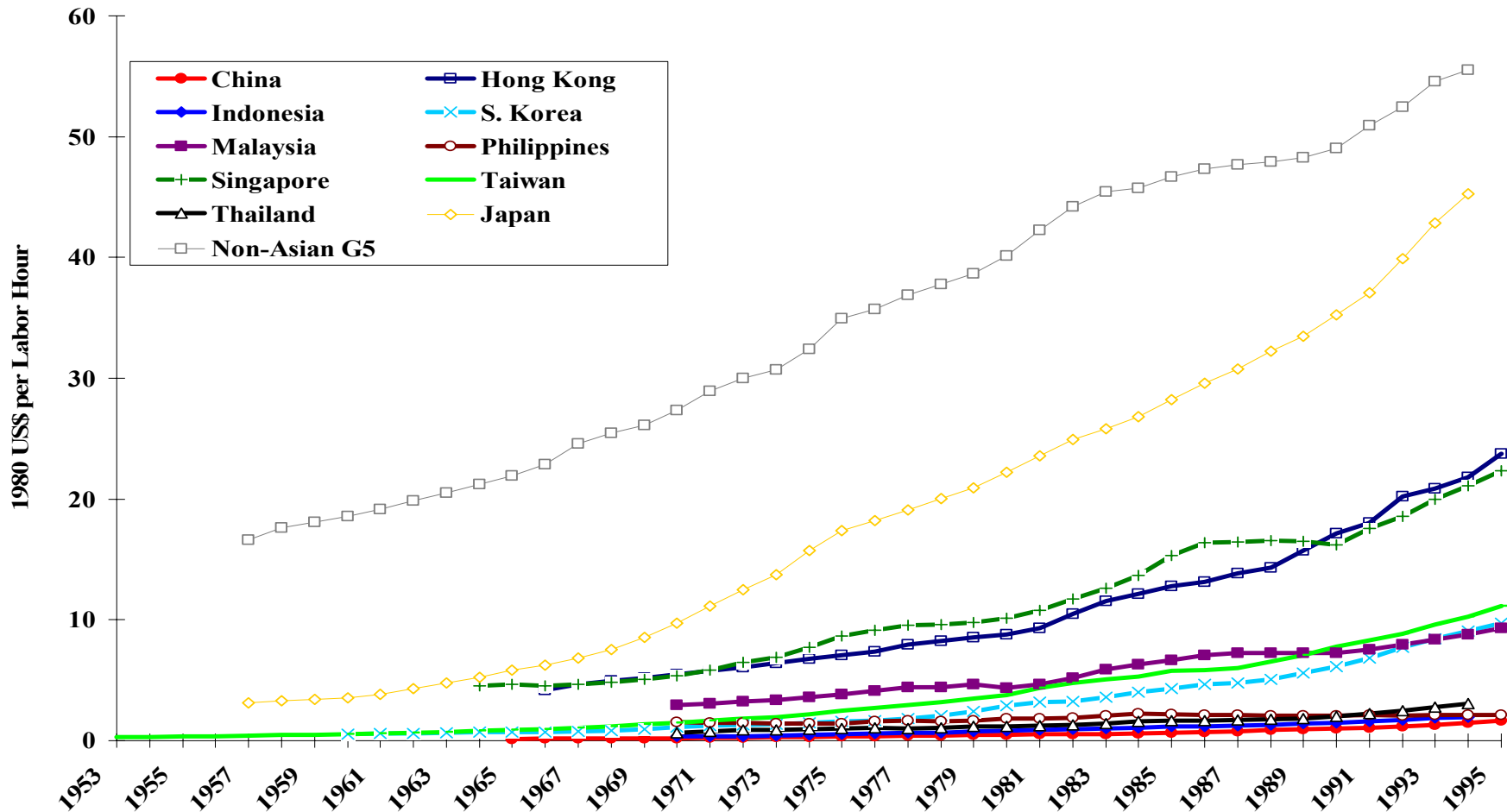
- ◆ Different types of measured inputs play different roles at different stages of economic growth
- ◆ Tangible capital accumulation is the most important source of growth in the early stage of economic development
- ◆ But simply accumulating tangible capital is not enough--it must also be efficiently allocated
- ◆ Efficient tangible capital accumulation is the major accomplishment of the East Asian NIEs in the postwar period
 - ◆ Market-directed allocation of new investment, aided by export orientation, promotes efficiency
 - ◆ Private enterprises have the incentives for prompt self-correction
- ◆ Intangible capital accumulation becomes important only after a certain level of tangible capital per worker is achieved but has begun to be important for some East Asian NIEs such as South Korea, Singapore and Taiwan, principally through R&D capital, accounting for between a quarter and a third of the growth in real output.

The Sources of Economic Growth-- Developed Economies

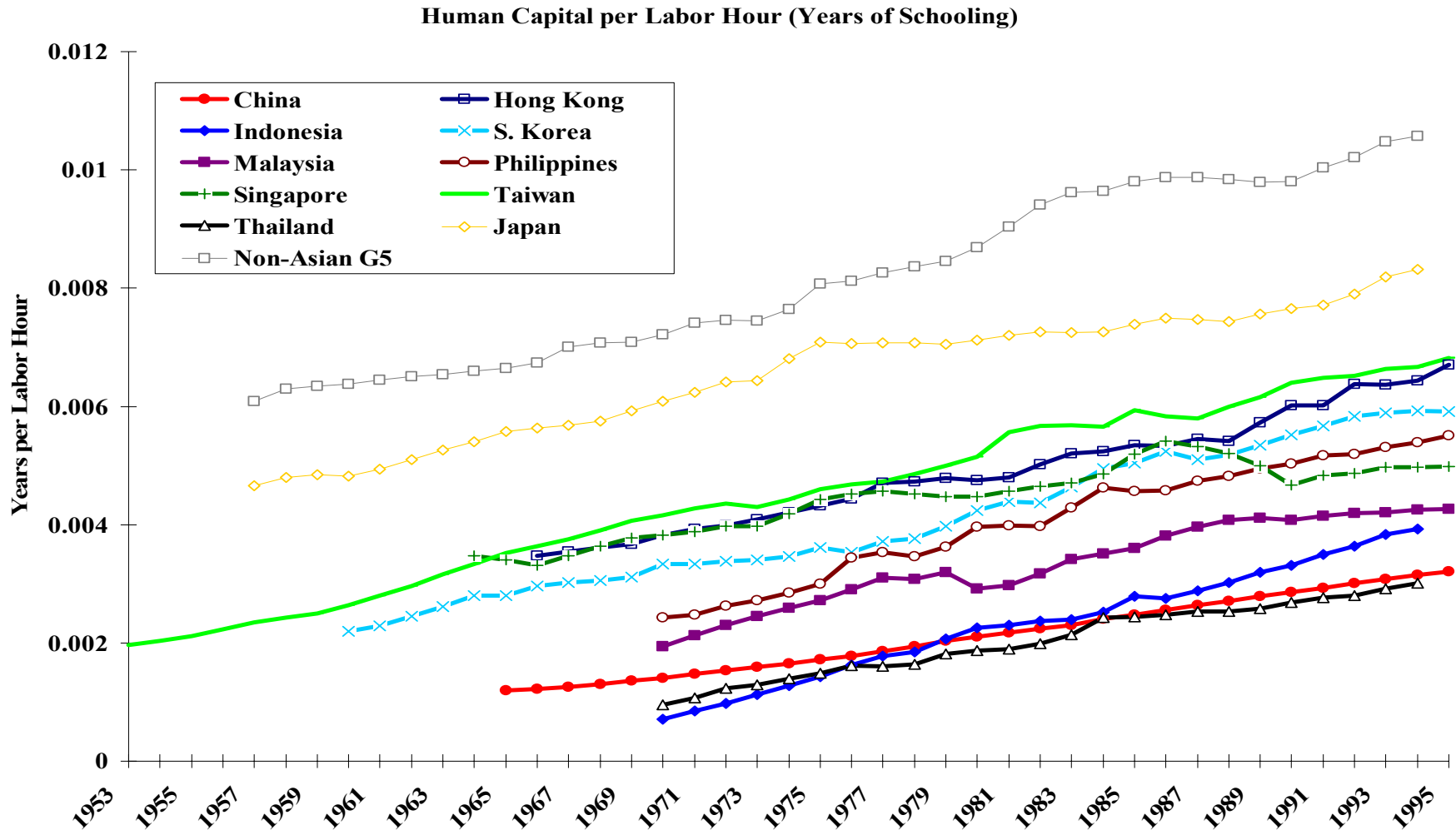
- ◆ The most important source of economic growth for developed economies is intangible capital, accounting for more than half of the growth of output.
 - ◆ Within intangible capital, technical progress (or unidentified tangible capital, is the most important, accounting for between one-third to one-half of the growth in real output, followed by R&D capital, accounting for between 15 and 20 percent.
- ◆ Tangible capital is the next important source of economic growth, accounting for almost a third.
- ◆ Technical progress reflects the effects of intangible capital that is not explicitly identified, i.e., other than human capital and R&D capital—e.g., knowledge capital, goodwill, software, etc.
- ◆ The United States is the world leader in human capital and R&D capital

Tangible Capital Stock per Labor Hour (1980 US\$): Selected Economies

Tangible Capital Stock per Labor Hour (1980 U.S.\$)



Human Capital per Labor Hour (Years of Schooling): Selected Economies



Is East Asian Economic Growth Sustainable?

Was East Asian Economic Growth a Bubble?

- ◆ Past economic growth neither a miracle nor a mere bubble
 - ◆ Economic growth experience replicated in different East Asian economies
 - ◆ Sustained economic growth over decades
 - ◆ Recent crisis due to many factors, of which “irrational exuberance” is only one
 - ◆ Economic fundamentals remain sound--high domestic savings rates, priority for investment in human capital, and more recently in R&D capital, entrepreneurship, and market orientation
- ◆ Past economic growth tangible input-driven rather than intangible input or technical progress-driven--it is attributable to growth in tangible inputs, particularly the efficient and rapid accumulation of tangible capital
- ◆ However, East Asian economies lag far behind in both tangible and intangible capital per unit labor.
- ◆ There is therefore still considerable room for continuation of rapid tangible input-driven economic growth in the future--tangible capital per unit labor in East Asian economies, with the exception of Japan, still lags significantly behind the developed economies.
- ◆ Intangible capital per unit labor, e.g., R&D capital, lags even further behind, offering additional opportunities for investment

Prospects for Future Economic Growth Remain Good for East Asian Economies

- ◆ The attractiveness of investment in intangible capital depends on the protection of intellectual property rights, which in turn depends on whether a country is a producer of intellectual property--some of the East Asian economies, e.g., Hong Kong, South Korea, Singapore and Taiwan are ahead of other East Asian economies with the possible exception of Japan on this score
- ◆ Because of its complementarity with tangible capital, investment in intangible capital can retard the decline in the marginal productivity of tangible capital and counteract the “Krugman effect”
- ◆ The experience of developed economies, especially that of Japan, and that of the East Asian NIEs in the more recent period, suggest that investment in R&D capital and other forms of intangible capital has high returns once a level of tangible capital per unit labor has been achieved. There is evidence of positive technical progress in the more recent period in South Korea, Singapore and Taiwan, reflecting their increased investment in intangible capital, including R&D capital.
- ◆ The people of East Asia are entrepreneurial, hard-working, and thrifty--all they need is a good, market-friendly, predictable and stable environment

Public Investments in the Physical and Virtual Infrastructure

- ◆ The traditional economy requires physical infrastructure--railroads, roads, ports, airports, power, etc.
- ◆ Digitization also requires physical as well as virtual infrastructure
 - ◆ Telecommunication (telephone and internet access from every corner of the country; fiber optic links); wireless networks; national and international delivery services—e.g., United Parcel Service (UPS), Federal Express; generic trading platforms; enabling technologies and services (internet service providers; portals)
 - ◆ Standardization, grading and quality assurance by public or quasi-public organizations to establish public credibility and to facilitate commerce
 - ◆ Credit information and reliable transactions settlement mechanisms

Public Investments in the Legal Infrastructure

- ◆ Affirmation of private ownership of means of production side-by-side with public ownership and the protection of such property rights
 - ◆ Private venture capital can be more efficient than public venture capital because of ability (resulting from necessity) to terminate unsuccessful projects at an earlier stage
 - ◆ It is a paradox that an indicator of the degree of success of venture capital is the failure rate of projects—a higher failure rate, within limits, is associated with greater success
- ◆ Protection of intellectual property rights, including patents, copyrights, brand names and trade secrets
- ◆ Rationalization of taxation on the old economy and the new--maintaining a level playing field
- ◆ Enactment of venture capital- and “angels”-friendly laws and regulations to encourage private risk capital, e.g. the deductibility and carrying-forward of losses against income taxes
- ◆ Maintenance of a fully integrated national market—with free flows of goods, services and factors (capital and labor)—the equivalent of the “Interstate Commerce” clause of the U.S. constitution
- ◆ Enforcement of contracts and prosecution of fraud;
- ◆ Enactment and enforcement of laws on corporate disclosure, transparency, insider trading, stock market manipulation and corporate governance; imposition of stringent auditing standards
- ◆ Legalization of electronic signatures; maintenance of security in cyber space

Public Investments in the Regulatory Infrastructure

- ◆ Maintenance of a competitive market environment with free entry and exit (use of anti-trust and fair trade laws to prevent unfair competition and monopolistic and anti-competitive practices)
- ◆ Regulation as well as deregulation of the telecommunications sector-
-promotion of lower and more competitive rates for universal access-
-prevention of monopoly rents and cartelization (maintenance of standards and mutual communicability and promotion of competition)
- ◆ Regulation of service providers as common carriers

Public Investments in the Social and Institutional Infrastructure

- ◆ Uncertainty created by globalization and hence global competition and the shortening of “Product Cycles” necessitate
 - ◆ The establishment of a viable social safety net that can be sustained independently of firms
 - ◆ Promotion of competitive, flexible, and mobile labor markets with wage rates and other compensation freely determined by market forces
- ◆ Creation and maintenance of an hospitable environment/habitat for entrepreneurs and start-up firms
 - ◆ Simplification of tax and competition laws and regulations to facilitate the establishment and operation of start-up and small and medium-sized firms which can be expected to be more nimble than large firms
 - ◆ Adoption of tax and competition laws and regulations that encourage entrepreneurship and new businesses so that new jobs may be created faster than old jobs are destroyed
 - ◆ Promotion of a culture of open communication and mobility; of acceptance of risk and failures; that enables the realization of network externalities and the benefits of networking
- ◆ Promotion of university-industry-government cooperation and collaboration

Public Investment in Human Capital

- ◆ Investment in Human Capital (formal, technical, on-the-job training, and re-education and re-training); re-orientation from firm-specificity to worker-specificity (flexibility, adaptability and re-employability); mobility (institutional and legal); network externalities and benefits from networking; accreditation, standardization, quality assurance and examinations and tests
 - ◆ Lengthening of the time for formal and general education, e.g., extension of compulsory education to 12 years; expansion of tertiary education and of adult education
 - ◆ Investments in information and communication technology
 - ◆ A PC in every classroom (in every urban home)
 - ◆ New modes of education and information dissemination
- ◆ Corporate and individual tax incentives for investment in education
- ◆ Because of globalization and de-verticalization, lifetime employment will become a thing of the past. No employer can guarantee or offer it (except possibly the government); and no employee should expect it. Thus, both the labor market and the participants in the labor market must maintain flexibility so that adjustment can be made quickly. This implies in turn that human capital, especially the more general and less enterprise-specific kind, will become much more important.
- ◆ It makes no sense to try to save low-paying jobs through government protection or subsidy; even if one were successful, the workers thus saved would be doomed to a permanent level of low income. Instead, The Government is much better off providing education and re-training allowances to affected workers, and to provide life-long subsistence support where it is not possible to re-educate or to retrain them (this way the problem will be solved in at most one generation)

Public Investment in R&D and Other Forms of Intangible Capital

- ◆ Improvements in technology, in particular the information and communication technology, are mostly the results of purposive activities such as investment in R&D and other forms of intangible capital. Innovation rents accrue to the inventors and patent and copyright holders
- ◆ Public support of R&D, especially basic and applied research; tax incentives for R&D
- ◆ Investment in domestic R&D capital is essential—learning and technology transfer have their limits:
 - ◆ Domestic R&D capital (and human capital) are essential for the successful exploitation and absorption of imported technology—to facilitate local adaptation and learning and to accelerate diffusion, e.g., new rice variety.
 - ◆ The distribution of gains from technology trade and transfer is biased in favor of the innovators and the owners of intangible capital (e.g. brand names) and not the imitators
 - ◆ Licensing frequently takes the form of trading and cross-licensing
 - ◆ The importance of strategic R&D—credible threats of entry are sometimes necessary to insure technology transfer.
 - ◆ Developing economies should focus on development rather than basic or applied research
 - ◆ Consortium approach
- ◆ Investment in other forms of Intangible Capital (Design, Market Development, Information System and Software, Etc.)