

Some Thoughts on Innovation Strategy and Innovation System

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Hong Kong, 21 May, 2007

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A Preview

- ◆ The Importance of Innovation
- ◆ The Process of Innovation
- ◆ The Role of the Government
- ◆ Collaboration and Cooperation between Mainland and Hong Kong
- ◆ Concluding Remarks

The Importance of Innovation

- ◆ Why is innovation important? Innovation is important because it enables an economy to produce more output with the same inputs and/or the same output with less inputs.
- ◆ With innovation, output can grow even if inputs do not grow (e.g., land input cannot grow, and for millennia, agricultural output grows through increases in yield).
- ◆ Innovation increases productivity, and hence enables the growth of real output per capita.
- ◆ While the real output of an economy can grow on the basis of the growth in inputs, in the absence of innovation, such growth cannot be sustained in the long run, as diminishing marginal productivity will eventually and inevitably reduce the incremental output obtainable from the incremental inputs. Innovation is critical to ensuring long-term sustainability of the growth of real output per capita.
- ◆ There can also be innovation that generates non-pecuniary (non-monetary) benefits (e.g., in the areas of environment and public health).
- ◆ Innovation can be an important source of socioeconomic mobility.

The Nature of Innovation

- ◆ Innovation is not manna from heaven; innovation is the outcome of purposive investment—investment in human capital, investment in R&D, investment in information systems, investment in other forms of intangible capital, e.g., knowledge capital, goodwill, software, new business models and methods, etc.
- ◆ As an investment, innovation depends on the rate of return, which in turn depends on the economic climate and environment, including the availability of infrastructure and incentives, tax treatment, and the security of intellectual property rights.

The Sources of Economic Growth of Different Types of Economies

Sources of Economic Growth (Percent)

	Innovation	Capital	Labour
Industrialised Economies	50	33	17
Newly Industrialised Economies	25	55	20
Developing Economies	0	80	20

The Sources of Economic Growth-- Industrialised Economies

- ◆ The most important source of economic growth for industrialised economies is innovation (also referred to as technical progress) accounting for more than half of the growth of output, on average.
- ◆ The growth of tangible or physical capital is the next important source of economic growth, accounting for almost a third, on average.
- ◆ The growth of labour accounts for the balance.
- ◆ The United States is the world leader in terms of innovation, but is also the world leader in investment in human capital and R&D capital.

The Sources of Economic Growth-- Newly Industrialised Economies

- ◆ Research of Kim and Lau (1994) and Lau and Park (2005) shows that innovation played very little part in the economic growth of the East Asian newly industrialised economies prior to 1985. Since 1985, because of the increases in investment in innovation activities in these economies, principally in R&D, the importance of innovation as a source of economic growth has gradually increased.

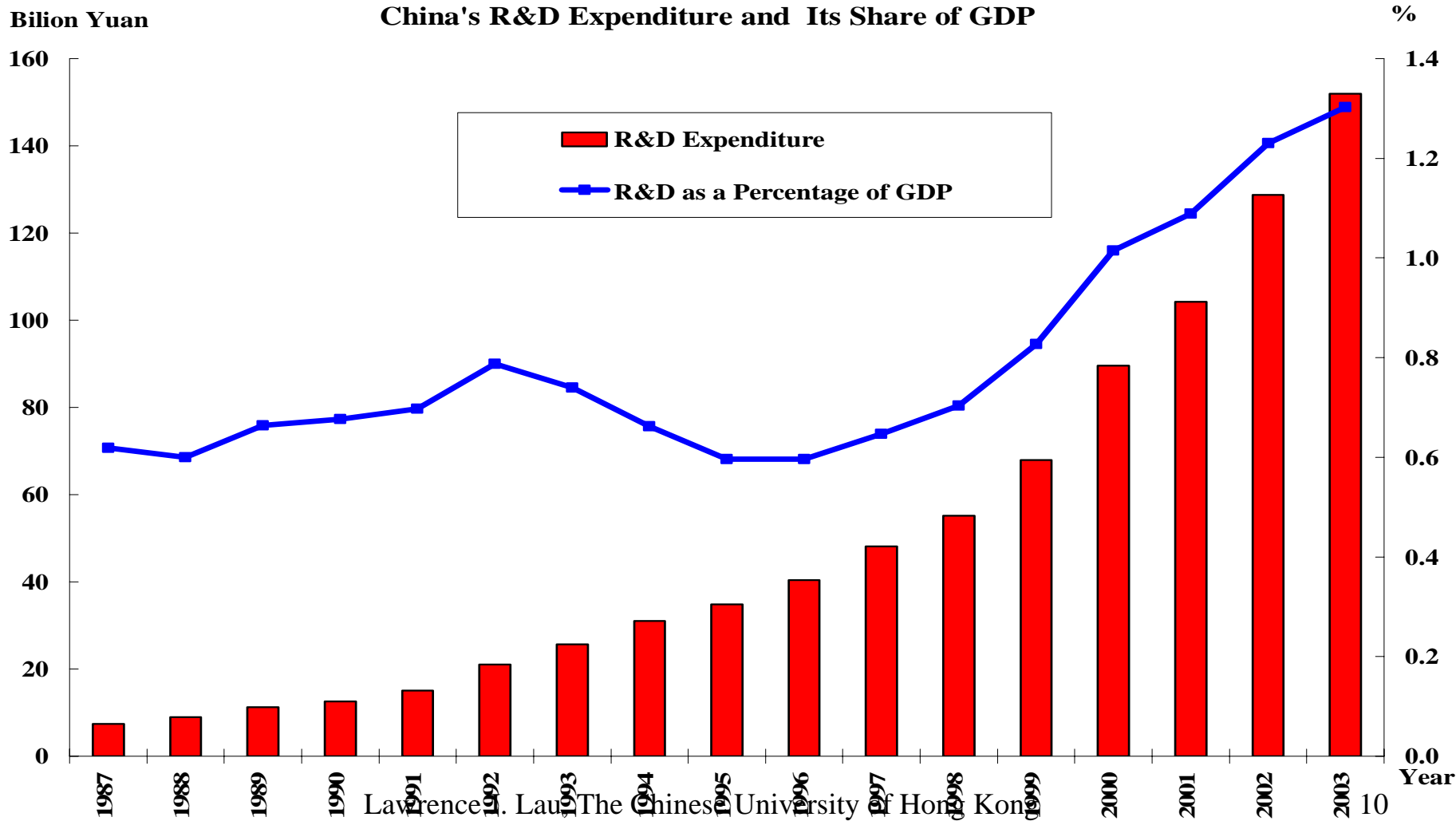
The Sources of Economic Growth-- Developing Economies

- ◆ Research of Kim and Lau (1994) and Lau and Park (2005) also shows that innovation has not been a significant source of growth in the East Asian developing economies, including China.
- ◆ The growth of tangible capital is the overwhelmingly important source of the growth of East Asian developed economies, accounting, on average, 80 percent, with the growth of labour accounting, on average, 20 percent.
- ◆ The unimportance of innovation and the overwhelming importance of tangible capital as a source of growth are typical of economies in their early stages of economic development, and has been confirmed by the experience of the United States in the 19th Century, of Japan from the Meiji Restoration of 1868 to the World War II, and of the East Asian newly industrialized economies of Hong Kong, South Korea, Singapore and Taiwan until the mid to late 1980s.

The Sources of Economic Growth-- China

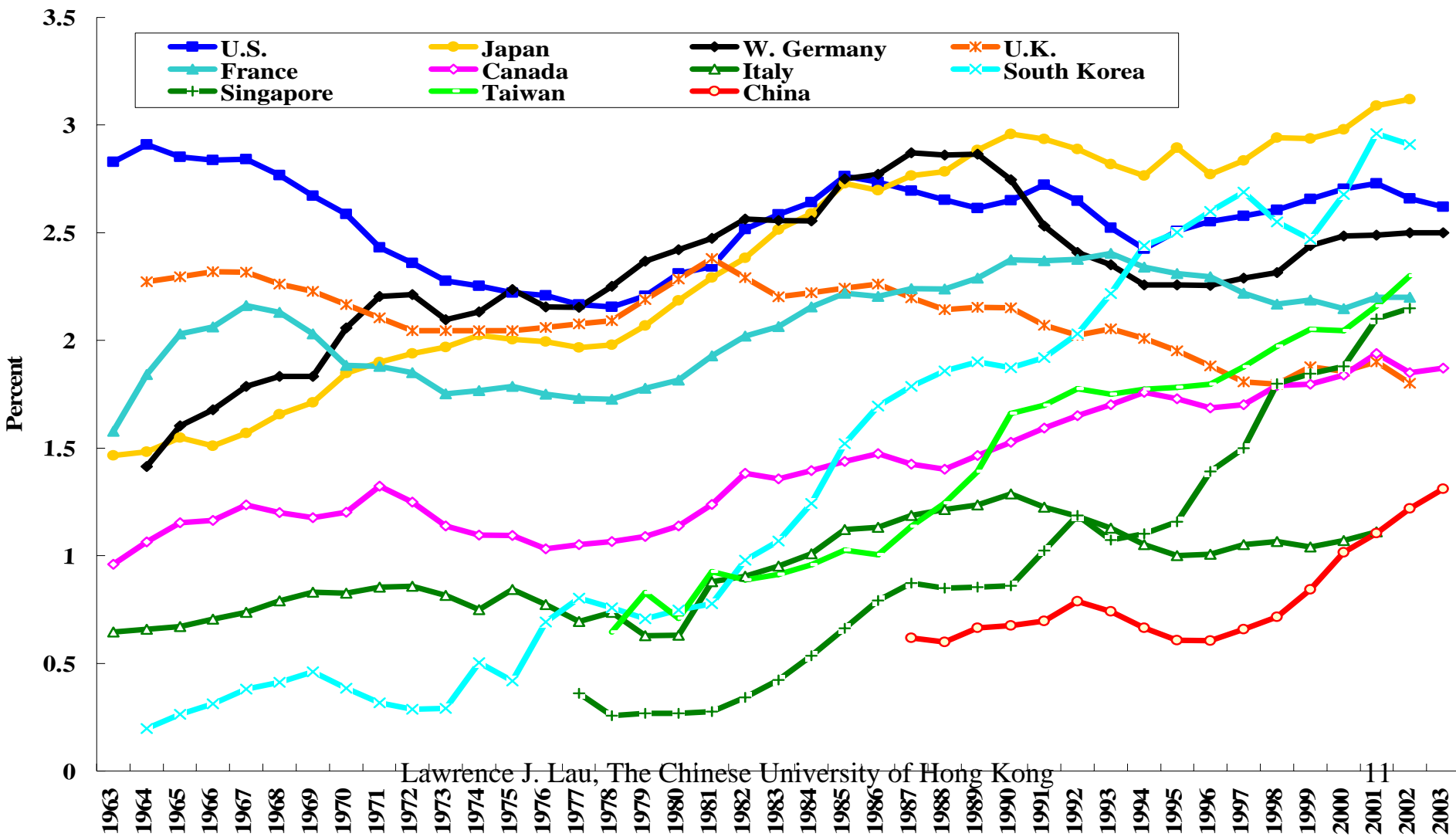
- ◆ In the aggregate, Chinese economic growth since 1978 has been mostly driven by the growth of tangible or physical inputs, principally tangible or physical capital, such as structures and equipment and physical infrastructure, and not by innovation. In particular, there has been relatively little investment in intangible capital (e.g., R&D, human capital, advertising and good will).
- ◆ The growth of tangible capital inputs accounts for the bulk (over 80 percent) of the measured economic growth in China since 1978.

R&D Expenditures: China



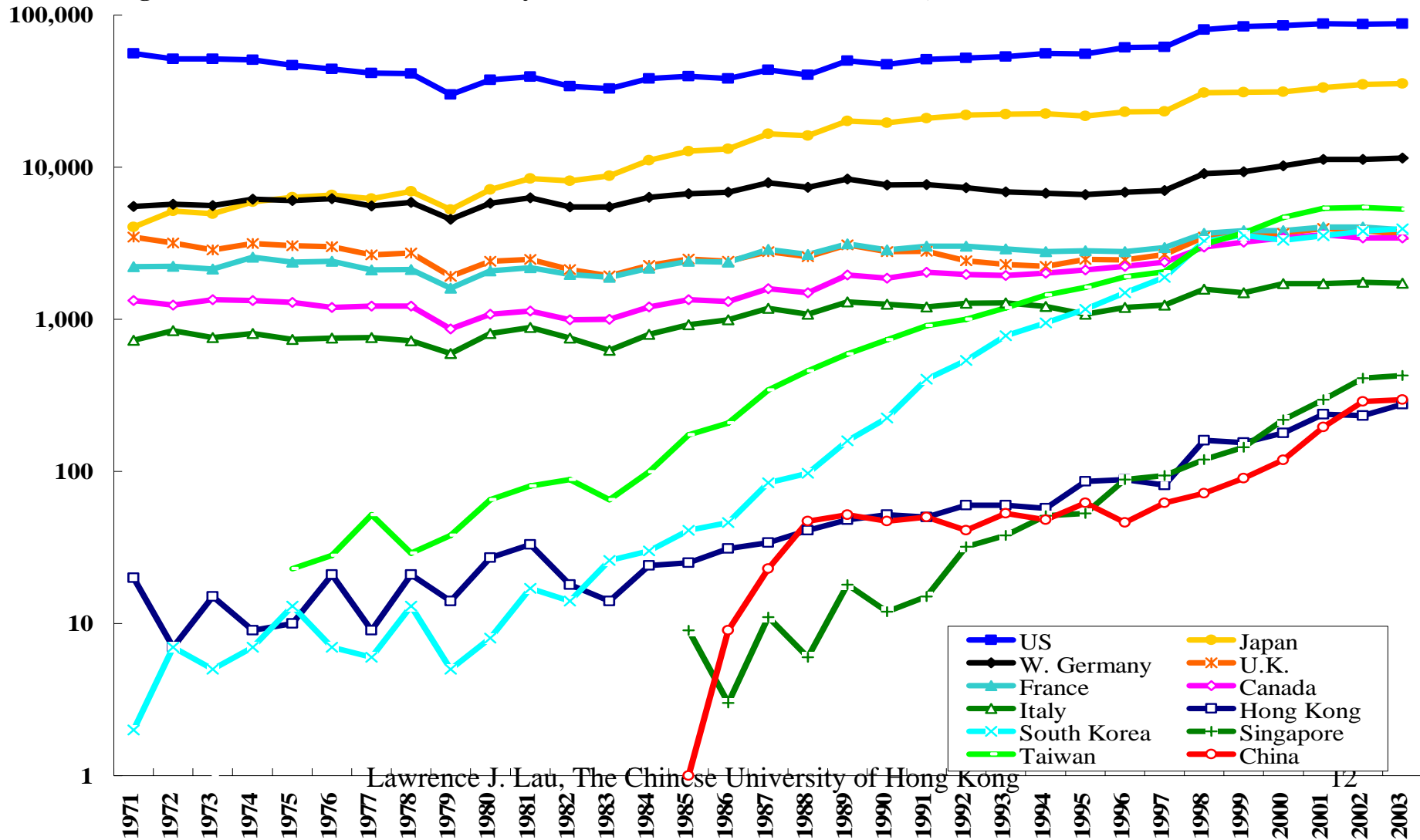
R&D Expenditures as a Ratio of GDP: G-7 Countries, 3 East Asian NIES & China

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



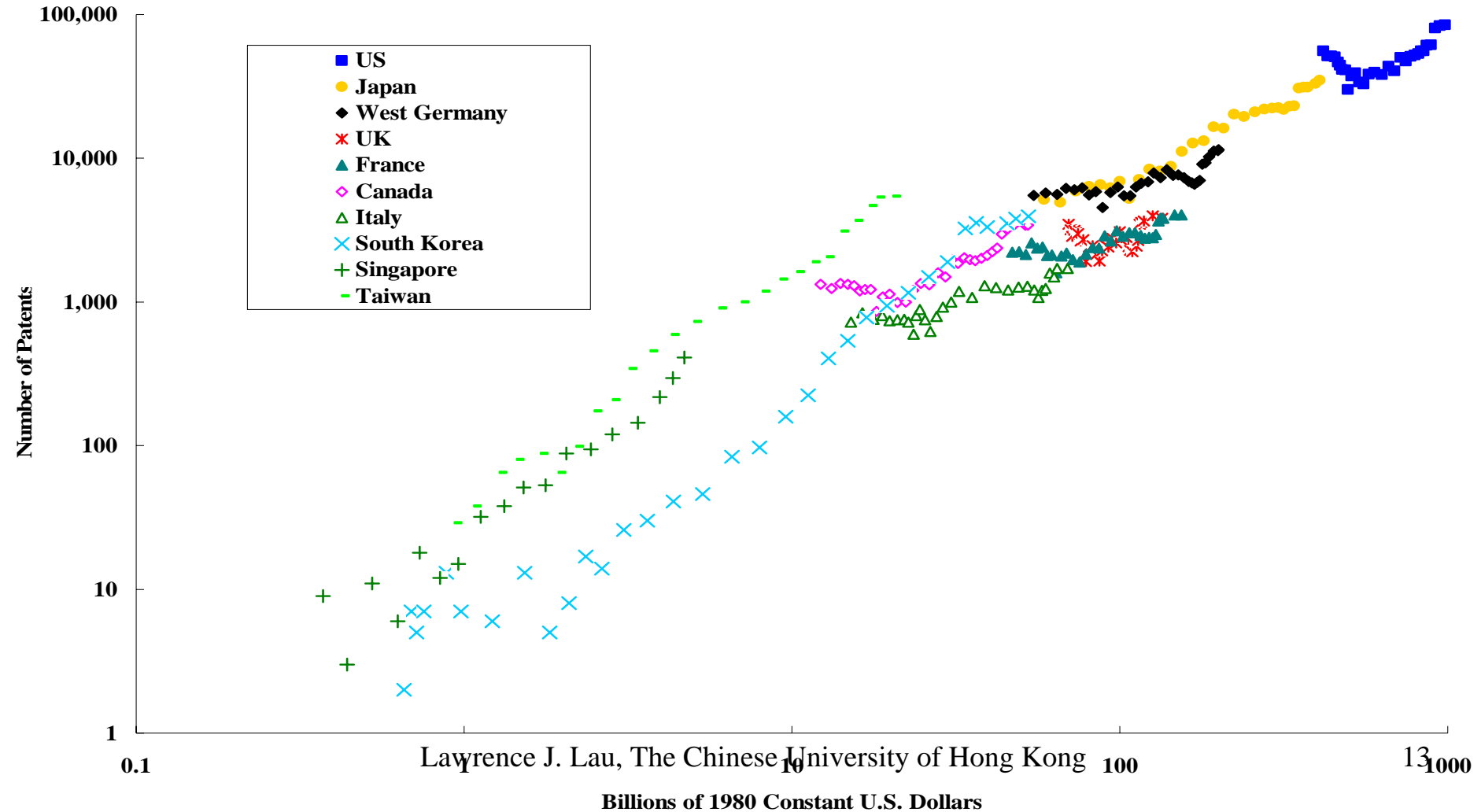
Patents Granted in the United States: G-7 Countries, 4 East Asian NIEs & China

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



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 Characteristics of Innovation Activities

- ◆ Innovation, e.g., the creation of a patented product or process, often requires a high fixed cost, but the expanded application of such innovation, once created, has low marginal cost (e.g., introduction of existing drugs into a new market) and hence high marginal revenue and profit.

The Advantages of the Chinese Economy: Large Domestic Market & Backwardness

- ◆ A large domestic market permits the realization of economies of scale.
- ◆ A large domestic market also allows a significant influence on the development and setting of technological standards for the domestic as well as the world markets.
- ◆ A large domestic market also enhances the returns to R&D and other forms of intangible capital. Economies of scale in the creation and utilization of intangible capital imply that the rate of return increases more than proportionally with the size of the market. The fixed development costs of innovative technologies can be more easily recovered from a large base of domestic demand.
- ◆ The advantages of backwardness—the ability to learn from the successes and failures of other economies; the ability to leap-frog stages of development; and the possibility of creation without destruction.

What Does It Take to Fully Exploit the Advantages of a Large Domestic Market?

- ◆ Availability of infrastructure (transportation and communication, including the internet)
- ◆ Maintenance of a domestically open economy (the equivalent of the “interstate commerce” clause of the U.S. constitution)—no inter-provincial tariff or non-tariff barriers
- ◆ Maintenance of an internationally open economy--the role of the "open door" (WTO)
- ◆ Affirmation of tangible and intangible property rights and the rule of law in the economic sphere--a national commercial and tax court empowered to settle all commercial and tax disputes, including intellectual property rights, on a nationwide basis

Globalization Enhances the Returns to Investment in Innovation

- ◆ (1) By being able to apply the same innovation over the much larger global market, the returns to the investment can be significantly enhanced. In principle, globalization also implies greater competition, which may reduce returns. In practice, innovation is usually associated with patents, copyrights, know-how and trade secrets and hence globalization is more likely to provide opportunities for gains rather than losses from greater competition.
- ◆ (2) Out-sourcing can enhance the returns to innovation. Examples include Nike and Qualcomm.
- ◆ (3) Supply of critical components as intermediate inputs at monopoly prices allows the continued appropriation of returns to innovation.

Foreign Direct Investment Leverages Innovation

- ◆ FDI also permits the application of innovation resulting from investment in intangible capital (patents, technology, knowhow, goodwill, brand name, reputation, business methods) beyond the domestic home market. Intangible capital is much more industry-specific than location-specific. It is much easier for an existing firm to enter the same industry in a different geographical market than to enter a different industry in the same geographical market.
- ◆ The protection of the intangible capital in the new market often requires direct supervision, management and control and hence direct investment. Franchising does not work well in many economies.

The Process of Innovation

- ◆ Basic Research—conducted in academic and research institutions such as universities and Chinese Academy of Sciences, typically supported by the government and foundations. No financial returns are expected.
- ◆ Applied Research—conducted in academic institutions as contract research sponsored by the government and enterprises and also in government-supported research institutions such as the system of National Laboratories and Sematech in the U.S. and the Industrial Technology Research Institute (ITRI) in Taiwan, and in laboratories in larger enterprises themselves. Little or no direct financial returns are expected except for applied research carried out at the enterprises.

The Process of Innovation

- ◆ Development—conducted in enterprises, typically supported by the internal funds of enterprises or by venture capital. The result is a new product/process/service that may be patented or copyrighted. Financial returns are expected.
- ◆ Commercialization--conducted at the level of the enterprises, including start-up enterprises
 - ◆ Pilot Project/Prototype
 - ◆ Incubation
 - ◆ Trial Manufacturing/Servicing
 - ◆ Efficient Scale Manufacturing (learning by doing), Servicing or Distribution
 - ◆ Success in commercialization is the key to translating innovation (patents, copyrights, know-how, trade secrets) into increases in real value-added or GDP.

Adoption as Innovation

- ◆ Adoption means the implementation of a concept already proven and executed elsewhere
- ◆ Relative innovation, e.g., introduction of branded fast food outlets and restaurant chains; introduction of logistics management
- ◆ Dissemination and diffusion
- ◆ The possibility of leap-frogging (telex machines and videotape players are virtually unknown in China; the high usage of mobile telephone service versus fixed-line telephone service).

Innovation Rents Are Mostly Captured by Innovators and Inventors

- ◆ The "innovation rents" have been largely captured by the inventors, manufacturers and distributors of the new equipment or intermediate inputs in the industrialized economies in markets that are only very imperfectly competitive.
- ◆ The "rents" can also take the form of royalties and licensing fees paid to the foreign technology licensors by the East Asian Developing Economies (Example: DVD player), or through transfer pricing by foreign direct investors (under-invoicing of exports and over-invoicing of imported inputs--Example: Hong Kong invested enterprises).

Innovation Rents Are Mostly Captured by Innovators and Inventors

- ◆ Monopolistic pricing of capital equipment, technology licenses and critical components (e.g., systems integration capability for aircraft manufacturers; plastic lens for cameras) limits the value added (and profits) of manufacturers/assemblers in East Asian developing economies, e.g., notebook computers (microprocessors from Intel, display from Japan, South Korea and Taiwan, operating system from Microsoft).
- ◆ Monopsonistic pricing for OEM manufacturers made possible by the control over marketing and design through the establishment of brand names implies that the benefits of learning-by-doing on the part of the OEM manufacturers accrue mostly to the owners of brand names, designs, and marketing organizations. For example, when the East Asian economies devalued during the 1997-1998 East Asian currency crisis, major firms such as Nike reduced their purchase prices in US\$ terms to take full advantage of the devaluations.

The Incentives for Innovation

- ◆ The returns to innovation depends on the creation of a monopoly or quasi-monopoly (patents, copyrights, trade secrets and know-how). The ability to do so depends on the degree of protection of intellectual property rights.
- ◆ They also depend on the existing producers/suppliers. Can there be creation without destruction? Existing producers/suppliers with their sunk costs may prevent or retard the introduction, diffusion and adoption of innovation (e.g., VHS videotapes in the U.S. are still being used; fixed line telephone service).
- ◆ The degree of protection of intellectual property rights in turn depends on whether a country is a producer of intellectual property. With the growth of domestic production of intellectual property, the protection of intellectual property will be vastly enhanced and improved.

The Role of Government

- ◆ Support of basic and applied research and establishment of industrial research institutions if enterprises are not large enough in scale.
- ◆ Provision of financing for major and highly capital-intensive research projects with long gestation periods, e.g., coal liquefaction, super-conducting electricity transmission lines.
- ◆ Registration and protection of intellectual property rights (e.g., patents and copyrights), with compulsory licensing when socially justified and necessary.
- ◆ Provision of infrastructure for information, communication, and transportation, as well as physical infrastructure such as science and technology industrial parks with low facility costs.

The Role of Government

- ◆ Developing and setting national standards and participation in the setting of international standards.
- ◆ Assuring the supply of an educated labour force; supporting higher education.
- ◆ Maintaining the advantages of a large domestic market.
- ◆ Provision of tax benefits for R&D and other forms of innovative activities and for venture capital.
- ◆ Provision of a social safety net to accommodate the “destruction” that accompanies “creation”.
- ◆ Promotion of Government-Industry-Academia cooperation.

Collaboration and Cooperation between Mainland and Hong Kong

- ◆ Comparative Advantage, Specialization and Division of Labour
- ◆ The Mainland is much more willing and able to support basic research (and has more scientific and engineering manpower to do so).
- ◆ The Mainland has more technical manpower as well as labour and hence more suited for manufacturing.
- ◆ The Mainland has a large domestic market with all of its advantages
- ◆ Hong Kong is much more suited for development just prior to commercialization; it is also much better linked to the international markets
- ◆ Hong Kong has lower taxes and a more favourable intellectual property rights regime and is thus more suited as a base for venture capital (a centre for registration of patents and intellectual property?)
- ◆ Hong Kong innovators have access to the large domestic market of the Mainland through CEPA
- ◆ Hong Kong as a potential education hub
- ◆ Shenzhen-Hong Kong Innovation Circle

Self-Sustaining Innovation System

- ◆ Eventually the innovation system must be made self-sustaining.
- ◆ It means that the educational system must be capable of training the high-level manpower needed for R&D and other innovative activities but also the trainers themselves so that the supply can be continually renewed.
- ◆ The innovation system must also be localized so that new or improved products/processes can be continually invented and introduced—at the enterprise level, for sustainability, there must be the capability of developing a second, follow-on product.

Concluding Remarks

- ◆ The complementarity of innovation and scale favours economies with large markets. The experiences of the United States and more recently China suggest that the size of the market can greatly increase returns to investment in innovation.
- ◆ That the United States has the highest rate of technical progress in the world, even though other economies may have invested similar percentages of their real GDPs in R&D, may be explained in part by its own large and open domestic market. Additionally, its own large and open domestic market raises the expected rate of return on investment in innovation to potential private investors (venture capitalists) and hence increase the private investment in innovation in the United States.
- ◆ Globalization of world markets thus further enhances the returns to innovation for the world as a whole.
- ◆ Ability and willingness for venture capitalists and entrepreneurs to take large risks and tolerance for failure are the two additional ingredients for the success of venture capital in the United States.