Policy Studies on Energy and the Environment at The Chinese University of Hong Kong

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International Symposium on Energy and Environment
McDonnell International Scholars Academy
Washington University in St. Louis
May 4-7, 2007, St. Louis, MI, USA

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A Preview

- Studies of Energy/Efficiency
- Studies of Incentives—Pricing, Credit Subsidies, and Regulations
- Studies of the Dynamic Processes—Capital Stock Turnover, Changes in Expectations, and Smoothing Industrial Adjustment
- Studies of Inter-Fuel Substitution—Carbon versus Non-Carbon Fuels
- Development of New Technologies
- Studies of Life-Style Choices
- How Developing and Developed Economies Can Cooperate

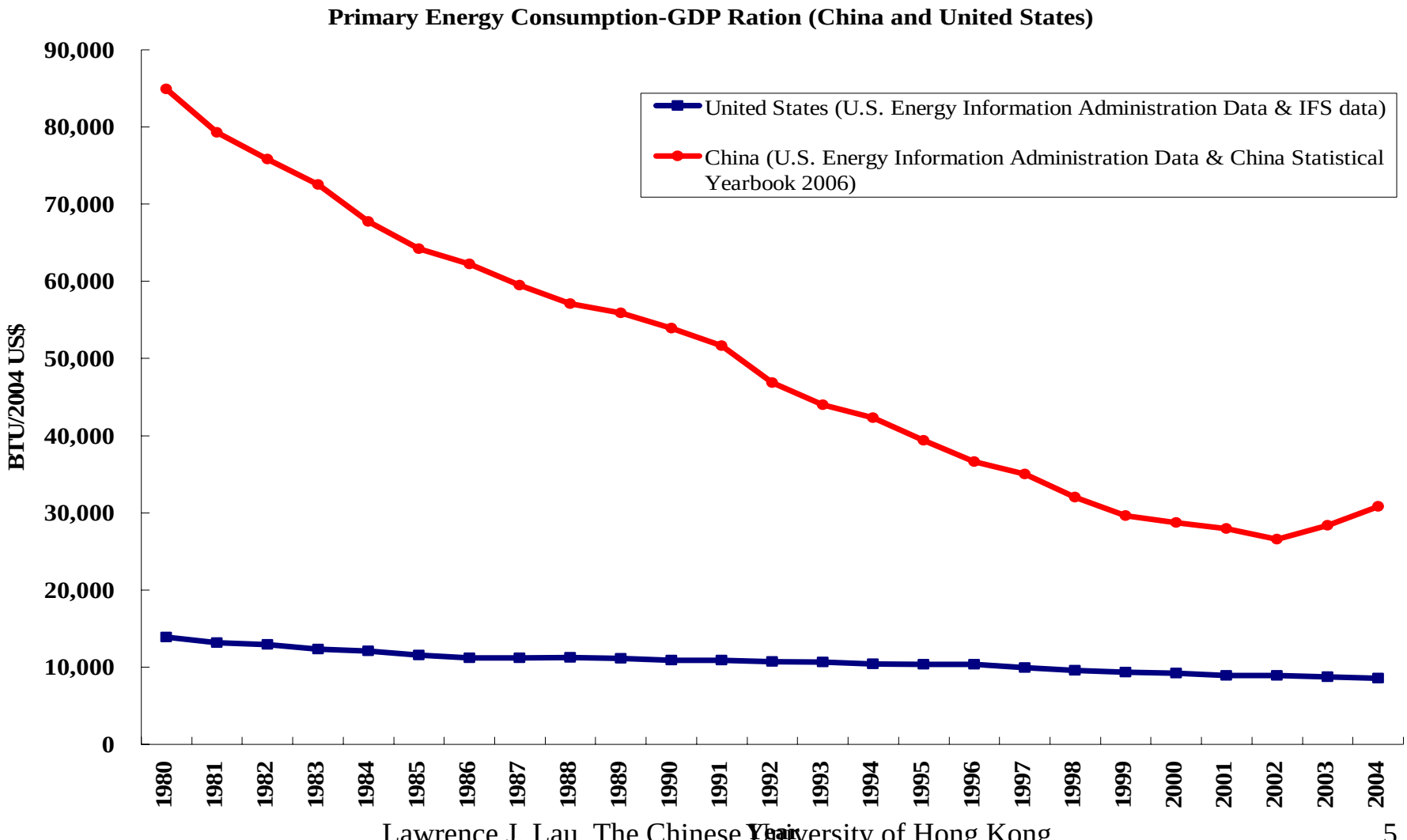
Energy Efficiency

- Energy consumption in China has been growing more slowly than real GDP until 2002.
- Energy efficiency, in terms of energy consumption per unit GDP, has actually improved significantly during the past two decades, until the last couple of years.
- It is, however, still considerably higher than those of the United States, Japan, and other developed economies. This is due, in part, to the lower price of energy to the end users; but also, in part, to the different sectoral composition of GDP originating—which in turn also depends on the domestic consumption patterns (e.g., the distribution between goods and services).

Energy Efficiency

- It is also affected by differences in life-styles: locational patterns, including residential patterns, densities, types of housing, types of transportation, temperature preferences, etc.
- It is also affected by the differences in the energy efficiency of the existing capital stocks of both the enterprises and the households—structure and equipment, housing, automobiles—which are legacies of the historical actual and expected prices of energy.
- But this also indicates considerable room for further improvements in energy efficiency in China.

Primary Energy Consumption-GDP Ratios (China and the United States), 1980-2004



Incentives—Appropriate Pricing and Taxation of Energy

- Pricing must reflect economic scarcities. Thus the prices of the different forms of energy should be set at world levels. Low-income households can be protected through lifeline rates on different forms of energy, e.g., electricity. Similar rate structures can be used to protect the existing enterprises and their employment without encouraging expansion of uneconomical use of energy.
- One can also use peak-load pricing for electricity which lowers the capital costs of providing electricity through higher utilization rates.
- Pricing must also reflect externalities. Externalities can also be priced in through the imposition of taxes on specific industries and/or products. For example, the price of gasoline, if left to the market, may not reflect the (social) costs of congestion, air pollution and global warming. Thus, a gasoline tax can be justified.
- Also, for certain investments, the private rate of discount may be higher than the appropriate social rate of discount and thus may require public subsidies or regulation.
- Wherever possible, the externalities should be internalized so that the total social costs are fully reflected.

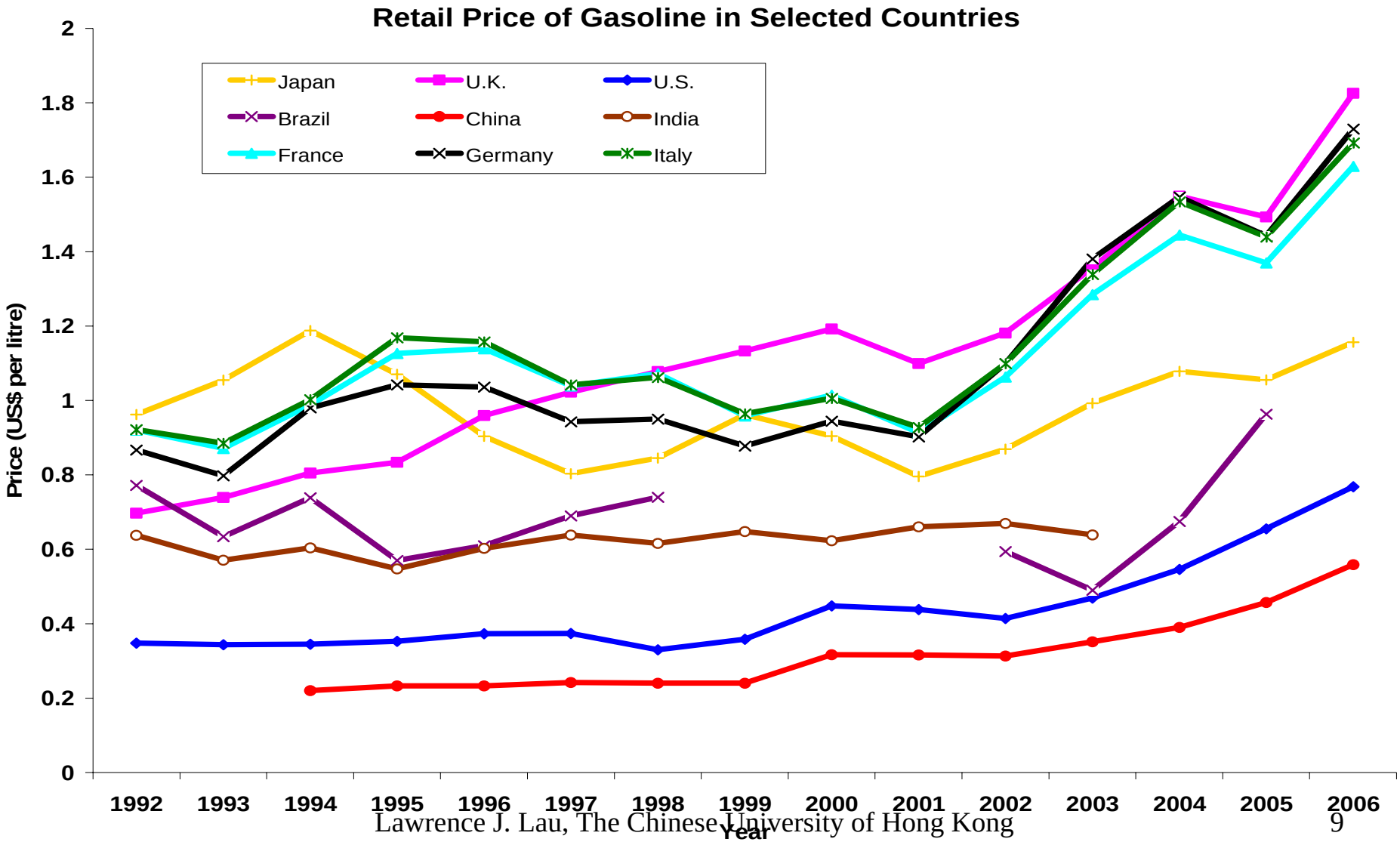
Incentives

- Incentives for capital cost-operating cost substitution—better insulation and construction of buildings lead to lower energy consumption for the useful life of the building; energy-efficient light bulbs are more expensive; durable products; buildings with higher ceiling height per floor for better natural ventilation and reduced demand for air conditioning; solar heating systems. The government can provide credit subsidies for financing these incremental capital expenditures.
- (For example, triple-paned windows are more expensive but houses equipped with them consume much less energy. Without incentives the developers are likely to opt to use single-paned windows to lower the up-front capital cost.)
- The government can also mandate energy efficiency standards. For example, the government can mandate double-paned windows in regions where the average winter temperature is below a certain level.

Incentives—The Gasoline Tax and the "Gas Guzzler Tax"

- The retail price of gasoline in China is among the lowest in the world, even lower than in the United States. China can impose a tax on gasoline that is similar in order of magnitude to that in the Western Europe and Japan.
- It is a myth that the high price of domestic gasoline deters the development of the automobile industry. Both Japan and Western Europe have long had high retail prices of gasoline and both have prosperous automobile manufacturing firms.
- China can also impose a gas guzzler tax (license fee) linked to the fuel efficiency of the automobile that penalizes inefficiency.
- The gasoline tax and the "gas guzzler" tax can reduce the externalities generated by the use of the automobile (e.g., congestion and public health (including loss of productive time), local and global environmental pollution).

Retail Prices of Gasoline in Selected Countries



The Gasoline Tax and the "Gas Guzzler" Tax

- The best time to impose and/or raise gasoline taxes and other user taxes is before there are too many automobile owners, not afterwards. It becomes politically difficult or even impossible to do so once the majority of the households own and depend on automobiles for their daily transportation needs.
- Such taxes as the gasoline tax and the "gas guzzler" tax are likely to be progressive in China because only high-income people are likely to have private automobiles. It may therefore be viewed as another means of "redistribution".

The Implementation of the Gasoline Tax and Other Measures

- The gasoline tax can be flexibly structured so as to maintain the retail price of gasoline (in real terms) at a stable level, independently of the short-term fluctuations in the world price of oil.
- The proceeds of the gasoline tax can be used to finance public investment in mass transportation. But it can also be done in a revenue-neutral manner, reducing the income taxes of the low income households, providing some compensation for the increase in the retail price of gasoline.
- Access fees to the central business districts during peak periods, as used in Singapore, are also an option.
- The promotion of a car rental industry and the encouragement of ride-sharing and car-pooling.

The Dynamic Processes

- It takes time for the energy-consumption characteristics of the capital stock of both the enterprises and households to turn over—it can be five years or more because it has to await the replacement of the existing capital stock with new investment. But early signaling is essential.
- Even the announcement of planned future price/tax increases, holding current price/tax constant, can have a substantial impact because they affect directly the expectations and hence the choice of new capital equipment in terms of its energy efficiency.
- For example, one can announce today an increase in the gasoline tax three years from now. It will have a large impact as users turn over their capital stock over the next three years.

The Dynamic Processes

- The experience of the oil shocks in 1973 and 1980 showed that while there was little adjustment in the short run, there would be substantial adjustment in the long run, so much so that the oil price had to come back down in the early to mid-1980s.
- An early announcement or phasing in of a future increase in the gasoline price permits smooth and orderly adjustment by enterprises and households so that any transitional hardship can be minimized.

Inter-Fuel Substitution

- Diversification of types and sources of primary energy, including hydroelectric, nuclear, solar, wind, biomass and natural gas.
- Nuclear power has an advantage over hydrocarbons because it is more environmentally friendly and it is recyclable. France and Japan generate a very large percentage of their electricity with nuclear power plants.
- Safety may be an issue but can be avoided by careful siting and the use of efficient transmission lines.

Development and Commercialization of New Technologies

- Hydrogen and fuel cell technologies, breeder-reactor, super-conducting transmission lines.
- China has the potential of leap-frogging because it has a vast domestic market but no strong vested interest yet to protect, no large existing investment that must be amortized. It is relatively low cost for China to switch to a hydrogen car but not so for the United States because of all the sunken investment in the stock of automobiles, in the invested structures and equipment of the automobile industry, and in the extensive gasoline-based fuel distribution system.
- The hybrid car can be more widely promoted.

A Collective Life-Style Choice

- What is an appropriate temperature for the summer? For the winter?
- What types of cities are the best for China (and for the world)?
- "A car in every garage" is a nightmare scenario for China and the World. (Imagine 400 million automobiles on the road and a replacement demand of at least 40 million automobiles a year eventually!)
- Urban sprawl and the traffic congestion that it generates are the natural outcomes of the growth of cities in the absence of adequate urban planning.
- Convenient, user-friendly urban mass transit is the only feasible substitute to the automobile, but it works effectively only in cities with high-density residential and non-residential neighborhoods.

A Collective Life-Style Choice

- Thus, one of the most important policy choices with long-term implications facing China is what can be described as a choice of urban life-style: Does China want its existing and future cities to be like Los Angeles and San Jose, where automobile ownership is a necessity, or London, New York, Paris and Singapore, where convenient and efficient mass transit systems exist and automobile ownership and/or use are genuine choices?
- It is critical for China to maintain a viable alternative to the automobile as a means of daily urban travel for the vast majority of the middle class, in addition to bicycles and walking.

A Collective Life-Style Choice

- However, such urban life-style choices must be made early on. Once made, often by default, they cannot be easily reversed. For example, it is far too late for Los Angeles and San Jose to try to become a city like New York—the low density and the sprawl have basically made such a change impossible.
- The modes of mass transportation also require a collective governmental choice as well as integrated urban planning and regulation on density, land use, spatial distribution and transportation routes. They must take into account the externalities and cannot be left alone to the invisible hand of the market.

A Collective Life-Style Choice

- Providing urban residents with a viable and workable system of mass transportation does not necessarily mean that they will not have the opportunity for automobile ownership just an option for less automobile use. Nor does it imply that the domestic automobile industry cannot be effectively developed. (Look at Japan and Western Europe.)
- Mass transit systems must be user-friendly to encourage greater utilization—fast, clean, efficient, and easy accessibility. The Paris Metro was designed so that any one standing anywhere in Paris is no more than 400 meters away from a station.
- The greatest success of mass transit systems is achieved where there is a relatively high density pattern of distribution of the urban population. However, in order to achieve high densities, urban planning is essential.
- Thus, there will have to be high density living rather than free-standing single family homes in urban China.

A Collective Life-Style Choice

- There are significant economies of scale in heating and cooling, e.g., houses share walls, incorporation of new technologies.
- Complementarity between the efficiency in land use and the efficiency in the consumption of resources, e.g., high density housing enhances the efficiency of mass transit and public transportation systems, and the availability of convenient mass transit reduces the demand for automobiles and for gasoline, and hence congestion and pollution.
- Life-style choices—design of furniture and appliances to fit in small spaces so as to make small spaces seem larger.

The Role of the Urban Middle Class

- The emergence of an urban middle class has both positive and negative implications on energy conservation and environmental protection. One the one hand, the urban middle class demands many products and services (e.g., automobiles and gasoline) that are both resource-intensive and environmentally unfriendly. On the other hand, the urban middle class, being better educated, tends to be more socially and environmentally conscious and values the quality of life.

How Developing and Developed Economies Can Cooperate

- Energy consumption and emission targets for different economies should be set with reference to both the level of GDP per capita and to its historical experience. Thus, one should allow the energy consumption per capita in developing economies to rise faster than that in developed economies (and hopefully in the latter it would be declining over time). It should be recognized that people in developing economies are still demanding things (houses, automobiles, furniture, appliances), whereas people in developed economies are demanding services on the margin, which take much less energy to produce than things.
- Carbon trading can be win-win.
- Economies should avoid competitive reduction of energy consumption and environmental standards and requirements so that producers cannot play one economy against another. And importers should be required to comply with the same standards and requirements as domestic manufacturers.