

Socio-Economic Determinants of China's Recent Economic Growth

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Abstract: This paper analyzes various socio-economic aspects of China and Japan in order to identify the major determinants for China's recent ascendancy over Japan as the world's second largest economy. Those aspects considered include China's aggressive policies for promoting exports, including high tech, capital formation, foreign direct investments, research and development, and tertiary education. China's economic growth also generated several serious adverse effects, such as income inequity, import of energy resources, environmental degradation, and international tension in the South China Sea, which may become serious bottlenecks for China's future economic growth.

Keywords: China's economic growth, Japan's economy, exports, capital formation, foreign direct investments, research and development, tertiary education, environment, regression analysis.

I. INTRODUCTION

In 2011, China's Gross Domestic Product (GDP) of U.S. \$7.3 trillion surpassed Japan's GDP of \$5.9 trillion, thus rendering China's economy the second largest in the world. This growth is often attributed to the natural evolution of China's large population. No doubt, the ten times larger population of China over that of Japan is an important contributor, yet it is totally an inadequate explanation for such robust growth. As an example, China's population in 1990 was also about ten times larger than Japan's population, yet China's GDP in that year was only about one tenth of Japan's GDP (i.e., U.S. \$357 million verse \$3.1 trillion). Thus, a fuller explanation for China's recent economic growth must be sought from non-population issues.

This paper attempts to analyze various socio-economic aspects of China and Japan in order to ascertain the main factors which enabled China's economy to surpass Japan's economy. We also discuss the adverse effects of China's rapid economic growth which, if not properly managed, may produce serious bottlenecks for its future growth. *By no means* do we intend to laud or denigrate one economy over the other. Our objective is simply that a comparison of the former and the current second largest economy in the world may render valuable lessons for the economic growth of other developing nations.

The composition of this paper is as follows: for China's economy, we analyze various favorable factors in Section II and unfavorable aspects in Section III.

China's energy usages and its increasing importation of energy resources are discussed in Section IV. To quantify the *relative* importance of factors for economic growth, regression analyses are presented in Section V. In Section VI, the future prospect of China's economy is discussed, which is followed by Section VII of conclusions. Unless otherwise indicated, all data used for this study are derived from comprehensive World Bank data sources. The period of our analysis is between 1990 and 2011, the most recent year with a reasonably full coverage of the requisite data.

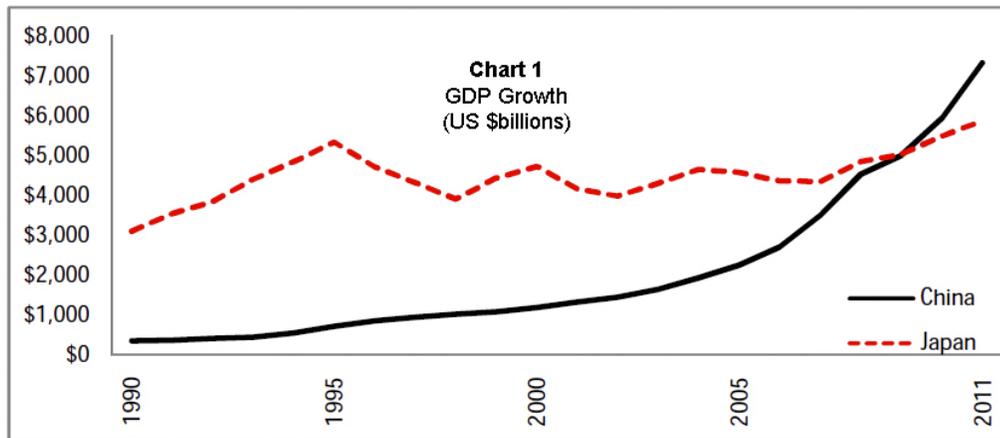
II. POSITIVE ASPECTS OF CHINA'S RECENT ECONOMIC GROWTH

The genesis of China's recent growth was the 1978 radical economic reform from an ineffective central planning to a market economy with a global linkage. The main thrust of the reform was its "four modernizations" that involved foreign direct investments, transfer of higher technology, expansion of export markets, and modern managerial techniques¹. The reform firmly launched China's economy to a rapid growth trajectory. Between 1990 and 2011, China's GDP in current prices grew 1,950% in comparison with 89% growth of Japan's GDP. The growth patterns of the two GDPs are plotted Chart 1.

In 1990, China's GDP was far below Japan's GDP. Yet, starting from 2000, China's GDP grew exponentially, whereas Japan's GDP grew rather linearly, and in 2010, China started to surpass Japan. The GDP represents the total economic strength of a nation, yet it does not accurately embody the general

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¹For a chronological discussion of China's economic reforms, see, Guo (2009).



economic welfare of its people. This welfare is better measured by GDP per capita. During the period of our analysis, China's GDP per capita increased significantly, yet even in 2011, Japan's GDP per capita of U.S. \$46,135 was more than eight times larger than China's GDP per capita of \$5,447. Or, China's standard of living was roughly 12% of Japan.

There are two caveats in this interpretation. An important component of China's economy is a

pervasive barter system at all levels of its economy. Farmers barter their products between themselves. Professional people also barter for such a thing as a driving lesson in exchange for a piano lesson. In fact, there is a website in China for barter among professionals with 50,000 offers. Any transactions through barter are not reflected in the GDP, so that China's GDP per capita might be grossly underestimated. However, the barter also entails the

Table 1: China and Japan Comparisons

| year | CHINA | | | JAPAN | | |
|--|-------|---------|--------|----------|----------|--------|
| | 1990 | 2011 | growth | 1990 | 2011 | growth |
| Positive aspects | | | | | | |
| GDP (US \$billion) ¹ | \$357 | \$7,318 | 1950% | \$3,104 | \$5,867 | 89% |
| Population(million) | 1,135 | 1,344 | 18% | 124 | 128 | 3% |
| GDP per Capita | \$314 | \$5,445 | 1634% | \$25,124 | \$45,903 | 83% |
| Exports (\$billion) | \$57 | \$2,296 | 3928% | \$319 | \$893 | 180% |
| Exports as % of GDP | 16% | 31% | 15% | 10% | 15% | 5% |
| High tech exports (\$billion) ² | \$4 | \$457 | 11325% | \$67 | \$126 | 88% |
| Total Capital (\$billion) ³ | \$129 | \$3,546 | 2649% | \$1,008 | \$1,166 | 16% |
| Capital Formation (% of GDP) | 36% | 48% | 12% | 32% | 20% | -12% |
| Gross Savings (% of GDP) | 40% | 53% | 13% | 34% | 27% | -7% |
| Foreign Direct Investment (\$billion) | \$3 | \$220 | 6213% | \$2 | \$0.10 | -96% |
| Research&Development(\$billion) ⁴ | \$2 | \$125 | 6150% | \$86 | \$197 | 129% |
| Tertiary School Enrollment ⁵ | 3% | 26% | 23% | 30% | 60% | 30% |
| Labor Force (million) | 643 | 806 | 25% | 64 | 67 | 5% |
| Population 65 years and up ⁶ | 6% | 9% | 3% | 12% | 24% | 13% |
| (% of total population) | | | | | | |

¹All dollar values are in current prices.

²High tech exports data for China started from 1992.

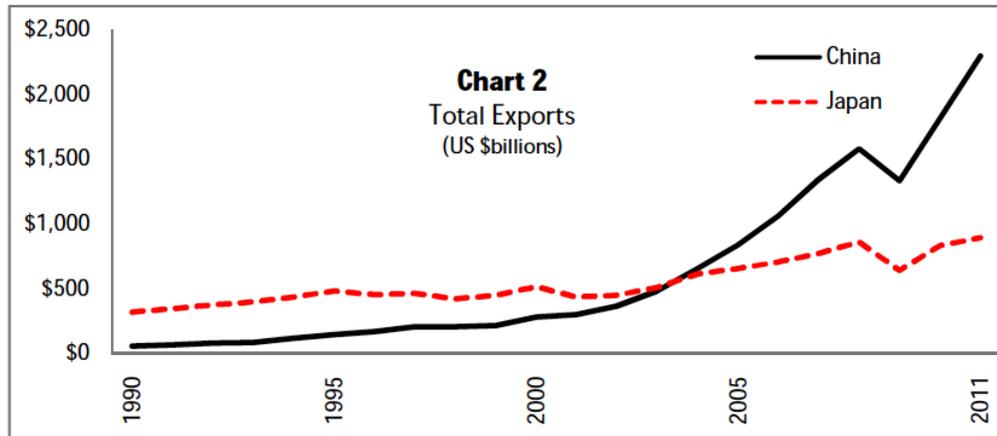
³First year of this data series was 1993.

⁴Last year of this data was 2009.

⁵% of population in this age group. Last year of this data was 2010.

⁶% of total population.

(source of data: The World Bank/Economic Policy, Education, & Environment).



hidden opportunity costs of time required for advertising and arranging transactions. If these hidden costs are subtracted from unreported benefits, the net benefits of the barter system may be significantly reduced.

The second caveat is that the GDP estimate is based on the current official exchange rate between the Chinese currency (*renminbi*) and the U.S. dollar. China's currency is purported to be undervalued by at least 30%, and thus China's GDP may also be grossly underestimated. However, without reliable data on the barter system and the undervaluation of the currency, we are not able to ascertain the *true* level of China's current standard of living.

Table 1 presents various socio-economic factors which enabled China's rapid economic growth in comparison with that of Japan. The choice of these determinants was prompted by the following considerations. The data for all our determinants need to be consistent and comparable with each other in order to ascertain their *relative* growths over years. For this purpose, we utilized a single source of data, i.e., the World Bank with a comprehensive coverage of socio-economic data for all individual countries in the world. In addition, since the main emphasis of our study is to underscore the recent economic growth of China, which enabled China to surpass Japan as the second largest economy in the world, we concentrate to those factors with the most salient contrasts in growth between these two countries, including those determinants targeted in the 1978 China's economic reform.

As is well known, the most visible catalyst of China's recent economic growth was its export activities. Between 1990 and 2011, China's exports increased not only in terms of their volume from \$57

billion to \$2 trillion but also in terms of their importance for GDP composition from 16% to 31%. In comparison, Japan's exports increased from \$319 billion to \$893 billion and from 10% to 15% of its GDP during the same period.

Chart 2 compares the growth patterns of the exports between the two countries.

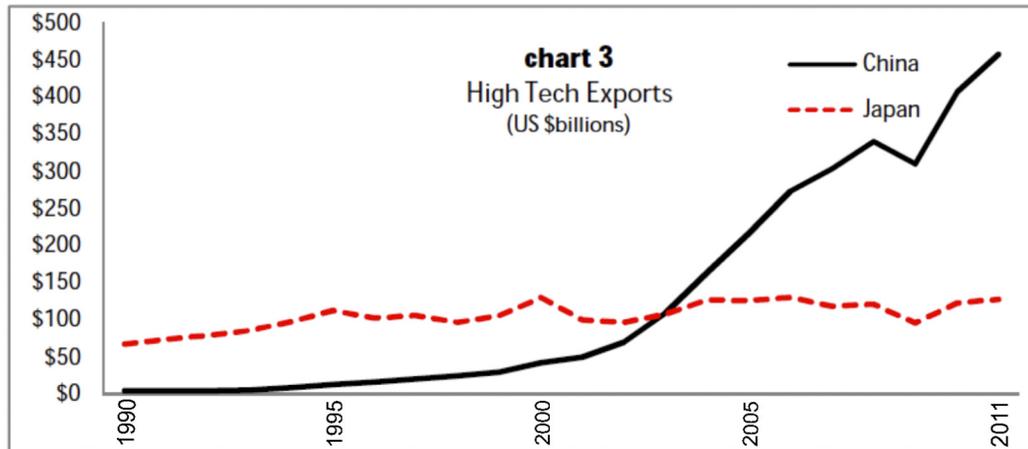
China's exports started to surpass Japan from year 2004, seven years earlier than the year when China's GDP exceeded Japan's GDP. In 2011, China's exports were 2.6 times larger than Japan's exports. To encourage the exports, China resorted to internal as well as external stimulus. Internally, China introduced in 1994a tax rebate policy for exports. Commercial VAT (value added tax) rates were 13 percent for basic goods, including agricultural products, and 17 percent for other products. However, if products were exported, firms were rebated for all their VATs, which meant direct subsidies for exports². Exports are also benefited significantly by China's *fixed* exchange rate which was much lower than the floating market rates. To maintain the fixed rate, the Chinese government actively intervened in currency markets, which amounted to indirect subsidies to exporters³.

Externally, in order to secure and expand overseas markets, China signed in 2002the China-ASEAN FTA (Association of South-East Asian Nations Free Trade Area) treaty with eleven nations in Southeast Asia, with a combined population of 1.85 billion and \$2.5 trillion GDP, the largest FTA in terms of population and the third largest FTA in terms of GDP in the world⁴. China's exports were also greatly facilitated by highly

²For China's export tax rebate policy, see, Cui (2003).

³Shambaugh (2013:160).

⁴Lawrence (2008).



sophisticated world trade expertise of Hong Kong, which was repatriated to China from Great Britain in 1997 but was allowed to remain as a self-administered area under the 2004 treaty of “Closer Economic Partnership Arrangement”⁵.

Initially, major Chinese exports were labor-intensive products. However, China gradually expanded to export of high tech products. Chart 3 presents high tech exports of China and Japan.

In 1992 (the first year of available data for China), China’s high tech exports were a mere \$4 billion or 5% of its total exports, whereas in 2011, the high tech exports grew to \$457 billion or 20% of its total exports. For Japan, high tech exports grew from \$67 billion to \$126 billion, and the share of high tech exports *declined* from 21% to 14% of its total exports.

In fact, China’s high tech exports started to outstrip Japan’s high tech exports from the year 2003 and since then, the gap between the two countries is widening. The majority of China’s high tech exports were the assembled products of foreign firms in China. However, China also attempted to indigenize and improve higher technologies introduced by the foreign firms. The improvements were broadly sought throughout all intermediate steps of production and were differentiated over regions in order to take full advantage of the regional economic differences.

As a consequence, China was able to produce similar products at much lower cost than the foreign firms and directly compete with the foreign firms in their export markets⁶. For example, Korean investments in

China contributed to China’s expansion of high tech exports to Japan by 27% while the Korean share of the same market declined by 20%⁷.

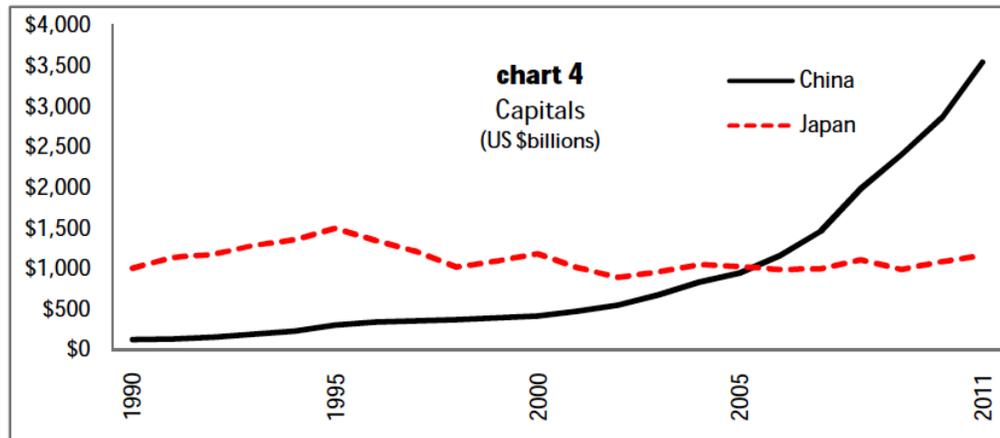
The second important determinant for the rapid growth of China’s GDP was its *capital* formation. Capital enhances output directly through automation and indirectly through improvements of labor productivity and efficiencies of economic infrastructures. Chart 4 compares capital accumulations between China and Japan. In 1990, China’s total capital was \$129 billion, or 13% of Japan’s capital of \$1 trillion. Yet, in 2011, China’s capital increased to \$3.5 trillion, whereas Japan’s capital increased only slightly to \$1.2 trillion, or a slight decline in terms of real value. In 2011, China’s total capital became three times larger than Japan’s total capital.

The primary source of capital formation is individual savings. In 2011, China’s gross saving was 53% of its GDP, the highest rate in the world, compared with 22% of Japan. Historically, as an economy grows, consumers tend to increase consumption and save less, as was demonstrated by the 12% decline in Japan’s saving rate between 1990 and 2011. Yet for China, the opposite occurred and the saving rate actually increased 13% during the same period.

We may speculate about reasons for China’s high propensity to save. The traditional Asian frugality, a small household size due to China’s ‘one-child’ policy, and soaring real estate values, all contributed to China’s high saving rates. Furthermore, in earlier years, the Chinese government actively discouraged any semi-luxury consumption by its people. Until 2001,

⁵For further discussion on this point, see Chan, Tracy, and Wenhui (1999).
⁶Breznitz and Murphree (2011).

⁷For trade relationships between China and South Korea, see Kim, Kim, and Lee (2004).



all products produced by foreign firms in China were required to be sold outside of China⁸.

In addition, as will be discussed, income distribution in China was being skewed in favor of upper income groups as China's economy grew, which ran against the Kuznets hypothesis that as economy develops, an earlier income inequality gradually tapers off. During the period of our analysis, income share held by the top 10% of high earners increased from 25% to 30%. At an early stage of economic growth, people with the highest income tend to save on a large scale, and this concentration of wealth in China contributed to China's greater savings.

The second source of capital was a large amount of its trade surplus. During the period of our analysis, both China's exports and imports increased significantly. Yet China's exports always outpaced its imports, and China earned a \$2.1 trillion total trade surplus, which became an important source of China's capital formation.

The third source of capital was foreign direct investments (FDI) in China. Initially, still haunted by the humiliation of the 19th century *Opium Wars*, China was very cautious about opening its economy to foreign firms⁹. Yet, at an early stage of economic development, foreign direct investments provide numerous advantages for a recipient country. The FDI immediately transfer necessary capital of hard currencies, higher technology, and modern business management system. The FDI firms possess the requisite expertise of international trade and finance, and often they already secured markets for their products. These advantages significantly reduce

commercial risks of the developing countries if they try to cultivate new foreign markets by their own initiatives. In addition, as South Korea's economic history attests, the import-substitution is the proven and quickest policy for an economic growth. After several years of learning by doing, the recipient country of the FDI is able to produce and export its own improved products of the FDI firms. Often these products are labor intensive primitive products at the beginning yet with many potential linkages into the advanced products in the future. The maximization of such linkages enables a country's continual exports and economic growth.

These considerations persuaded China to encourage the FDI with very generous tax incentives. In the first two years, the FDI firms are exempt from any income taxes. Afterwards, corporate income tax for the FDI was 15 percent instead of 33 percent for the Chinese firms¹⁰.

Chart 5 compares the growth of the FDI between China and Japan.

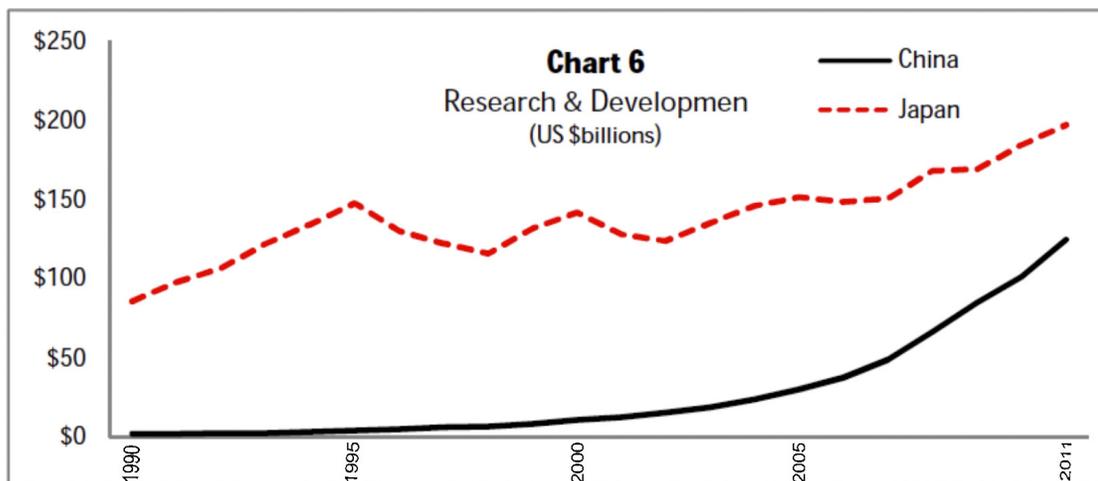
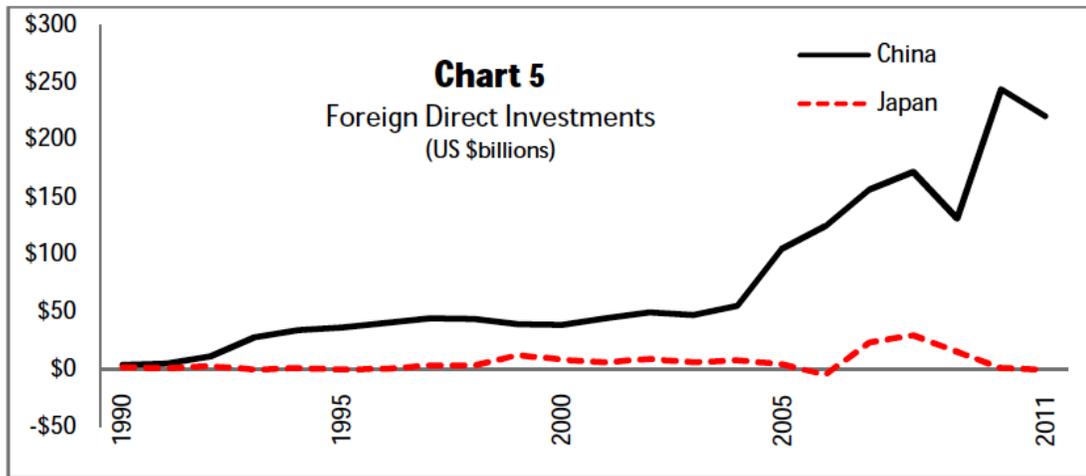
The FDI in China grew from \$3 billion in 1990 to \$220 billion in 2011, whereas in Japan, the FDI actually declined from \$2 billion to \$.1 billion during the same period. Japan's high wage and strong *yen vis-à-vis* China, plus Japan's general lack of enthusiasm for the FDI, may explain the sharp contrast of the growths between China and Japan.

Initially, China required the FDI firms to sell all their products outside of China, which was the major grievance by the FDI firms in China. However, in 2001, in order to join the World Trade Organization (WTO), China finally allowed the FDI firms to sell part of their

⁸For further discussion on this point, see, Horioka and Wan (2008).

⁹Wilson (2009).

¹⁰see, Prasad and Wei (2008).



products in Chinese markets. This relaxation significantly increased new FDI in China. These firms transferred high technologies as well as modernization in management and production processes. As a consequence, FDI contributed to 15 percent of China's total capital formation¹¹.

Returning to the recent growth of China's economy, the third major determinant was China's rapid growth in research and development (R&D), which directly enhances the quality of capital and labor productivity. Between 1990 and 2011, China's R&D grew 159% from a mere \$2 billion to \$125 billion, whereas the comparable growth of Japan was 129% from \$86 billion to \$197 billion. Japan still enjoys an edge over China in the R&D, but judged by the annual expansion rate, the gap will be quickly eroded in near future. The growth patterns of the R&D for the two countries are presented in Chart 6.

The fourth major determinant for China's economic growth was an increase in the number of students enrolled in tertiary education, either in educational or vocational facilities beyond high school level. The comparative economic advantages of unskilled labor in international trades have an absolute upper limit for their growth. Already, China's such current advantages are seriously challenged by the emerging economies of India, Indonesia, and Brazil. For China to continue the expansion of its foreign trade, it is essential to significantly increase an overall skill level of its workers so that they will be able to produce products of the advanced technologies. In addition, the transfers of higher commercial technologies between individual countries are becoming more stringent through patent laws and protections of the intellectual properties. Thus, China needs to develop its own indigenous high technologies as well as high-tech products, and China's large scale investments in tertiary education are the appropriate response to this challenge. Even in

¹¹Huang (2011:153).

the U.S., the two most important determinants for differences in the nation's regional incomes were found to be the level of education and innovation through research and development¹².

In 1990, only 3% of Chinese population that completed secondary education received tertiary education, whereas this percentage increased to 26% in 2011. China's tertiary education also improved significantly in terms of gender equity. The ratio of female over male students participating in the tertiary education dramatically increased from .53 in 1994 to 1.13 in 2011, whereas the ratio remained similar for Japan from .81 in 1994 to .89 in 2010. Not only the number of students, but China also attempted to enhance the quality of education in order to better adapt to the modern global economy¹³. In Japan, the comparable figures for engaging in tertiary education were 30% in 1990 and 60% in 2011, thus Japan still maintains an overwhelming superiority over China in higher education. This may be one reason why Japan continues to enjoy absolute comparative advantages over China in advanced consumer technologies, such as in electronics and automobile production, in spite of the comparable total GDPs of the two countries.

Finally, a healthy growth of an indigenous labor force is a prerequisite for long-run sustainable economic growth. A critically important resource which is lacking at an early stage of economic development is the number of entrepreneurs who are willing to take risks for potentially large economic rewards. As more people directly participate in the economy, their values of pecuniary advantages increase as well as their desires to save for capital and become entrepreneurs. During the period of our study, China's labor force increased by a healthy 25% from 643 million to 806 million, while Japan's labor force increased only 5% from 64 million to 67 million, due to the slow growth of Japan's population, a common phenomenon of all industrialized countries except the U.S. In order to overcome labor shortages, Japan experimented with several policies of inviting foreign guest workers, especially the ethnic Japanese from South America. These guest workers alleviated the labor shortages temporarily, yet caused serious social problems as well financial burdens on Japan during the recent economic recessions when demand for labor declined and the

guest workers had to be repatriated often against their own wishes.

An additional burden of the Japanese population is a large number of economically inactive people. In 2011, retired workers out of total labor force were 9% for China and 24% for Japan, due to Japan's increasing longevity of life. Japan's retirement system is still based on a previously prosperous economy and a rather small number of retired workers, and the benefits are extremely generous. In year 2000, Japan spent 12% of its GDP for the welfare of its senior citizens, and within next three decades, the burden is expected to become 27% of the GDP¹⁴. Strictly from an economic point of view, funds provided for welfare benefits are economically non-productive and compete with funds for new investment projects. Therefore, as the number of Japan's senior citizens was increasing, the provision of such generous retirement benefits must have caused serious economic burdens on Japan and retarded its economic growth.

III. NEGATIVE ASPECTS OF CHINA'S ECONOMY

Now we turn to negative aspects which have been caused by China's recent economic growth or remain as deadweights to stifle its future progress. These features are presented in Table 2.

From the outset, it should be pointed out that China has a large surplus fund for improving its economy without adversely affecting its current growth. In 2011, China had a \$3 trillion total reserve fund in monetary gold, foreign currencies, and IMF special drawing rights. China can use these funds immediately in order to dismantle the existing economic inefficiencies and increase the social welfare of its people.

First, in spite of the past radical reform, China's economy is not fully attuned to the modern industrial system and still suffers from an antiquated structure. One piece of evidence of this predicament is the World Bank's data on the 'index of ease of doing business,' which ranges from 1 (the easiest) to 185 (the most cumbersome). In 2011, this index was 91 for China and 20 for Japan, meaning that it was 4.6 times more time-consuming and difficult to conduct business in China than in Japan. One may be tempted to attribute China's burdensome business practices to Asian tradition or Asia's reluctance to adapt to Western-style business

¹²A. report by Federal Reserve Bank of Cleveland (2005).

¹³Hannum, Behrman, Wang, and Liu (2008:215).

¹⁴Sheen (2013).

Table 2:

| Negative aspects | CHINA | | | JAPAN | | |
|--|-----------------|----------|--------|----------|----------|--------|
| | 1990 | 2011 | growth | 1990 | 2011 | growth |
| Total reserve(\$billion) | NA ¹ | \$3,255 | | NA | \$1,296 | |
| Ease of doing business index ² | ND ³ | 91 | | ND | 20 | |
| Income share by top 10% ⁴ | 25% | 32% | 7% | 22% | ND | |
| Income share by lowest 10% ⁵ | 3% | 2% | -1% | 5% | ND | |
| Poverty headcount ratio ⁶ | 60% | 12% | -48% | ND | ND | |
| CO ₂ emission(megaton) ⁷ | 2,461 | 7,687 | 212% | 1,095 | 1,101 | 1% |
| Energy imports ⁸ | -1.6% | 8.6% | 10.2% | 82.9% | 80.5% | -2.4% |
| Health expenditures per capita | NA | \$281 | | NA | \$4,255 | |
| Education per capita ⁹ | NA | \$16 | | NA | \$1,238 | |
| GDP per labor | \$2,562 | \$14,196 | 454% | \$36,173 | \$44,567 | 23% |
| Urban population | 26% | 51% | 25% | 77% | 91% | 14% |
| Forest land ¹⁰ | 17% | 22% | 5% | 68% | 69% | 1% |

¹NA, not applicable, means that only last year's data are relevant for the current study.

²Available only for 2011. This index ranges from 1, the easiest to 185.

³D means no data.

⁴Last year of this data for China was 2005. The first year for Japan was 1993.

⁵Last year of this data for China was 2005. The first year for Japan was 1993.

⁶Poverty is defined as income \$1.25 per day. Last year of this data for China was 2010.

⁷Last year of this data was 2009.

⁸% of total energy use.

⁹Last year of this data was 1999.

¹⁰Forest land as % of total land.

(Source of data: The World Bank/Economic Policy, Education, and Environment).

management. Yet it is interesting to note that China's two Asian neighbors, Singapore and Hong Kong, ranked 1 and 2 respectively, for this index. Thus, China's current in efficiency has nothing to do with its culture or tradition, but stems from its reluctance to dismantle completely the vested interests of the former central planning system. The ineffectiveness of central planning was amply demonstrated by the collapse of the former East Germany and the U.S.S.R. China must discard any remaining vestiges of the planned economy and modernize its structure in order to facilitate a smooth transition to the global market economy.

Second, China is still heavily saddled with unnecessary state monopolies even in areas of non-natural monopolies. Prices of the state monopolies are often determined by the average costs of production. This pricing policy in fact encourages an economic inefficiency. If the cost is higher, the higher the permitted price and higher profit ensue, and therefore, there are no incentives to minimize the costs. One piece of evidence of such inefficiency is the three times

higher wage of a worker engaged in the state monopoly than the wage of a comparable worker in a civilian firm. In addition, fixed price policy made the state monopoly unresponsive to market prices both for input and output¹⁵. This resulted in serious misallocations of resources. Often, the goal of the state monopoly was the accomplishment of an assigned quota within a specified time period and thus the issues of product quality and safety of work places were frequently ignored.

In fact, China enacted in August 2008 an anti-monopoly law in order to curtail the inefficiency of the state monopolies. However, the law was based on the "two-tier system" of one committee identifying the monopoly abuses and the other committee enforcing the anti-monopoly law. Precise delineation of duties and authority between the two committees were not clearly spelled out. In addition, both committees were part of the government entity, and were not totally

¹⁵Lai (2006:233).

independent from the interests of the government monopolies. Consequently, so far the effectiveness of the anti-monopoly law is very marginal¹⁶.

Third, as China's GDP increased exponentially in recent years, income distribution of its population became extremely skewed in favor of high income groups and against low income counterparts. Between 1990 and 2005 (last year of available data from the World Bank), the income share of the China's richest 10% increased from 25% to 30%, and income share of the poorest 10% declined from 3% to 2%. This means that almost one third of China's national income is owned by the top 10% of either successful entrepreneurs or people with political connections.

In fact, there are still significant numbers of people mired in extreme poverty in China. The World Bank defines poverty as people earning \$1.25 per day. In 2010, 12% of total Chinese population subsisted on this level of poverty, which means that more than 136 million people in China were totally denied of any benefits of its recent economic growth and survived with the same level of destitution as the least developed economy in the world. If the general public perceives, rightly or wrongly, that rich people attained their wealth through political connections or corruption, this income disparity may not only discourage work incentives of the poor but also will become potentially a very serious source of social instability in the future. China is keenly aware of this predicament and introduced a policy of rectifying it through a "scientific development" approach, without much success to date¹⁷.

Fourth, China's current level of corruption significantly reduces its economic effectiveness and the general welfare of its people. One indication of China's pervasive corruption is the World Bank data on the percentage of firms expected to make informal payments to public officials to "get things done." For China, this data is available only for 2003. In that year, China received 73% on this category of corruption, the third highest score in the world just below Cambodia (83%) and the Kyrgyz Republic (77%). Most of these informal payments remain in an underground economy. They encourage luxury consumption, often in imported foreign goods, and occur strictly through cash transactions having little impact on the productive side

of the economy. As the second largest economy in the world, China's rampant corruption at a level of the least developed economies of the world is a totally unacceptable phenomenon. China must implement its existing anti-corruption laws vigorously and universally in order to eliminate, or at least significantly reduce the current level of corruption, so that China can join the world community with pride and without apologies.

Fifth, China's expenditures on general health have not kept pace with the progress of its economy. Even in 2011, China's health expenditure per capita was \$281 compared with \$4,255 for Japan meaning that China's health expenditure was only about 7% of that of Japan. This inattention of China on general health was clearly reflected in various health related aspects. The Chinese and Japanese are almost identical in terms of ethnicity and customs. Yet, in that year, the infant mortality number per 1,000 live births was 12.6 for China and 2.6 for Japan. With a ten times larger population than that of Japan, China's actual infant mortality number is totally unacceptable in the contemporary world given readily available medicines as well as China's large surplus funds. In 2011, the life expectancy of the average Chinese citizen was 73 years, or ten years shorter than Japanese with 83 years. Judging by China's high infant mortality rate, we may infer that senior citizens of China enjoy not only a shorter life span but also a much poorer quality of life. Infant mortality and quality of life directly affect the general welfare of the people, and China now faces the urgent task of rectifying the basic health issues of its people.

Sixth, China grossly neglected general education of its people. For the year 1999 (this was the only available data for China from the World Bank), China spent \$16 per capita in comparison with Japan's \$1,238, thereby rendering the quality of China's general education to be only about 1.3% of that of Japan. This parsimonious expenditure of China was directly reflected in its overall labor productivity. In 2011, the GDP per worker was \$14,196 for China and \$44,567 for Japan, meaning that China's labor productivity was about 32% of that of Japan. The quality of education can be quickly improved upon by increasing the number of teachers and introducing computer-related educational aids, without major investments in social infrastructures.

Seventh, at an early stage of economic development, industries tend to agglomerate at major urban centers. The urban centers offer several

¹⁶Shi (2009:97).

¹⁷For a further discussion on this point, see Wu (2011).

economic advantages over rural areas. Large labor pools, especially of skilled and semi-skilled workers, are readily available at urban centers. The economies of scale due to a large number of firms operating in the same area reduce the cost of production. Many public utilities, including local transportation, gas and electricity, are provided by the government below costs in the urban areas, which are indirect subsidies to the firms operating at the urban centers. Such industrial cluster encourages a large scale labor migration from rural to urban areas. In China, only 26% of its total population resided in the urban centers in 1990 which became 51% in 2011, meaning that 679 million people resided at China's urban centers in 2011. To accommodate such a large influx of population, forest areas had to be cleared for housing and the related social infrastructures. As a consequence, in 2011, the percentage of total forest areas remaining in China was only 22% of its total land. In contrast, the percentage of Japanese urban population increased from 77% in 1990 to 91% in 2011, yet Japan was able to maintain 69% of its forest lands despite a large influx of people to urban centers. Consequently, the lack of forest lands became China's major source of ecological and health problems. China must lay out immediately a comprehensive urban planning strategy to discourage further rural-urban labor migration, as well as dispersing the existing industries to less congested areas by reversing economic subsidies from firms in urban centers to the firms in rural areas. The longer China waits for industrial dispersion, the higher the future costs of industrial dispersion will become.

Eighth, pollution and degradation of air quality in China is rapidly reaching to an almost intolerable level.

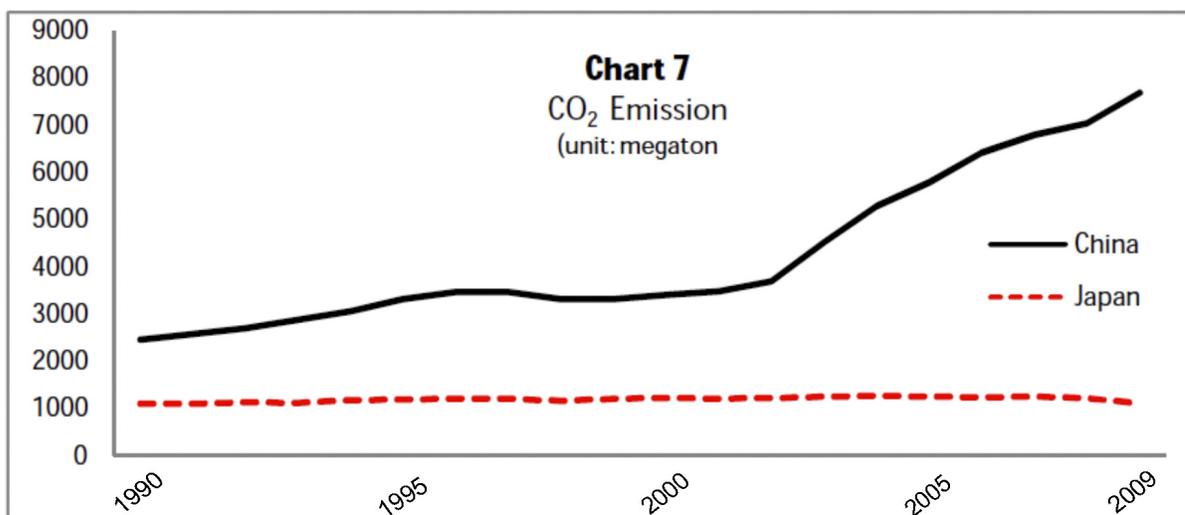
Chart 7 compares the increases in CO₂ emission between China and Japan.

Between 1990 and 2009 (last year of available data), China's emission of CO₂ increased 212% from 2,461 megatons to 7,687 megatons, and China became the largest polluter in the world accounting for 24% of the world total. In comparison, Japan's emission increased only 1% from the 1,095 megaton level to the 1,101 megaton level during the same period. In fact, in 2009, Japan's GDP was larger than China's GDP, yet China's CO₂ emission was almost seven times larger than that of Japan. The main sources for China's extreme level of pollution are the types of energy resources, especially fossil fuels, currently in use for its growing economy.

China used to be an important exporter of such energy resources, yet now China heavily depends on their imports. Since this subject has a direct impact on the world economy, we discuss it in a separate section below. It is imperative that the Chinese government introduces very stringent policies to control the pollution problem, including government subsidies to develop non-pollutant energy resources. In fact, in June 2013, the presidents of China and the U.S. (the second largest pollutant with 17% of the world total) agreed to significantly reduce the pollution of chlorofluorocarbons (CFCs), the most harmful ozone-depleting pollutant, to the level of the 1987 Montreal Protocol. Both countries must strictly adhere to the spirit and mandate of the agreement.

IV. CHINA'S IMPORTS OF ENERGY RESOURCES

China used to export energy resources, but now it became the world major importer of such resources.



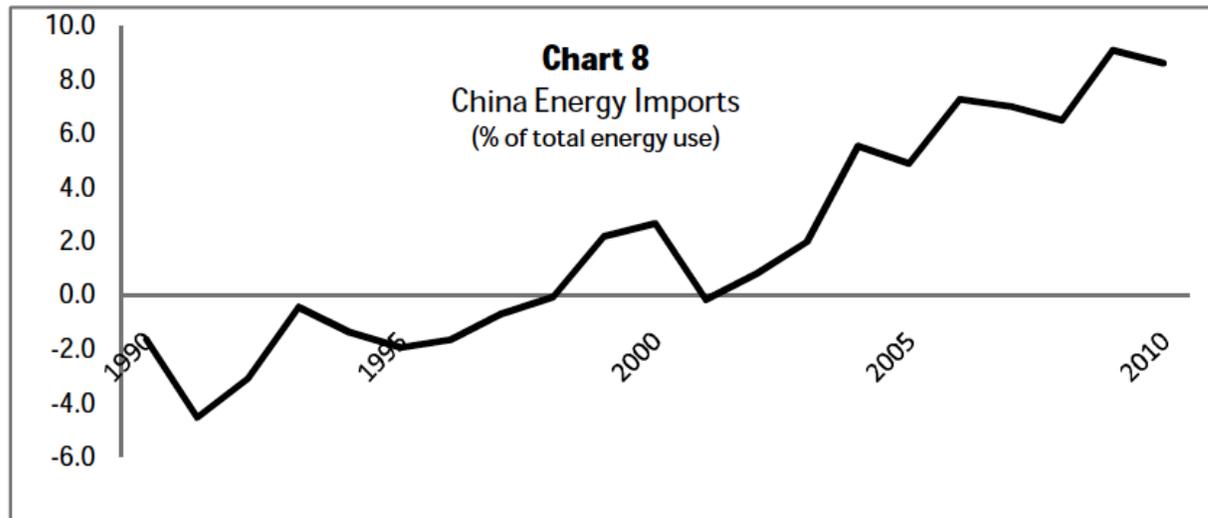


Chart 8 depicts a trend of China's imports of the resources in which negative values indicate exports.

Up to 1988, China was a net exporter, yet from 1999, China's dependency on imported energy gradually increased, and in 2011, 9% of China's total energy requirement was met by imports. In value terms, China imported \$2.8 billion of mineral fuel, lubricants and related materials mainly from Africa and South America in 2012¹⁸.

To analyze the main causes of China's growing dependency on imported energy, Table 3 compares energy uses between China and Japan. The main culprit for China's enormous demand for energy resources is China's extreme inefficiency in energy use. Even in 2010, China produced \$3.8 GDP per unit of energy use (measured in terms of per kg of oil equivalent), which may be compared with \$7.9 GDP for Japan, so that China's energy efficiency was about half that of Japan. In fact, China's energy efficiency was even less than the world average of \$5.5.

For comparison, we list the top five countries in the world with high energy efficiency. They are Hong Kong (\$22 per unit of energy use), Peru (\$13), Columbia (\$12), Albania (\$12), and Panama (\$12). These countries do not have significantly higher commercial technologies than China. There fore, China's energy inefficiency must be explained in terms of its energy sources.

Between 1990 and 2010, China's use of fossil fuel increased 12% from 76% to 88% of total energy use,

whereas for Japan, it declined 3% from 84% to 81% of total energy use. Yet, the dependency of the two countries on fossil fuel is reasonably similar. The main difference between the two countries is in the use of alternative energy, non-carbohydrate clean energy including hydropower, nuclear, solar, and geothermal energies. In 2010, only 4% of China's total energy came from the alternative energy, compared with 17% for Japan.

Why does China prefer fossil energy and continue to import this resource despite its energy inefficiency and serious pollution problem? The main components of fossil fuel are coal and crude oil. China is richly endowed with both resources, and China's economic structure is strongly influenced by the use of these resources. The coal industry is largely a government monopoly. Therefore, both government and workers in this industry have vested interests in maintaining the current production system and oppose adapting to new energy sources or technologies. China's strategy for obtaining energy resources was firmly established in its Long-term Energy Development Plan for 2004-2020, which encouraged the "two markets, two resources strategy", meaning obtaining the resources from domestic as well as overseas sources¹⁹.

Currently, China procures energy resources mainly from Africa and South America by carrying out joint ventures for exploration of new energy sources, rather than simply exploiting the existing energy resources, a common practice of previous western colonial powers with significant resentment and resistance on the part

¹⁸China Statistical Yearbook 2012.

¹⁹Teng (2010).

Table 3: Energy

| year | CHINA | | | JAPAN | | |
|---|---------|-----------|--------|---------|---------|--------|
| | 1990 | 2010 | growth | 1990 | 2010 | growth |
| GDP per unit of energy use ¹ | \$1.43 | \$3.77 | 164% | \$7.46 | \$7.94 | 6% |
| Total energy use (kt of oil equivalent) | 872,119 | 2,417,126 | 177% | 439,325 | 496,849 | 13% |
| Energy production (kt of oil equivalent) | 886,292 | 2,208,962 | 149% | 75,211 | 96,791 | 89% |
| Energy limports (% of total energy use) | -2% | 9% | 10% | 83% | 81% | -2% |
| Fossil fuel (% of total energy) ² | 76% | 88% | 12% | 84% | 81% | -3% |
| Combustible waste (% of total energy) ³ | 23% | 9% | -14% | 14% | 1% | -13% |
| Alternative energy (% of total energy) ⁴ | 1% | 4% | 3% | 14% | 17% | 3% |

¹Constant 2005 prices per kg of oil equivalent.

²Fossil fuel comprises of coal, oil, petroleum, and natural gas products.

³Combustible wastes comprise of solid biomass, liquid biomass, biogas, industrial waste, and municipal waste.

⁴Alternative energy is clean noncarbohydrate energy that does not produce carbon dioxide. It includes hydropower and nuclear, geothermal, and solar power, among others.

(Source of data: The World Bank/Energy & Mining).

of the exploited countries. However, with the dwindling new sources of energy, often such explorations entail desecration of ancestral burial sites or religious places, or dislocation of large populations. This may also engender social discontent in the affected regions and possible bitterness toward China.

In addition, China's ever increasing quest for energy resources encouraged China to explore new sources at remote islands in the South China Sea (SCS). However, the sovereignty over these islands are strongly challenged by six neighboring countries, including Taiwan, and indirectly by four outside countries with vested interests, including the U.S., for freedom of navigation and future explorations of undersea mineral resources. The U.S.'s vital interests in the SCS areas are clearly enunciated in 2007 by "A Comprehensive Strategy for 21st Century," which committed a large naval task force to the Far East. This force will be reinforced with forces to be withdrawn from Iraq and Afghanistan²⁰. Also, the government of Japan agreed in May 2013 on major rearmament of its naval forces, including a creation of new marine military units.

Thus, the SCS may become the third dangerous East Asian flashpoint after the Korean Peninsula and the Taiwan Strait for a possible super power entanglement. It will be much more productive, both economically as well as in international relationships, for China to encourage the growth of alternative energy

sources. China must quickly transfer necessary technology and infrastructure from Hong Kong, the most efficient energy user in the world, in order to significantly increase alternative energy.

V. REGRESSION ANALYSIS

So far, we analyzed various determinants of China's economic growth individually. Now we attempt to evaluate the *relative* importance of these determinants through a regression analysis between 1990 and 2011. All economic data are related to each other to a certain degree. In order to avoid a potentially serious problem of linear dependency among our explanatory variables, i.e., multicollinearity, we adopted a principle of parsimony in regression so that only three most important explanatory variables are introduced in the regression, namely, the GDP per capita, capital per labor, and research and development per labor.

The final estimated regression equation was:

$$\ln(\text{GDP}/L)_t = \beta_1 + \beta_2 \ln(K/L)_t + \beta_3 \ln(R\&D/L)_t + \varepsilon_t$$

where GDP represents Gross Domestic Product, K the capital, L the labor, R&D the research and development, ε the random disturbance term and t the years. We estimated this regression for the World total, China, and Japan. In addition, now that China is the second largest economy after the U.S. and there might be a certain degree of economic competition between China and the U.S. in the near future, we also estimated the regression for the U.S. as well for its comparison with China.

²⁰For potential conflicts in the South China Sea, see Simon (2012).

World Total:

$$\ln(\text{GDP/L}) = 3.06 + .375 \ln(\text{K/L}) + .613 \ln(\text{R\&D/L}) \quad R^2=.997 \text{ adj } R^2=.997 \quad F=3700$$

[t-stat] [7.31] [14.49]

China:

$$\ln(\text{GDP/L}) = 3.04 + .567 \ln(\text{K/L}) + .259 \ln(\text{R\&D/L}) \quad R^2=.996 \text{ adj } R^2=.996 \quad F=2626$$

[t-stat] [6.13] [3.85]

Japan:

$$\ln(\text{GDP/L}) = 2.19 + .395 \ln(\text{K/L}) + .667 \ln(\text{R\&D/L}) \quad R^2=.969 \text{ adj } R^2=.966 \quad F=301$$

[t-stat] [9.22] [23.00]

U.S.A.:

$$\ln(\text{GDP/L}) = 4.06 + .165 \ln(\text{K/L}) + .736 \ln(\text{R\&D/L}) \quad R^2=.996 \text{ adj } R^2=.996 \quad F=2320$$

[t-stat] [5.66] [27.72]

t=1990 to 2011.

We first note that all signs of the explanatory variables are correctly determined as expected, and judged by individual t statistics, all regression coefficients are statistically significant at 5% critical level of significance. A coefficient of a log-linear regression represents partial elasticity of an individual explanatory variable.

First, for the World, holding the R&D/L variable constant, every one percent increase in K/L increases GDP/L by .375%. Similarly, holding K/L constant, every 1% increase in R&D/L increases the GDP/L by .613%, implying that R&D/L is about 1.6 times more important for the increase in GDP/L. With these two explanatory variables, our regression with adjusted $R^2=.997$ accounts for almost all variations in the GDP/L.

In interpreting the regression results for China, Japan, and the U.S., we observe a very interesting phenomenon, i.e., the coefficients of the K/L are continually declining while the coefficients of the R&D/L are consistently increasing, over China, Japan, and the U.S. For China, the coefficient of K/L is more than twice larger than that of R&D/L, whereas for Japan, the coefficient of R&D/L is 1.7 times larger than the coefficient of K/L, and for the U.S., R&D/L is 4.5 times more important than the K/L variable. This observation suggests that for a mature economy where most of the profitable investment opportunities are fully exploited, subsequent economic growth mainly stems from additional research and development in order to create new investment opportunities.

For China at least at the present, there are still plentiful opportunities to create new profitable investments by investing in new capital, so that investments in capital yield larger return than investments in new R&D. It might be also possible that the quality of China's current R&D is significantly lower than that of the two mature economies. An indication to determine in directly the quality of the R&D is the number of researchers engaged in research and development. In 2009 (latest year with available data), the number of the researchers per million population were 863 for China, 5,180 for Japan and 4,673 for the U.S. in 2007 (U.S. data are not available for 2009), respectively, meaning that in the *relative* sense, there are six times more researchers employed in research and development in Japan than in China. These are the people who are engaged in improvements and creation of new technology and products, and strong competition among the mcreates products with high profitability.

VI. FUTURE PROSPECT OF CHINA'S ECONOMY

China has accomplished remarkable economic growth in recent years. Whether or not China will be able to maintain a similar rate of growth in the foreseeable future may depend on how well the country will optimize its indigenous economic advantages as well as overcoming many potential obstacles. We now discuss those socio-economic factors advantageous for China's future economic growth, followed by the adverse factors.

First, with a population of 1.3 billion, China possesses a very large domestic market. China must encourage consumption by its people, including internal tourism, by lowering general income and sales taxes, and imposing taxes on household savings and inheritances above certain threshold amounts. At the same time, in order to alleviate the general concern for retirement incomes and medical expenses, the government must introduce well-established retirement and medical insurance systems.

Second, in 2012, China holds \$3.3 trillion foreign reserves mainly invested in the U.S. government bonds. China can use the reserve more productively in such areas as acquiring high level technologies and education, including government-funded overseas education for its promising students.

Third, the new territory of Hong Kong is one of the best well-developed areas in the world in terms of international trade, banking, and high commercial technology. These economic advantages can be readily incorporated into China's total economic framework.

Fourth, China is currently the largest importer from the world. Any slowdowns of China's economy and its imports from the world may cause serious economic repercussions upon its trade partners. These countries may wish to sustain a continual economic growth of China, and this may serve as a certain degree of an insurance against a serious collapse of the Chinese economy. Therefore, China needs to maintain very favorable relationships with its trade partners not only in economic but also political interactions.

Now, in contrast, we turn to possible constraints on the future growth of China's economy.

First, the scale of China's exports of low tech products is almost reaching the point of satiation of its major trading partners, including the U.S. Any further significant increases in the exports may generate severe resistance or possible retaliation against China. Already serious protests were undertaken against imported goods from China in such disparate countries as Spain, Italy, Fiji, and Yemen²¹. This possibility reinforces the necessity of aggressively expanding China's domestic market and the promotion of high tech exports as partial substitutes for its low tech exports.

Second, China still maintains a one party political system. Currently, the Chinese Communist Party with its seventy-three million active members controls the government, police, courts, and the armed forces²². There are certain advantages of such a structure at an early stage of economic development. Major economic decisions can be quickly decided and implemented upon, instead of serious disagreements among the opposing interests under democracy. The best example is China's construction of the mammoth Three Gorges Dam in the Yangtze River, completed in 2006 by forcefully removing 1.3 million residents from their ancestral homesteads.

However, China is now entrapped in the vicious circle of its one party system. To justify and maintain the system, China must continuously deliver economic growth in order to appease the general public. Thus, current economic growth takes an absolute priority over all other issues²³. Modernization of the existing inefficient economic structures is postponed for fear of large-scale unemployment of its workers, and this makes future growth more costly in terms of materials and labor. To satisfy the increasing requirements for energy resources, China is exploring remote islands of the South China Sea, with potentially very serious international confrontations. The worsening environmental issues will become a serious economic burden in the near future.

As China's economy grows, social consciousness of its younger generations, who are fully attuned to world events through the internet, will also increase, and they will demand full participations in the government and economy, instead of sharing limited benefits of economic growth under the current one-party system. In fact, in order to appease the general public partially, China enacted the 1979 Election Law to allow independent candidates to stand for government positions. In the past, the Communist Party never lost elections at the national and regional levels. After the new law, despite enormous covert objections and pressure from the state, a few independent candidates did win elections and encouraged others to follow²⁴. Eventual democratization of China seems to be a matter of time rather than a hypothetical question. The issue is whether it will be a smooth transition or a violent one which may possibly reverse several

²¹Shambaugh (2013:201).

²²Porter (2011).

²³For a further discussion on this point, see Ong (2012).

²⁴Sun (2013).

decades of economic growth. Thus, China's internal political reform is a prerequisite for the continual growth of its economy.

VII. SUMMARY AND CONCLUSIONS

China's exponential economic growth in the recent years owed to the promotions of the following factors: foreign trades, foreign direct investments, capital formations, research and developments, tertiary education, and healthy growth of labor force. Yet, in spite of the economic growth, China is still saddled with many negative factors such as the antiquated managerial system, pervasive state monopolies, serious inequity in income distributions, public corruptions, and neglect of general health of its people.

With the currently available data, it may not be possible to assess the exact contributions of the individual determinants to the Chinese economy. However, China's recent economic accomplishments attest that impacts of the positive aspects were far greater than the negative factors. Nevertheless, these negative factors, if remaining unabated, will pose serious bottlenecks for China's future economic growth. China is keenly aware of these negative aspects, and is making serious efforts to eliminate them.

In fact, China is at the threshold to reassess its future priority. Marginal costs of China's future economic growth will significantly escalate. China's export markets are being satiated. Its pollution is reaching a level that causes serious health problems for its people as well as egregious environmental degradation issues for the world. The ever-increasing need for raw materials, especially energy resources, compel China to explore them at its remote islands whose sovereignties are strongly contested by several neighboring countries as well as distant super-powers.

Any military confrontations will certainly aggravate neighboring countries' good will and economic cooperation which China has strived assiduously to achieve in order to forge large free trade zones. China was once a victim of flagrant aggression by stronger external military forces, and now endeavors to be a champion for the weaker nations of the world. Thus, China's instigation of a military belligerence will be an antithesis to historical lessons, thereby causing it to face a greater condemnation by the world community.

The ultimate goal of economic growth is the maximum welfare of the people, and the GDP with

many serious contradictions in the matter of social welfare may not be the best index to measure economic growth. In fact, there is a growing consensus that a better indicator is a "social progressive index" which incorporates basic human needs, foundations of wellbeing, and opportunities²⁵. It is worth noting that currently China ranks in the 32nd position of the world in terms of the social progressive index as compared with the 5th place for Japan. With its large surplus fund, now is the propitious time for China to readjust its priority from the maximum GDP to the maximum social progressive index.

REFERENCES

- Breznitz, Dan and Michael Murphree. 2011. *Run of The Red Queen, Government, Innovation, Globalization, and Economic Growth in China*. New Haven: Yale University Press.
- Chan, Tomas, Noel Tracy, and Zhu Wenhui. 1999. *China's Export Miracle, Origins, Results and Prospects*. London: MacMillan Press.
- Cui, Zhiyuan. 2003. "China's Export Tax Rebate Policy." *China: An International Journal* 1(2): 339-349.
- Guo, Rongxing. 2009. *How the Chinese Economy Works*. New York: Palgrave Macmillan.
- Hannum, Emily, Jere Behrman, Meiyang Wang, and Jihong Liu. 2008. "Education in the Reform Era," in *China's Great Economic Transformation*, edited by L. Bandt and T. G. Rawski. New York: Cambridge University Press.
- Horioka, Charles and Junmin Wan, "Why Does China Save so Much?" 2008. Pp.371-391, in *China, Asia, and the New World Economy*, edited by B. Eichengreen, C. Wyplosz, and Y.C. Park. New York: Oxford University press.
- Huang, Yasheng. 2011. "The Role of foreign-invested Enterprises in the Chinese Economy: An Institutional Foundation Approach." in *China, the United States and the Global Economy*, edited by in S. Chen and C. Wolf. Santa Monica, CA: Rand.
- Kim, Joon-Kyung, Yangseon Kim, and Chung H Lee. 2004. "Trade and Investment between China and South Korea: toward a Long-Term Partnership." *Journal of the Korean Economy*. 5(1):97-124.
- Lai, Hongyi. 2006. *Reform in the Non-State Economy in China, the Political Economy of Liberalization Strategies*. New York: Palgrave Macmillan.
- Lawrence, Robert. 2008. "China and the multilateral Trading System," Pp.145-167 in *China, Asia, and the New World Economy*, edited by B. Eichengreen, C. Wyplosz, and Y.C. Park. *ibid*.
- National Bureau of Statistics of China. *China Statistical Yearbook 2012*.
- Ong, Lynette H. 2012. "The Apparent "Paradox" in China's Climate Policies, Weak International Commitment on Emissions Reduction and Aggressive Renewable Energy Policy," *Asian Survey*, 52(6):1138-1160.
- Porter, Robin. 2011. *From Mao to Market, China Reconfigured*. New York: Columbia University press.

²⁵<http://www.socialprogressimperative.org>.

- Prasad, Eswar and Shang-Jin Wei. 2008. "The Chinese Approach to Capital Inflows: Patterns and Possible Explanations," in B. Eichengreen, C. Wyplosz, and Y.C. Park, *ibid*.
- Reserve Bank of Cleveland. "Innovation and Education: Renewing the Northeast Ohio economy" 2005. a report.
- Shambaugh, David. 2013. *China goes global, the partial power*. New York: Oxford University Press.
- Sheen, Seongho. 2013 "Northeast Asia's aging population and regional security: Demographic Peace?" *Asian Survey*, 53(2).
- Shi, Lin. 2009. "Research on the Efficiency of China's Anti-monopoly Law," *Asian Social Science*, 5(2).
- Simon, Sheldon W. 2012. "Conflict and Diplomacy in the South China Sea: The View from Washington." *Asian Survey* 52(6):995-1018.
- Sun, Ying. 2013. "Independent Candidates in Mainland China: Origin, Development, and Implications for China's Democratization," *Asian Survey*, 53(2):245-268.
- Teng, Chung-Chian. 2010. "Democracy, Development and China's Acquisition of oil in the Third World." Pp.995-1018 in *Dancing with the Dragon, China's Emergence in the Developing World*, edited by D. Hickey and B. Guo. Maryland: Lexington Books.
- Wilson, Scott. *Remade in China*, 2009. New York: Oxford University Press.
- Wu, Guoguang. 2011. "China in 2010, Dilemmas of "Scientific Development," *Asian Survey*. 51(1). Pp.18-32.

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