Chinese Algebra: Understanding the Coming Changes of the Modern Chinese State

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Much is written concerning the impending hegemony of an emerging Chinese state that will dominate the world economically. Like its predecessors, the British and American empires, the Chinese empire will likely require a large military to ensure the continuity of this economic empire and thus possibly be a threat to the national interests of America and other democratic nations. A glance at the numbers behind these predictions supports a near certainty of China passing the United States in gross domestic product (GDP) by 2027,[1] but a closer examination reveals a much more complex mathematical function which does not paint such a positive picture for the Chinese nation-state.

Most people are uncomfortable with mathematical analysis and tend to examine trends by projecting straight lines or exponential curves out for a number of years, which will not give an accurate forecast. Nature typically gives us mathematical curves of a second or third order, not straight lines, requiring a more complex analysis. Curves for China in regards to economic output, military spending, and, most importantly, population, are not as favorable as some of the predictions warrant.

The first examination should be on the population curve as this has a major bearing on all other factors. China's draconian "One-Child Policy" is estimated to have prevented roughly 400 million births.[2] While not feeding this many mouths may benefit China today, it points to an irreversible trend of manpower shortages with economic and military consequences. Interestingly, China's current birth rate of 1.54 children per couple is close to the birth rate of other economically-established Northern Asian nations such as Japan with 1.20 and South Korea with 1.22. For comparison, the birth rate required for

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population replacement is accepted as 2.10 and the United Sates is currently at 2.06.[3] This shows a critical trend when population pyramids are compared for like years between China and Japan, 1990, 2010, and 2050 (see Figure 1).[4]

The pyramids for Japan 1990 and China 2010 are nearly identical, with only the size of the population being substantially different. Likewise, the pyramids for Japan 2010 and the projected curve for China 2050 are essentially identical and demonstrate the severe "graying" of the populace. We can then see the projected Japan 2050 curve will very likely be China's future with a vast elderly population being supported by an increasingly smaller young working population.

Using a statistical analysis, the similarity to the Japanese and Chinese population distributions is very apparent for both 1990:2010 and 2010:2050

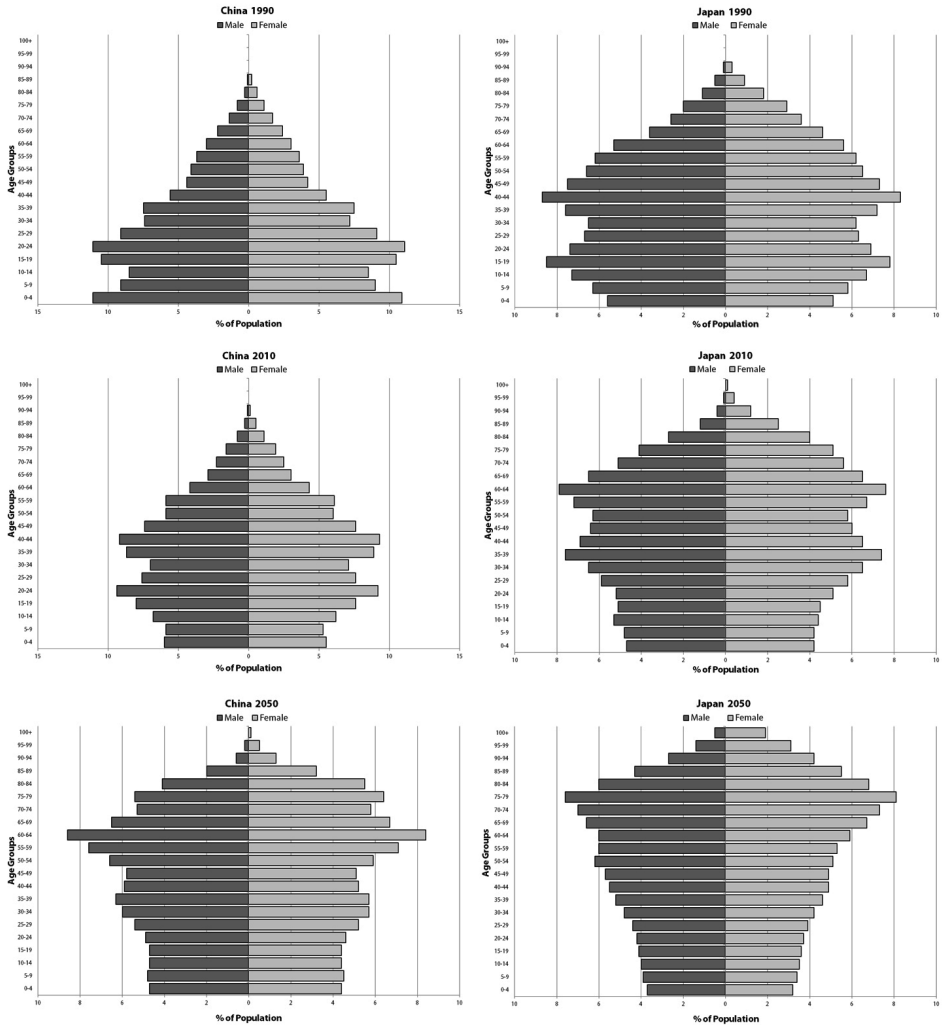

Figure 1. Population Pyramids for Comparisons of China and Japan in 1990, 2010, and 2050

comparisons. The Chinese population data was normalized to one-tenth the actual numbers for comparative purposes. Those with a background in statistics can note the high coefficient of determination (R^2) values resulting from a polynomial regression line applied to the population distribution curves. The curve of values demonstrated is considered to be "statistically significant" in both comparisons (see Figure 2).

For comparison, population pyramids for the United States are shown for 2010 and 2050 (see Figure 3). Notice the stark differences and the healthy number of working age populations compared to elderly.

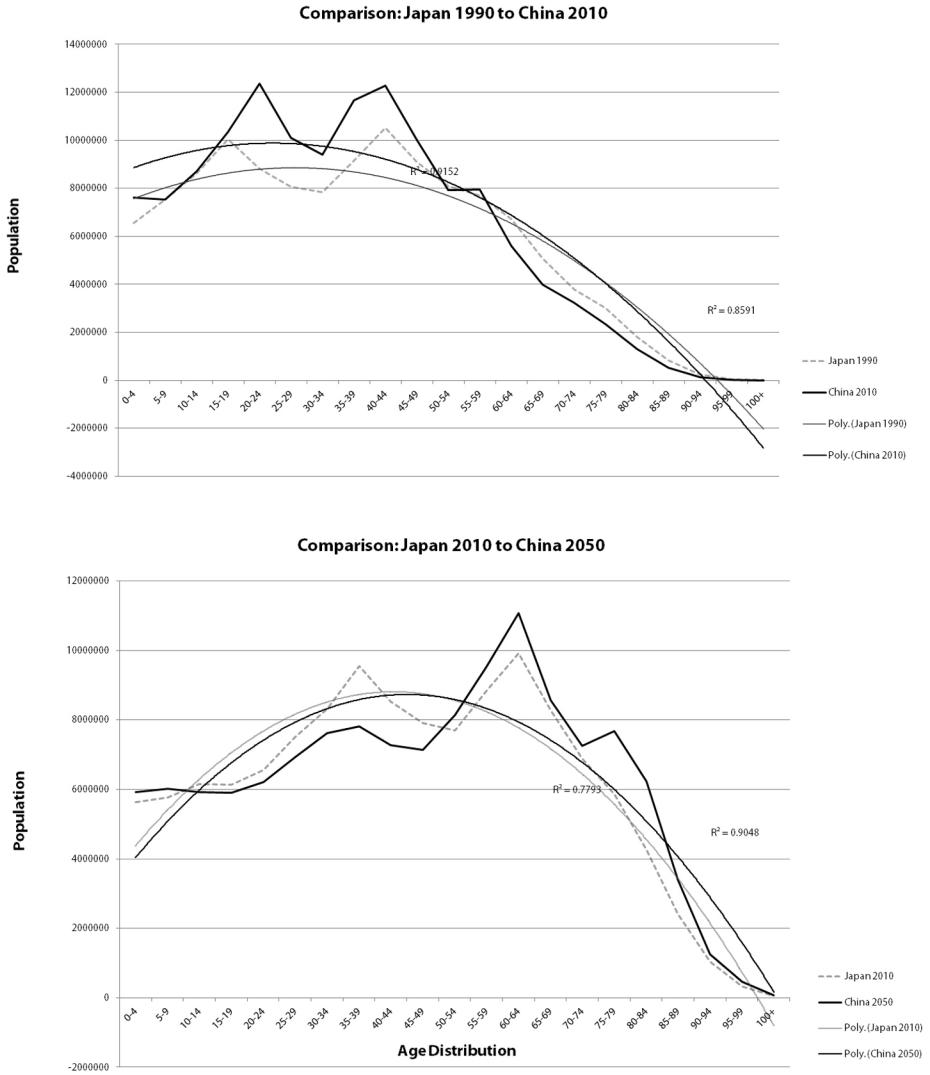

Figure 2. Comparison of Japan in 1990 to China in 2010 and Japan in 2010 to China in 2050

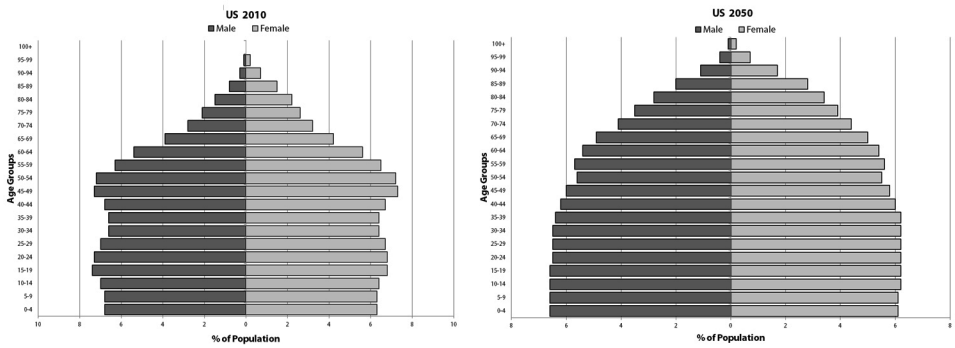

Figure 3. Population Pyramids for the United States in 2010 and 2050

This well-known population problem for the Chinese is titled the "4-2-1 family" meaning four grandparents supported by two parents supported by one child.[5] The strong correlation to the Japanese curve means we can hypothetically predict the future economy of China based upon the dire economic problems Japan is currently experiencing due to their population demographics.

After a spectacular rise from 1960 to 1990, Japan's economy tumbled and has best been characterized as moribund for the last 20 years with minimal growth and a deflationary spiral. Japanese growth was between 5 and 14 percent during the 1960s followed by 0 to 6 percent until the 1990s and has been just above zero for the last 20 years. The downward trend coincides with the drop-off in the working age population which is likely a key factor in the economic decline due to a lower-wage, young population transforming to a higher wage mature population and finally to a no-wage-higher-cost elderly population. Compare this with the Chinese GDP of 12 to 15 percent from 1980 to 2000 and in the most recent years reducing to less than 10 percent. Factor in that China's working age population is expected to start a decline about 2015[6] and the similarities of the trend lines are obvious.

Further information to dim China's bright future is the question of inflation and what the real statistics are vice the official government version. According to Dr. Derek Scissors from the Heritage Foundation, "From 2001 to 2009, both retail sales and personal savings rose far faster than household income. In other words, over a nine-year period, Chinese households appeared to be able to both spend much faster and save much faster than they earned."[7] This government obfuscation is not surprising in an authoritarian state and likely masks some fundamental economic concerns that are just beginning to leak out. We are well aware of the American and European stimulus packages that were injected into their economies as a result of negative growth in the fourth quarter of 2008. During this same time, China reported growth of almost 7 percent and yet created their own stimulus package that injected 4 trillion yuan (roughly $600 billion). State banks created $1.4 trillion in new loans or about 30 percent of GDP.[8]

This would normally be considered a foolish reaction by a government as it will certainly lead to inflation causing a bubble in the economy that will eventually burst. The only rational explanation could be that the government was keenly concerned with job creation and that even at 7 percent growth it was inadequate.[9] This is borne out by a report that 20 million migrant workers lost jobs in 2009.[10] Unemployed workers can create unrest, something an authoritarian government is keenly aware of and works to avoid. Additionally, the Real GDP (GDP minus inflation) is likely overstated since inflation should be increasing after such a large injection of liquidity in 2008/9. "[A] bust always follows a liquidity-driven boom" according to Dr. Scissors, and the Chinese government has taken several recent steps to try and cool off a property bubble that has formed in the major cities. It will not be surprising to see a severe real estate decline as happened in the West over the last three years and throughout Asia, except for China, in 1997. The Chinese government has recognized this hazard and worked to slow this speculative market without the loss of construction jobs impacting the economy. Signs of a slowdown are appearing with home prices falling in nearly two-thirds of China's major cities.[11] Even China's official government website acknowledged a severe inflation threat on 9 January 2008. China's inflation rate hit a new 11-year high of 6.9 percent last November. This high inflation rate would stagger any Western economy. The government worked to engineer a soft landing for the economy and inflation has now tamed to 3.6 percent for March 2012,[12] but growth has also slowed to an official target of only 7.5 percent. This means the real growth is a weak 3.9 percent, very healthy by Western standards, but much less than the Chinese average over the last 30 years.

Classic thought is that a strong military is required to safeguard a strong economy. Great Britain and the United States did this by strengthening their militaries into the strongest of their day and modern Japan and Germany did it by using the security umbrellas of alliances. China's military build-up is widely reported and perceived as a threat by many including the Chairman of the Joint Chiefs of Staff.[13] Many more feel that the United States must take steps to counter this threat from a "near peer" competitor.[14] What is the reality of a military threat from China?

Despite having four times the population of the United States, the Chinese military is relatively the same size when comparing active and reserve military at 2.8 million for the United States versus 3.0 million for the Chinese.[15] Like the United States, China has no compulsory military service, so unless they are going to start slapping rifles in the hands of untrained workers, this is what each would have in a current conflict. This single statistic, however, is as close to parity as the two countries get. The US defense budget is $663 billion (about 4.4 percent of GDP), while China's climbing budget will reach $99 billion (about 2.0 percent of GDP).[16] To put it another way, the U.S. spends as much on new weapons and equipment each year as China does on its entire military.[17] So while much is made of China's modernization in buying aircraft carriers or developing stealth planes, the low level of capability from which they are

rising means it will be a very long time, if at all, before they could overpower the United States in a conflict. Much has been made of the recent test flight of a Chinese stealth plane, but recall that the United States first flew a stealth plane when Jimmy Carter was president. The Defense Intelligence Agency (DIA) estimates the best 10 percent of the Chinese military will have equipment that is 20 years behind the capabilities of the United States military.[18] China does not even have the technology to manufacture their own commercial jet engines,[19] let alone many of the advanced technologies employed by the United States.

The dwindling pool of young recruits will not enhance the Chinese's military capability. The majority of young people would rather go into the more lucrative private industry. Wages are already surging in many parts of China as the labor market starts to tighten, going up 40 percent to $160 per month at one factory in Dongguan.[20] From 2003 to 2009 the average salary increase grew by 80 percent for migrant labor.[21] The military is fighting that same labor shortage and gave a 50 percent increase to all soldiers in 2009 to $133 per month for a new recruit.[22] As the labor pool shrinks, the military will either have to spend more of their budget on salaries or take lower-qualified recruits. Neither is a desirable option for a military trying to expand and equip with modern weapons.

This increase in wages and standard of living is quite normal as a nation converts from cheap manufacturing to higher value products and services. Japan and South Korea have both followed similar curves in the past and China should be no exception. In brief, export-oriented economies develop along a common path.[23] Export manufacturing first thrives due to large amounts of low-wage, unskilled labor. As the economy progresses, more value-added industries are introduced necessitating higher wages for skilled manufacturing workers. Productivity is increased through development of an educated white-collar management class. This increased efficiency allows for even greater wages. The increase in wages contributes to inflation, but as long as wage growth outpaces inflation everyone remains content.

This can only continue until certain things occur. First, the market for the goods manufactured becomes saturated. An example of this was the South Korean memory chip market. Overcapacity compared with world demand led this high-value manufacturing into a price war that resulted in flash memory drives dropping from an expensive personal device to a common item costing only a few dollars each. Secondly, the country runs out of labor to match the skill level required. This results in a bidding war among companies to hire the required labor, but the same company is constrained by the price it is able to charge for goods on the world market. Eventually, the manufacturing for that item moves outside of the country to take advantage of a low labor cost in an effort to make the item profitable. This is the reason there are few shoe manufacturers in America, Japan, or even South Korea. As Chinese workers' wages rise, they will eventually price themselves out of the world market for that item and will move on to a more value-added market. Lastly, younger workers will continuously enter the workforce. With nonskilled labor, all groups make the

same wage. For skilled workers, especially white-collar workers, there is an expectation of wages increasing with age due to increased experience and cultural expectations. Without younger, cheaper workers entering the workforce in the right proportion, the average labor cost will rise and lead to decreased competitiveness. This is currently exhibited in Japan where the aging workforce is expecting, but not receiving, higher wages. Wage growth there is achieved only through deflation, an undesirable effect.

So what are the implications of the above on China's future? As the country matures economically, wage growth is certain. This will be accelerated by the decreasing number of youth available to provide cheap labor. Existing migrant labor will go wherever the work is either in cities or rural manufacturing areas, but increasingly, they will be able to dictate their wage structure. The labor cost of Chinese goods will increase as a result and the world cost of Chinese manufacturing will increase until a competitor country can figure out a way to produce the same goods cheaper. According to *The Economist*, "Labor costs (including benefits) for blue-collar workers in Guangdong rose by 12 percent a year, in dollar terms, from 2002 to 2009; in Shanghai 14 percent a year."[24] Comparable figures for the Philippines and Mexico were 8 percent and 1 percent respectively.[25] The declining working age population in China compared to the increasing working age population in surrounding countries, particularly India, means an almost certain loss of export trade to lower cost countries.[26] The continued westward migration of low-cost manufacturing, from Japan, Korea, and China seems certain to continue to other countries west and south of China.

China has already launched multiple efforts to start higher-value manufacturing in new areas such as solar panels and wind turbines.[27] Again, this is typical behavior demonstrated by Japan and South Korea when they changed from basic manufacturing to the world's leading producers of advanced manufacturing in everything from cars to semiconductors. The Chinese are learning from the past and are not trying to become the world's cheap car manufacturer in a field where overcapacity already exists. Forays into emerging technology, such as renewable energy, are wise and reminiscent of South Korea's surpassing the Japanese in chip manufacturing in the 1990s.[28]

Nevertheless, China will still have an enormous requirement for unskilled labor to meet their internal needs. All of the so-called "dirty jobs" still need to be done for a population that is still increasing, but is less capable due to aging workers. Ten years ago, Japan and South Korea faced this dire need and overcame their desire for homogeneity by allowing Filipino and other Asian migrant labor into their countries. For China this is more problematic as an authoritarian state is generally not as comfortable with large groups of foreigners capable of fomenting unrest. One way out of this situation is increased productivity, especially in agriculture. Modern farm machinery and chemical fertilizers can reduce the need for farm workers, but only at an increased cost which is passed along in food prices or subsidized by the government. The price for this efficiency will be a higher internal cost of goods that China can only

offset by increasing its trade gap in an effort to generate additional income. As already noted, however, the income from low-tech manufacturing will be declining leaving only high-value items for export and the volume of goods will be decidedly less than in the past. It is likely China will need to accept a smaller profit margin in export trade. One way to make up for this loss in trade is to turn inward and increase domestic consumption, as many Western economies have done.

The question may well be asked—given all the facts concerning the changing demographics and resultant impact—who will fill the Walmarts with cheap plastic goods for western consumers? Just as in the past the world saw the center of cheap manufactured goods go from Japan in the 1950s to South Korea in the 1970s and to China in the 1990s, one would have to believe that this westward migration will continue. For while the Northern Asian nations are becoming older, wealthier, and high-value manufacturers, the opposite characterizes China's neighbor to the east, India.

For most of the twentieth century, since its independence in 1947, India was viewed as a country with an endless supply of people, but one that grew at an anemic 3 to 4 percent GDP and exhibited little potential to overcome its third-world status. That view began to change in the 1990s as India changed from a socialist state to a capitalist one. Removing the "license raja" and opening foreign trade allowed Indian business to become more entrepreneurial and created a boom that has lasted.[29] The previous weak growth rate has given way to a robust 8.5 percent of GDP in 2010. Although the Indian economy is only a fourth the size of China's, some economists predict that their growth rate could surpass China's by 2013 and expand even faster than other large nations during the next 25 years.[30] Critical to the thesis of this article is the projection that India will pass China as the world's most populated nation by 2025. India's population trend lies somewhere between a typical third-world developing country and the healthy 2.06 birth rate curve of the United States. The current Indian population pyramid is somewhat unhealthy at a birthrate of 2.7, as reflected in the triangular shape on the following graphs. The projection for 2050 rounds out the shape into one much more similar to the United States' "beehive" shape (see Figure 4). This shaping is directly related to India's increasing per capita

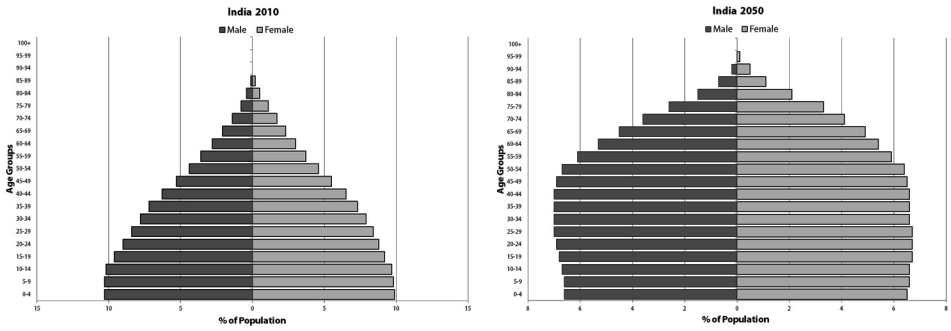

Figure 4. Population Pyramids for India 2010 and 2050

GDP and the same reduction in family size noted with other developed economies. Note how different the pyramids are from the Japanese and Chinese that reflect top-heavy aging populations.

So what does Indian algebra have to do with Chinese algebra? Simply that India's population rate is too high, but trending toward the healthy 2.1 rate while China's rate is already unhealthy and trending in the wrong direction. India will be a ready source of cheap labor for the world's manufacturers to depend on and will supplant Chinese manufacturing in that role. Other nations surrounding China also have cheap labor and are ready to replace Chinese manufacturers while India retains several key advantages in the conduct of international trade. India is the world's largest democracy and has demonstrated stability when changing governments and in time of crisis. India follows the rule of law when conducting business, and even more importantly for certain industries, has strong intellectual property rights, something for which China is famous for abusing.[31] Finally, the Indians have an expanding and educated middle-class capable of the productivity boost that results from good management of manufacturing and services. India also has another advantage that is little known. While much is made of the very high savings rate of the Chinese, Indian families actually have the highest in the world at 36 percent.[32] This provides a huge base of capital ready for investment in manufacturing infrastructure enhancing India's ability to rapidly build an industrial base through collective investment.

If this scenario is realized and India becomes the world's primary supplier of inexpensive quality manufacturing, what will China's reaction be? China could react militarily and enter into an expensive arms race in an effort to cow India into obsequiousness. A nuclear-armed India, however, is unlikely to fear a Chinese military threat. A more likely approach for China would be to economically co-opt India through significant investment in the manufacturing sector. Chinese firms may establish factories in India to take advantage of cheap labor where they would lose a good portion of the profit from self-manufacturing, but retain a small, yet significant margin from the ownership of manufacturing. This would be similar to Japan and South Korea's investment in China in the 1980s and 90s. As mentioned earlier, Chinese manufacturers would then need to establish themselves in the ever more competitive field of high-value manufacturing. Competing on the world market for cars and televisions may be difficult given the Japanese and Korean head start, but there is another market that China can control and use as captive consumers by selling to themselves. Although declining, the Chinese population will still comprise approximately 20 percent of the world's population and be a self-sustaining market for internal production provided they can successfully change their laws and regulations. The result of all this market turmoil will be a decoupling from the United States economy as America sends orders for Tupperware to India and China's export industry dries up. The political consequences of such action will be that it is no longer economic suicide for China to be involved in a conflict with the United States. While China will undoubtedly retain significant

US debt, much as Japan does today, it will not be the purchaser it is today. That honor will likely pass to India as it seeks an outlet for the cash infusion generated from a growing trade deficit with the United States. An increasingly codependent economy will strengthen a defacto US-Indian alliance even at the expense of displeasing some of India's neighbors, specifically Pakistan and China. This can create a strong presence in the region for US interests in Southern Asia, much as Japan and South Korea have done in Northern Asia.

The Chinese can "read the tea leaves" as well as any nation and change this hypothetical future; however, their ability to do this will be very difficult. China could possibly try to align itself economically with neighboring nations in an attempt to create a "virtual" Chinese workforce where Chinese companies use foreign workers in Chinese factories located in other nations in an attempt to continue the manufacturing of consumer goods. If China can accomplish this in a peaceful manner, and generate an economic sphere of trade, it will help stabilize the region and the world. What if China finds this scenario too difficult and decides to go back to the "old China"? China could remove their restrictive one-child policy tomorrow, but would that mean a sudden change in the demographic curve? Such actions are unlikely, as societies are much like ships, and reacting to directions dictated by leaders is accomplished in a very slow manner, much akin to changing the direction of a battleship. There is no reason to believe that undoing 40 years of draconian policy would change the world trend toward fewer children as a particular society becomes more affluent. The Chinese are likely to follow the trend of Japan and South Korea's anemic 1.20 birth rate rather than give up affluence and revert back to a land of peasants and workers requiring multiple children in an effort to ensure economic support for the family and a social safety net. It will be up to China's totalitarian government as to how they will maintain the "iron rice bowl" without generating unrest. The path forward will be a tricky one, a path that has never been tread by a nondemocratic government. Transforming a country takes patience and skill, but it can be done as demonstrated by Japan and South Korea. If China is to be successful in this transformation, they must act soon. The mathematics of the algebraic curve dictates that a dramatic change is required.

Notes

1. "The country of 1.3 billion people will overtake the U.S., where annual GDP is about $14 trillion, as the world's largest economy by 2027, according to Goldman Sachs Group Inc. chief economist Jim O'Neill," *China GDP Surpasses Japan, Capping Three Decade Rise,* Bloomberg *Businessweek,* August 16, 2010, http://www.bloomberg.com/news/2010-08-15/japan-economy-grew-annualized-0-4-in-second-quarter-less-than-estimated.html (accessed April 12, 2012).

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