

A Half Century of Trans-Pacific Competition:

Price level indices and productivity gaps for Japanese and U.S. industries, 1955–2012

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Are there productivity gaps between Japan and the United States? Along with Professor Dale W. Jorgenson of Harvard University and Jon D. Samuels of the U.S. Bureau of Economic Analysis, RIETI Faculty Fellow Koji Nomura analyzed the productivity gap for 36 industries in Japan and the United States over the approximate 60 years since the end of World War II. With only about 50% of the productivity of the United States in 1955, Japan experienced a period of rapid economic growth and quickly became a rival until the beginning of the 1990s. However, Japan's current productivity has been pushed back to its level at the beginning of the 1980s. Whereas Japan's productivity in the motor vehicles industry and medical care is relatively high, it lags behind the United States in such industries as wholesale/retail, agriculture, and electricity/gas. Nomura emphasizes that with the broad agreement of the Trans-Pacific Partnership (TPP) negotiations, now is the time for Japan to identify the potential for growth in industries with low productivity.



Profile

Koji Nomura has been an associate professor at Keio Economic Observatory, Keio University since 2003. He became a faculty fellow at RIETI followed by visiting senior research fellow, Economic and Social Research Institute, Cabinet Office. His recent works include: *APO Productivity Databook*, Keio University Press, 2015 (co-authored with Fukunari Kimura); "The Japan-U.S. Price Level Index for Industry Outputs," RIETI Discussion Paper, 15-E-059, 34p, May 2015 (co-authored with Kozo Miyagawa); "Measurement of Quality-Adjusted Labor Input in Japan, 1955–2012," KEO Discussion Paper, No. 133, 144p, December 2014 (co-authored with Hiroshi Shirane); "Labor Productivity and Quality Change in Singapore: Achievements in 1974–2011 and Prospects for the Next Two Decades," KEO Discussion Paper, No. 129, 55p, September 2012 (co-authored with Tomomichi Amano).

A Half Century of Trans-Pacific Competition: Price level indices and productivity gaps for Japanese and U.S. industries, 1955-2012

DP No. 15-E-054

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<http://www.rieti.go.jp/publications/dp/15e054.pdf>

Research Digest

— I can understand how the difference in competitiveness between Japan and the United States is reflected in the price gap of the products produced. The party that can produce at lower cost is more competitive, but how did you calculate the price gaps for the 36 industries?

The U.S. dollar (USD)/Japanese yen (JPY) exchange rate where an identical good in both the United States and Japan has the same price in the same currency is called the purchasing power parity (PPP). A well-known form of PPP is that for the gross domestic product (GDP) which is used for international comparison. The International Comparison Program (ICP) implemented by the World Bank and the Organisation for Economic Co-operation and Development (OECD) covers the products composing final demands.

Since our objective is comparing the productivity of industries, we will not measure the price gaps at the consumption stage, but rather at the production stage. However, it is only possible to directly observe the producer prices of limited goods. Therefore, for many products, a price model that associates the price gap experienced by the purchaser with the price gap of the producer must be developed. When surveying prices at the purchasing stage, added distribution margins and transportation costs must be accounted for, and understanding that imported goods are also included as well as domestic goods.

Wholesale and retail margin rates are estimated in both countries, but there are problems with their accuracy. For example, according to Japan's 2005 Input-Output (IO) Tables, the retail margin rate for perishables, fruits, and meat was about 10%. Thinking that this was too low, we re-estimated the margin rates for each good using the micro data of the Census of Commerce by the Ministry of Economy, Trade and Industry (METI) and found that the rate was actually about 30%. In the 2011 IO Tables that were released in June 2015, some of these margin rates have been corrected.

Also, intermediate goods such as semiconductors are not included in the final goods survey by the ICP. Since many countries confront these data restrictions, productivity gaps are estimated only at the aggregate level. However, in Japan, METI started accumulating data from the Survey on Disparities between Domestic and Foreign Prices of Industrial Intermediate Inputs in the 1990s. This price survey for intermediate goods is vital data that serve as the core for our estimates.

Even in the same industry, the percentage of import by good and the importing country differs between Japan and the United States, as does the import price. In order to systematically describe price models, my colleagues from the project in RIETI, including Associate Professor Kozo Miyagawa, devoted two years to constructing an expanded Japan-U.S. Input-Output Table (174 categories) based on METI's 2005 table. Using this extended table as a benchmark, we removed the impact of margins and import goods from the PPP survey results for final goods and intermediate goods. By considering imports from six

exogenous countries (China, Germany, Korea, Malaysia, Taiwan, and Thailand) and mutual trade between the Japan and the United States, we are able to obtain producer prices by product, and reflect the components of products by industry production (by supply/make table), thereby allowing us to estimate production price by industry in both the United States and Japan. This index of basic prices for domestic production (output) becomes industry-level price indices for competitiveness.

— You've also calculated the prices of products consumed in each industry. And, you have developed indices for input prices, what does this mean?

Input price gaps in addition to output price gaps are needed to calculate productivity gaps. The acronym for production input factor groups is KLEMS. "K" is for capital, "L" is for labor, "E" is for energy, "M" is for material, and "S" is for service. We measured the price gaps for each KLEMS in each industry in the United States and Japan. As with products, we estimate the PPP for factor inputs, such as labor and capital, when consuming the constant-quality volume of services. These types of measurements are rarely conducted in the rest of the world, and it's only possible because of the detailed databases that are developed with a methodological harmonization between the United States and Japan.

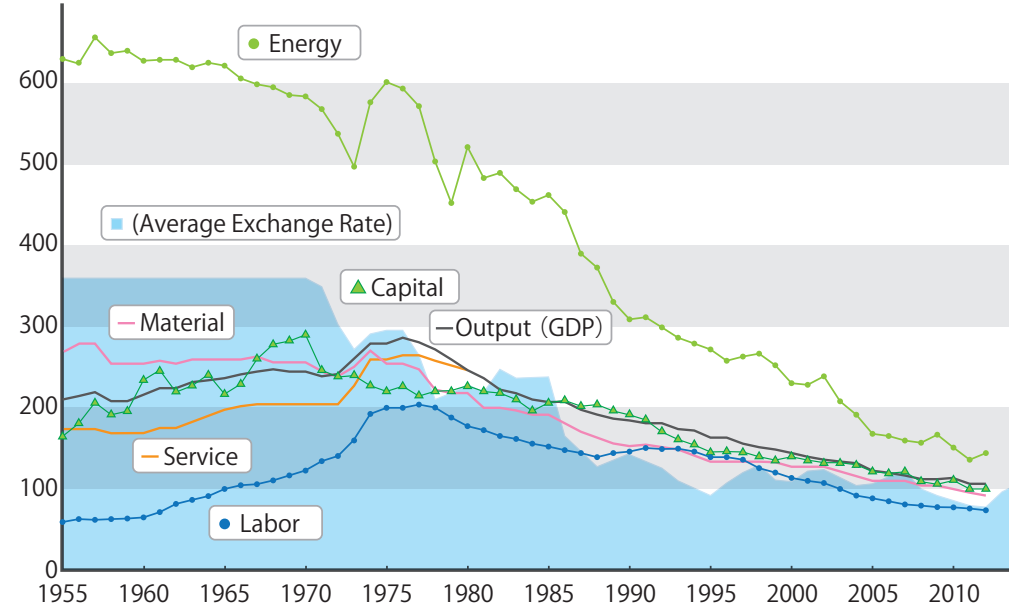
The price level index (PLI) is calculated as each PPP divided by the exchange rate. We use the exchange rate to determine the superiority or inferiority of price competitiveness. For example in 1955, the PPP for GDP (aggregate output) was 210.2 JPY per USD. The exchange rate at the time was 360 JPY/USD. Therefore, the PLI of GDP was 0.58, indicating that Japan's price competitiveness was approximately 40% above that of the United States. In other words, the yen was undervalued, thereby creating an environment conducive for exporting.

— What trends have you found in price levels between the United States and Japan?

Figure 1 (P. 22) gives you an easy-to-understand bird's eye view of environmental changes that the Japanese economy has faced in terms of price gap. It shows our PPP estimates for output price and KLEMS inputs. The blue shadow is the market exchange rate.

When the black solid line indicating output price is below the blue shadow presenting the exchange rate, overall price competitiveness is superior to the United States, thereby indicating that the yen is undervalued. In contrast, when it is above the blue shadow, Japan's production price is higher than that of the United States (PLI exceeds 1) thereby indicating that the yen is overvalued. After the Plaza Accord, Japan was faced with disadvantageous conditions, and, in 1995, the yen was overvalued by 75%. Corrections were made thereafter, but with the strong yen following the collapse of Lehman Brothers, Japan's price competitiveness once again decreased substantially.

Figure 1: Changes of PPP for Output (GDP) and KLEMS at National Level (1955–2012)
(Japanese Yen/US Dollar)



In terms of input price for example, if we look at labor cost (the dotted blue line), we see that labor in Japan was quite cheap during the 1950s and 1960s. The cost of labor for the same quality when one USD equaled 360 JPY was 50 JPY. That's 1/7 that of the United States. During this period, companies maintained price competitiveness with low wages. The cost of capital (green triangle line) was much higher than labor costs during the 1950s and 1960s, but the rate of return decreased in conjunction with economic growth, causing the user cost of capital to fall to approximately the same level from the late 1970s.

Since the beginning of the 1990s when Japan's economy entered a long period of stagnation, the price of all input factors was relatively high as a result of the strong yen, which was a big cause of the long-term stagnation. Then, after the global financial crisis, the yen continued to be strong, thereby causing wages that had continued to decrease since the end of the 1990s to become relatively high, but as can be seen, this was corrected by Abenomics.

— What have you learned about the price competitiveness of each industry?

We compiled results for 36 industries, and if we look at the PLI for the 2005 industry-based value added (net output), we see that the agriculture industry in Japan is about 3.9 times higher than that in the United States. Real estate is two times higher and airline service is 2.5 times higher. Meanwhile, the motor vehicle industry and medical care industry in Japan are 50% and 60% cheaper respectively than that in the United States. If we look at Japan's industry-based contribution to price competitiveness, we see that Japan's position is inferior to the United States by approximately 13%, and approximately half of this (six percentage points) is derived from wholesale/retail industries.

As you can see in Figure 1, regardless of the time period, the price of energy in Japan has always been more than twice of that in the United States. This higher price of secondary energy is not necessarily based on more expenses on fuel, such as natural gas and coal. The added value PLI of electricity and gas is 3.8 times that of the United States. It is assumed that this is because Japan is faced with a 20% to 30% higher cost of capital required to improve power generation efficiency by only a few percent. Higher performance contributes to energy productivity, but as we will look at later, it doesn't always lead to improvement in total productivity.

— What relationship did you find between output price, input price, and productivity gaps, which is the main focus of your research?

If the input price is the same and the output price is cheaper, productivity will be superior. And even if you're faced with a high input price, if you can achieve an equal production price, productivity will be superior. Subtracting the output price gap from the input price gap for aggregated KLEMS will give you the gap in total factor productivity (TFP).

Figure 2 shows changes over time for productivity gaps between the United States and Japan broken down into two categories: manufacturing and nonmanufacturing. When the value is less than one, it means that Japan's productivity was lower than the United States. In 1955, Japan's productivity was 50% lower than the United States, and approximately 40% of this was contributed by the manufacturing industry. By the 1980s, Japan's manufacturing industry had caught up to the United States, and there was very little gap. Going into the 1990s, the yen became excessively stronger and all input factors increased in price thereby causing Japan to lose price competitiveness and experience decreased productivity once again. Meanwhile, following the collapse of Lehman Brothers, U.S. manufacturers

such as General Motors Company recovered. There is yet again another gap between the United States and Japan, and, currently, Japan's productivity is inferior.

— It looks like there is a considerable gap between the United States and Japan if we look at productivity by industry.

Figure 3 (P.24) is a graph that shows the changes in U.S.-Japan productivity gap for several industries.

In the 1980s, the U.S. agricultural industry saw remarkable improvement in productivity. In contrast, Japan's productivity remained almost the same for half a century. There are of course differences in the scale of individual production units, but the gap between both countries' productivity growth is most likely a reflection of the institutional inefficiencies of agricultural cooperatives.

Between the 1950s and the 1970s, the productivity of the U.S. chemical industry greatly exceeded that of Japan, but Japan quickly caught up, and both countries started to experience a gradual decline. If there's no superiority in terms of productivity, the United States will be more advantageous in terms of price competitiveness due to cheaper input prices such as the price of electricity. Japan has overtaken the United States in terms of primary metals, such as iron and steel, but productivity has recently dropped off. There is a concern that this change to inferior productivity is the direct result of rising electricity costs.

In the 1970s, Japan's motor vehicle industry caught up to the United States and remained superior for a long period of time, but that gap has disappeared recently. The reason why U.S. motor vehicle manufacturers have not been largely critical of the recent weak yen may be because they have improved productivity. The productivity of Japan's communications industry quickly increased and surpassed that of the United

States due to deregulation and the promotion of liberalization in the 1990s, but Japan's productivity in this industry is once again stagnating. Productivity improvement in the U.S. wholesale/retail industry has far surpassed that of Japan due to the huge impact of information technology (IT) in the 1990s.

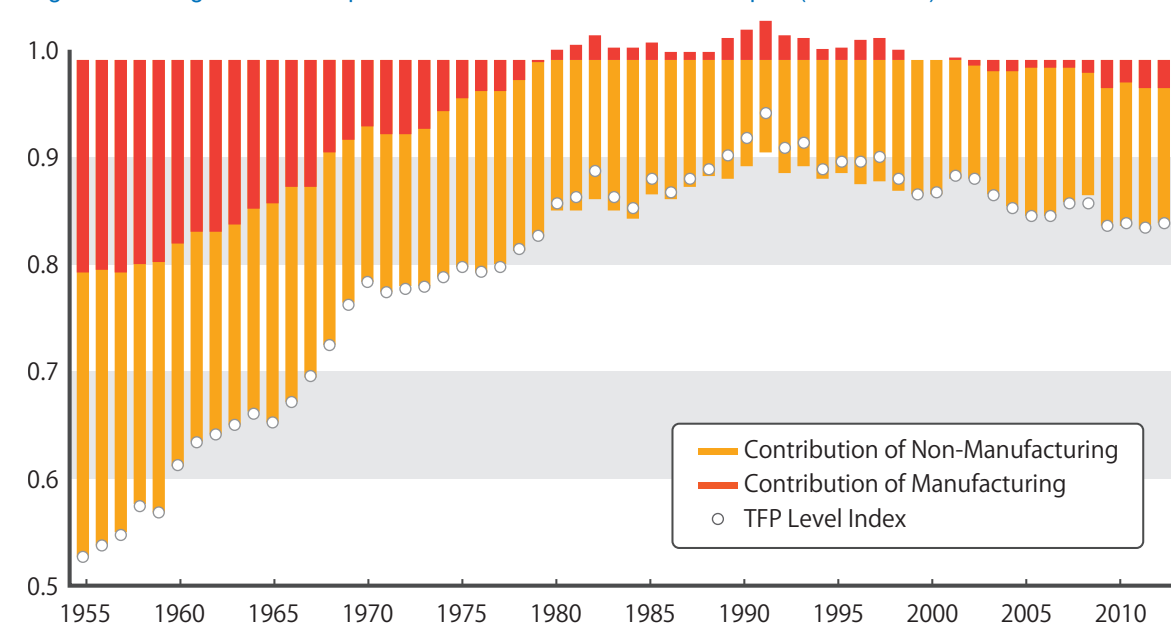
Japan's productivity in the medical care industry has remained constant while the United States has seen a steady decline in productivity since the middle of the 1970s. This is opposite from what is happening in Japan's electricity industry that has had inferior productivity due to high performance. The United States has a technically superior medical care industry, but it is very expensive and TFP has greatly decreased over the long-term. In contrast, Japan has continued to provide good service at a good price. There are problems with how the quality of the medical care industry is measured, but I do not believe that they impact these trends.

— What is the difference between research you have done in the past and this research?

Research on productivity gaps between the United States and Japan began in the 1980s. The base model was devised by Professor Jorgenson, Keio University Professor Masahiro Kuroda, and Mieko Nishimizu who later served as vice president of the World Bank, and then was later improved upon. At the time, PLI was measured by taking amounts obtained from trade statistics and calculating the per unit price from quantity, however, this is unstable and there are limits to comprehensive analysis. With the hybrid approach, nothing could be learned in detail unless you meticulously calculated price differences for each good.

In 2007, Professor Jorgenson and I analyzed productivity gaps between the United States and Japan. At the time, we estimated the PLI benchmark estimate for 1990. With this research, we updated this value with the 2005 benchmark estimate.

Figure 2: Changes in TFP Gaps between the United States and Japan (1955–2012)



Globalization has spread greatly compared to 1990, so in looking at the relationship between the United States and Japan, the PPP system is constructed while considering the impact of the price of imports from China, Germany, etc.

Furthermore, what is unique about our recent research is that we calculated productivity gap by incorporating research and development (R&D) into capital input. Each industry engages in production by investing in capital services, such as R&D, but until now, it had been handled as an intermediate good. This concept was incorporated into the new system of national accounting (2008SNA), the international statistical standard for national accounts. Japan will switch over to using the new system as of the end of 2016, but we developed our own estimates using the latest data on R&D expenditures. As a result, all of the graphs, such as Figure 2, will shift up a little, and the time when Japan's manufacturing industry will catch up to the United States will be moved up. This means that the United States has been investing more in R&D capital and Japan has been producing efficiently with less input.

— What are the policy implications of this research?

The productivity gaps in each industry not only impact trade

competitiveness but also Japan's mid and long-term economic growth. Japan's productivity in industries that have been protected from international competition, such as agriculture and fisheries, electricity, wholesale/retail, etc., is remarkably inferior. And, if we consider the weight in terms of Japan's economy, the service industry, such as the wholesale/retail industry, contributes greatly and is an important area that should be given attention in order to improve economic efficiency. This type of systematic measurement enables us to identify not only the sources of Japan's inefficiency and price competitiveness but also the factors by product for each industry. It will serve as a kind of map or X-ray to determine strategies for economic growth.

If we look at input price, Japan's cheapest factor is still labor. Long-term economic stagnation forced wages down, but Japan's largest advantage in price competitiveness is labor service that is more than 30% cheaper. I think this will create new opportunities for competition for Japan's manufacturing industry, such as by attracting overseas manufacturers to begin production in Japan utilizing the high-quality labor. I think it's important that industries that still have room for improvement in terms of production efficiency take advantage of the TPP to move forward with reforms.

Figure 3: Changes in TFP Gap between the United States and Japan in Selected Industries (1955–2012)

