

The Evolution of ICT and Monetary Policy

Ryuzo Miyao

Professor, Graduate School of Economics, The University of Tokyo

A recovery in the Japanese economy centering on the corporate sector is ongoing, and economic growth potential and competitiveness are steadily increasing. The utilization of information and communications technology (ICT) is becoming increasingly entrenched, and this has significantly reduced the cost of innovation and communication. There is no question that further promotion of investment in and utilization of intangible assets such as ICT and research and development will be essential to increasing Japan's growth potential.

However, against the background of Japan's shortage of labor power, it is possible that the entrenchment of ICT as a general-purpose technology will result in the future replacement of numerous jobs and forms of labor by capital embodying new technologies. If the potential for substitution by technology increases, it will be economically rational for companies to control their allocation of funds to labor income. If this mechanism becomes stronger, it could suppress an increase in the labor share despite the fact that the total economic pie increases. We must consider the possibility that this will sap the momentum of the recovery in consumption and prices.

From the perspective of ensuring that Japan's economic growth potential continues to increase into the future, a 2% rate of inflation is a feasible target that we should continue to aim towards. However, it is predicted that the realization of this target will require a considerable amount of time. The necessary orientation for future monetary policy will be to flexibly but tenaciously maintain the existing framework, while also giving deeper consideration to both the effects and potential risk of adverse effects associated with the prolongation of monetary easing.

Japan's economy is continuing to display a recovery centering on the corporate sector, and the nation's economic growth potential and competitiveness are steadily increasing. The utilization of information and communications technology (ICT) is becoming further entrenched, significantly reducing the cost of innovation and communication. At the same time, however, household consumption remains cautious, and it is predicted that the realization of the 2% price stability target will require a considerable amount of time. In addition to discussing the diverse mechanisms by which the evolution of ICT affects such factors as economic conditions, prices, and labor share, this paper will examine the risk of adverse effects, for example in relation to public finance, which might arise from a prolongation of monetary easing. Finally, the paper will consider the desirable future direction for monetary policy management.

The Japanese economy continues to display a recovery centering on the corporate sector, but household consumption remains cautious

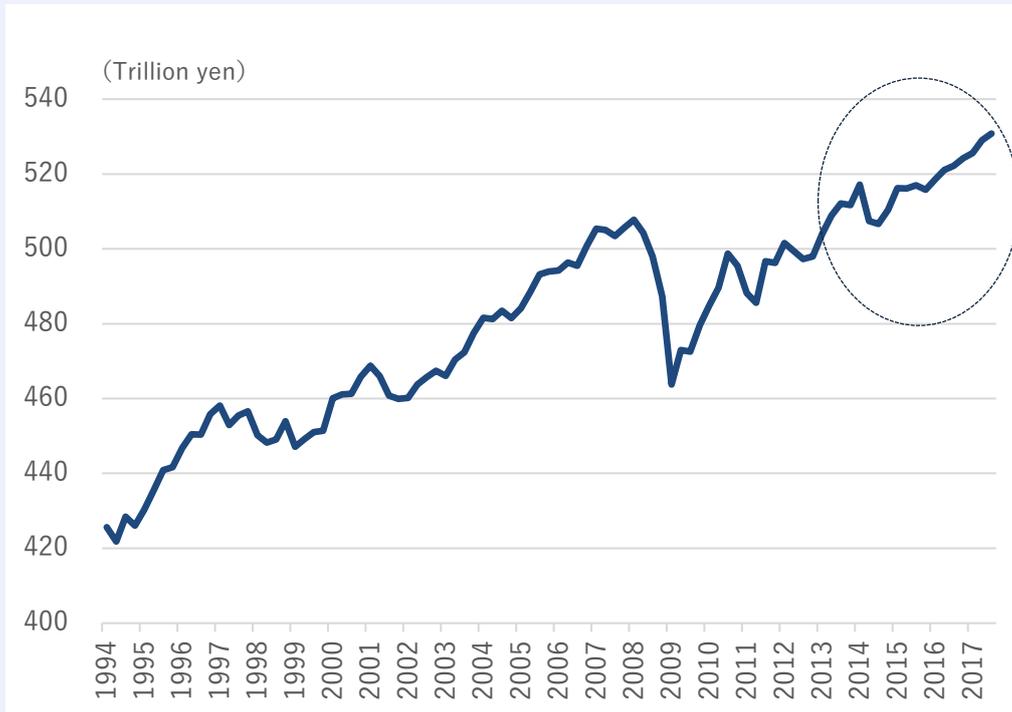
To begin, I would like to consider the current status of Japan's recovering economy. Overall, Japan's macro-economy is continuing to improve steadily (Figure 1). The corporate sector in particular is leading Japan's recent recovery. Corporate profits continue to improve, and domestic capital investment has also recently been displaying an increase (Figures 2 and 3).

In addition to recovery in overseas economies, the ongoing development of information and communications technology (ICT), to be discussed in the following section, cannot be ignored as a factor in the background of this improvement in Japan's corporate sector. Investment in ICT and the utilization of the technology are becoming more broadly entrenched, and as a result the cost of innovation and communication has been significantly reduced. A continuing positive supply shock is occurring, and this is contributing to increasing Japan's growth potential and productivity.

At the same time, however, household consumption remains cautious. From around 2012, the momentum of recovery in consumption expenditure increased, and this drove an increase in consumer prices. However, the anticipated ripple effect on wages was weaker than expected, and since 2014 the overlapping effects of factors including an increase in consumption tax and a decline in pension income (with the suspension of price indexation and the implementation of macroeconomic indexation) have also contributed to sapping the momentum of the upswing in consumption (Figure 4).

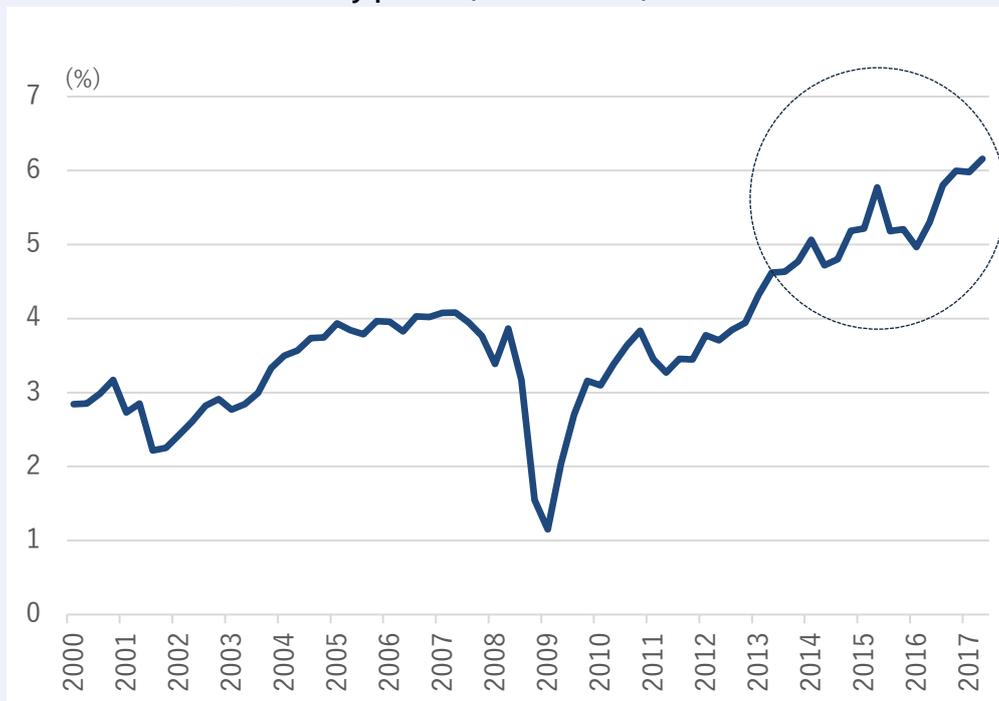
The overall economic pie is steadily expanding, and labor income itself is also increasing (Figure 5A). At the same time, the part of overall income represented by labor income (the labor share) is declining (Figure 5B). This means that many household budgets which rely exclusively on labor income are not experiencing the full extent of the recovery observed in the economy as a whole. As will be discussed below, it is possible that the development of ICT is acting as a factor suppressing increase in the labor share, and that this is exerting a heavy drag on the recovery of consumption.

Figure 1 The Japanese economy as a whole is experiencing an ongoing recovery
-Real GDP -



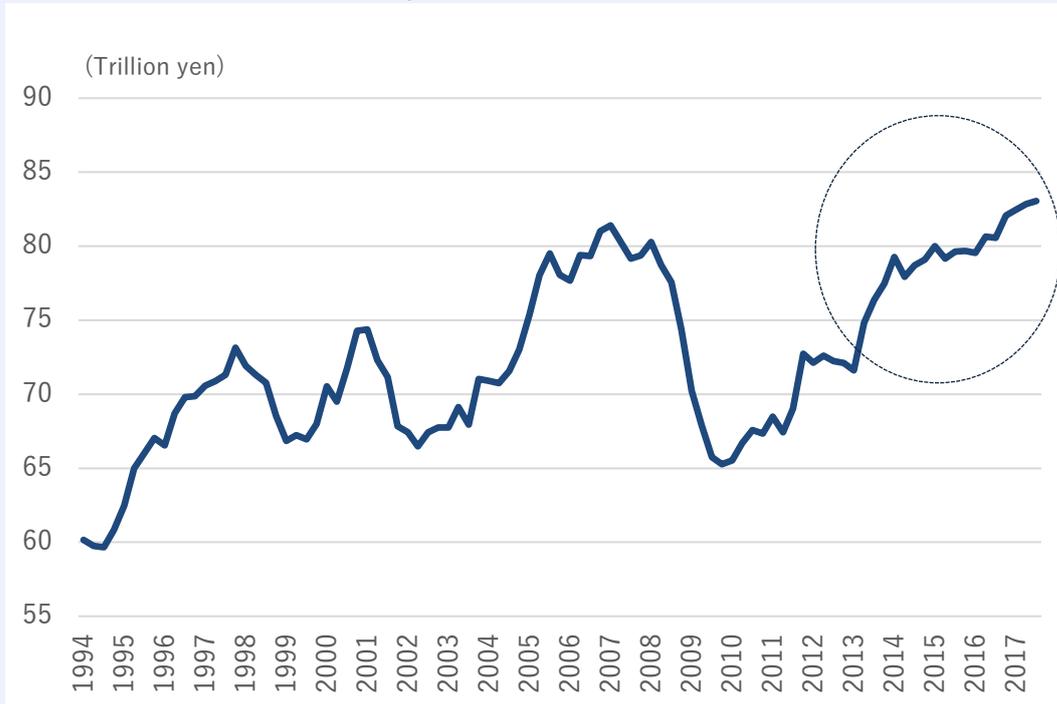
(Source) Cabinet Office, National Accounts

Figure 2 Improvement in corporate profits is driving this recovery
- Sales / Ordinary profits (All industries)-



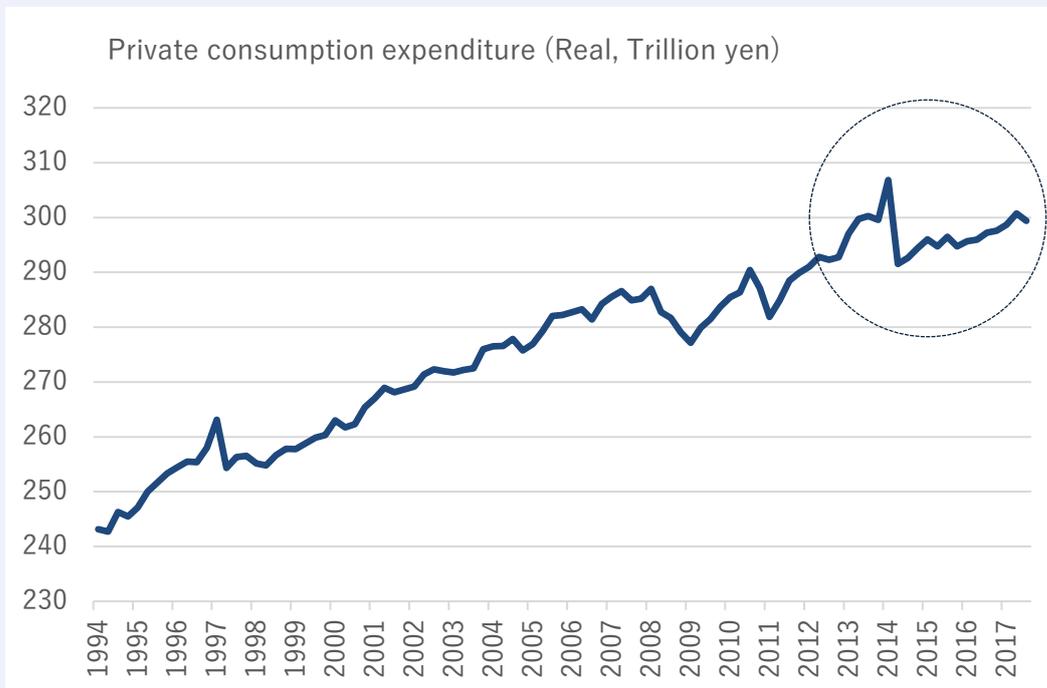
(Source) Ministry of Finance, Financial Statements Statistics of Corporations by Industry

Figure 3 Domestic capital investment has also recently become more vigorous - Private sector capital investment (Real) -



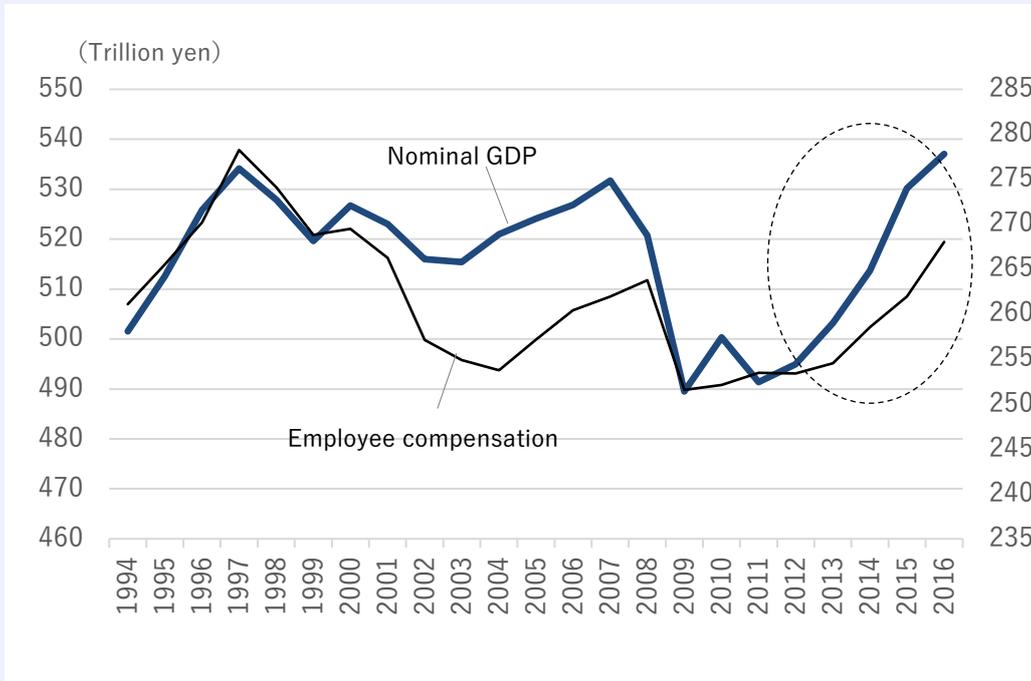
(Source) Cabinet Office, National Accounts

Figure 4 Household consumption remains cautious

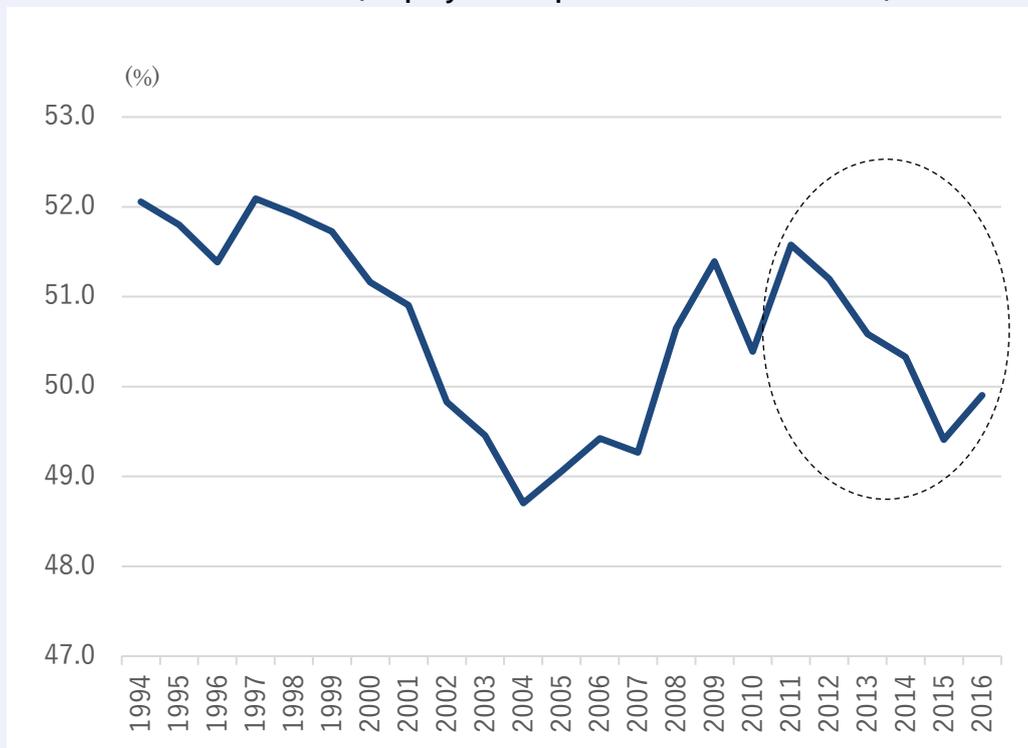


(Source) Cabinet Office, National Accounts

Figure 5 Labor income is increasing, but the labor share is displaying a decreasing tendency
- A. Nominal GDP and employee compensation -



- B. Labor share (Employee compensation / Nominal GDP)-

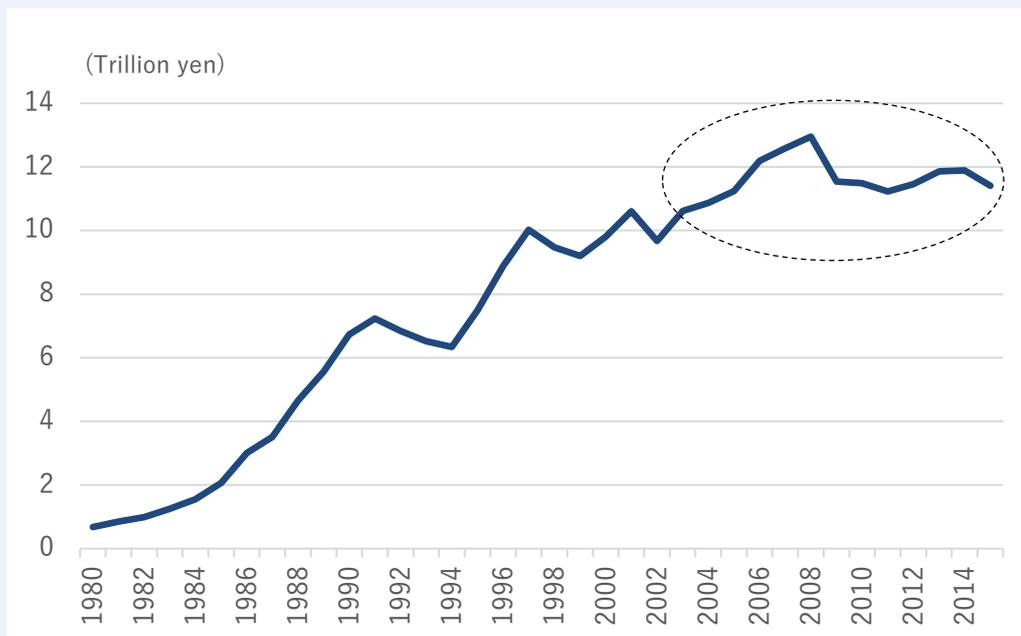


(Source) Cabinet Office, National Accounts

Factors including the development of ICT and investment in research and development are contributing to enhancing growth potential

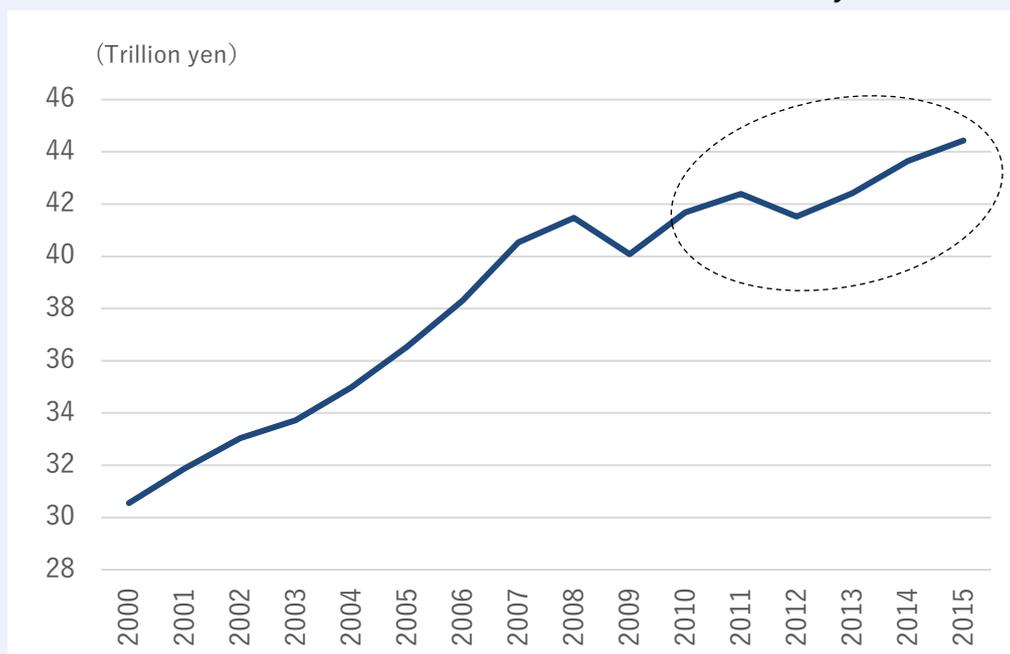
A brief overview of the development of ICT is in order. The awareness of ICT as a contemporary general-purpose technology and as a driver of ongoing growth is no doubt broadly shared. Today, mobile telephones and smartphones are widely diffused among the general public, and the so-called “Fourth Industrial Revolution,” centering on elements including the Internet of Things (IoT), Big Data, and artificial intelligence (AI), is progressing rapidly. The digitalization of the economy has penetrated to numerous areas of corporate activities and economic transactions, and these tendencies are becoming stronger day-by-day. Technological progress is reducing the cost of using and developing ICT, and this fact promotes further utilization of the technology. Aggregated data published by the Ministry of Internal Affairs and Communications show a high level of ICT-related investment, and a survey of ICT value added (real GDP) also indicates continuing increases (Figures 6 and 7).

Figure 6 ICT investment is maintaining a high level
 -Informatization-related investment (Real) -



(Note) Informatization-related investment = Computers + Software + Electronic communications devices; 2011 prices
 (Source) Ministry of Internal Affairs and Communications, 2017 White Paper: Information and Communications in Japan

Figure 7 ICT-related increase in GDP is also ongoing
-Real GDP of information and communications industry-

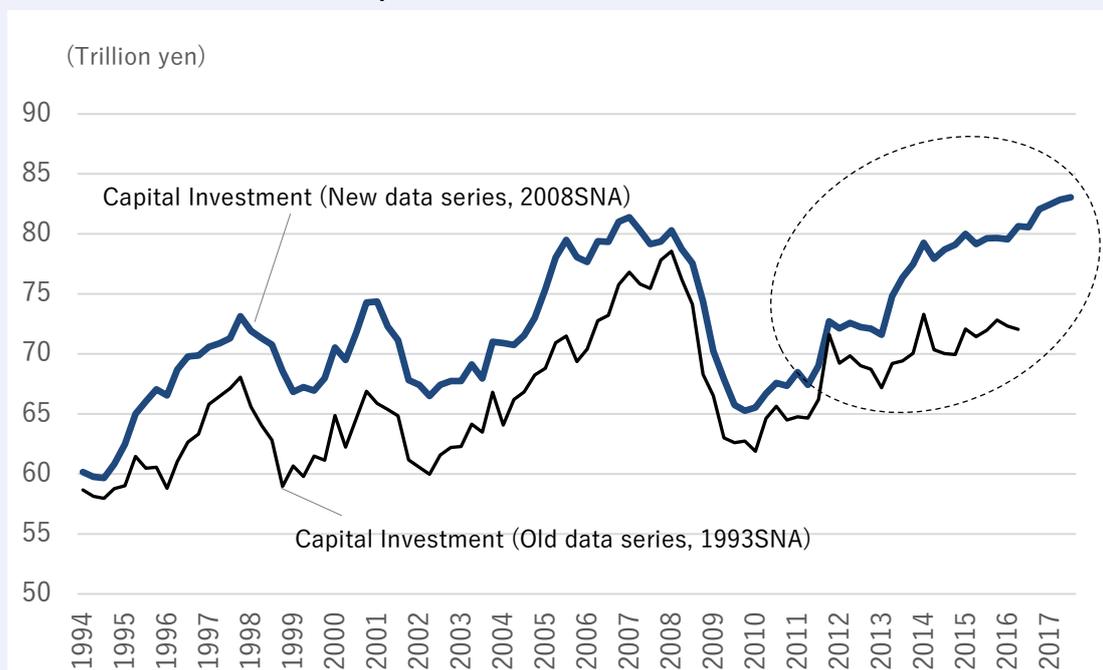


(Note) GDP of information and communications industry = Communications industry, information and communications-related manufacturing and service industries, research, etc.; 2011 prices

(Source) Ministry of Internal Affairs and Communications, 2017 White Paper: Information and Communications in Japan

Additionally, investment in research and development is increasing in vigor in step with the development of ICT. At the end of 2016, GDP statistical standards were updated to the System of National Accounts 2008 (2008 SNA), and investment in research and development was capitalized and came to be included in domestic capital investment. Figure 8 compares the new data series for corporate capital investment with the old series (1993 SNA, until 2nd quarter, 2016). The difference between the new and old series in this figure corresponds to investment in research and development. It can be seen that investment in research and development began to increase from around 2012, and this increase contributed to an expansion in domestic capital investment. Corporate research and development is further advancing trends including digitalization, robotization, and the development of the IoT, and is resulting in the further entrenchment of ICT in the economy. This is further driving down the cost of innovation, providing impetus to the development of new products and new services. Capital accumulation is proceeding against the background of this mutual influence of research and development and ICT, and this has created an environment contributing to the enhancement of growth potential.

Figure 8 Investment in R&D is contributing to the invigoration of domestic capital investment –Corporate capital investment – Old and new data series: The difference represents investment in R&D –



(Note) New data series: 2008 SNA (1994-2017; 3rd quarter); Old data series: 1993 SNA (1994-2016; 2nd quarter).

The difference between the two data series can chiefly be attributed to investment in R&D

(Source) Cabinet Office, System of National Accounts

If the mechanism of substitution of labor by capital as a result of technological progress becomes stronger, it will suppress the allocation of resources to labor income

The development of ICT is also promoting fundamental change in manufacturing technologies. As has already been much discussed, routine jobs which would previously have been performed by humans are being replaced by ICT capital (digital devices, information systems, etc.) and automated. The advancement of technology is acting to reduce the cost of capital goods, and this trend can be observed globally.

For companies seeking to maximize profit, it is rational to manufacture goods by making greater use of cheaper capital. In the study of economics, the extent of the reaction in which the ratio of labor and capital invested in processes changes as a result of changes in the ratio of wages and the cost of capital goods (the relative cost of capital) is termed elasticity of substitution. When this elasticity of substitution is higher than 1, the amount of capital invested by companies is equivalent to or larger than the size of reduction of the cost of capital. As a result, the ratio of income allocated to capital services increases, while the ratio of income allocated to labor services (the labor share) decreases¹. Recent research has shown empirically that approximately half of the

¹ When elasticity of substitution exceeds 1, production technology is expressed using a more general CES production function (usually, elasticity of substitution is assumed to be 1, based on the Cobb-Douglas production function). When elasticity of substitution exceeds 1, a CES production function indicates a decline in the ratio of labor income to capital income (and hence of the labor share) due to a relative decline in the price of capital goods.

cases of declining labor share which have been observed globally in recent years can be explained on the basis of this mechanism².

This paper will focus on the question as to whether the further advancement of technology (ICT, digitalization, etc.) is further increasing the substitutability of labor by capital in manufacturing technology (i.e. the elasticity of substitution has exceeded 1 and is further increasing), with the result that the mechanism discussed above is increasing in strength. In Japan in particular, it is possible that the trend towards the replacement of relatively scarce and high-priced labor by cheap and abundant capital is increasing in strength, exacerbated by the pre-existing labor shortage. In fact, capital investment which advances labor saving approaches and digitalization is increasing in vigor together with investment in research and development, and the trend towards the substitution of labor by capital is increasing in pace in industries in which innovation is accelerating, such as the finance industry. In addition, it can be considered that the increasing number of jobs and areas of labor being replaced by capital is resulting in excess workers due to mismatches between jobs and workers (frictional unemployment within companies) and adjustment costs to companies in relation to reallocation of employees, and that this is having an effect in suppressing increases in wages.

The continued action of this mechanism suppressing increases in wages and the labor share will also have an effect on household consumption. If households are able to access capital income (dividends, etc.), they will be able to adequately benefit from the fruits of growth generated by the development of ICT. However, as is well known, the proportion of stocks and investment trusts is low among the financial assets of Japanese households. Just how low this level is becomes quite clear in comparison with the US and Europe, with the percentage in Japan around 15% against around 47% in the US and 27% in Europe³. The benefits of expansion of the economy as a whole tend not to be smoothly transferred to Japan's middle class, which has limited access to capital income. In addition, if households anticipate that the mechanism of substitution of labor by capital will become stronger in future, while there may hypothetically be prospects for an expansion in the economy as a whole, the future outlook for labor income will be for resistance to increase.

As Figure 5 showed, the labor share is declining in Japan; it is not possible to ignore the possibility that the mechanism of substitution of labor by capital functioning against the background of the development of ICT is acting as a factor in this decline⁴. ICT is expected to develop further in future, and ensuring that the benefits of growth are transferred to the household sector more broadly and more smoothly will become even more important than previously. Given this, it will be necessary to examine the application of measures that consider the mechanism of substitution of labor by capital⁵. For example, it would be worth examining the

² L. Karabarbounis and B. Neiman, "The Global Decline of the Labor Share," *Quarterly Journal of Economics*, 129(1), 61-103, 2014.

³ Bank of Japan, *Flow of Funds – Overview of Japan, US, and the Euro Area*, August 2017.

⁴ A number of other factors can be indicated as contributing to the decline of the labor share. These are: ① corporate globalization (the offshoring of labor-intensive production processes); ② institutional factors in labor markets (a decline in the rate of unionization, etc.); and ③ the rise of "superstar companies" (the labor share demonstrates a greater decline in industries in which specific companies (Amazon, Facebook, etc.) have a high market share).

⁵ Excessive demands on companies for wage increases mean a further increase in the cost of labor relative to capital, which presumably has the effect of strengthening the mechanism of substitution of labor by capital.

possibility of reducing taxation on income from interest and dividends as a means of increasing the access of households to capital income.

The 2% price stability target: Realization will take time, but it remains a target worth striving to achieve

I would like now to look at the conduct of monetary policy based on the considerations outlined above.

Considering first the achievement of the 2% price stability target, we can assume that there is a strong possibility that the achievement of the target will require a considerable amount of time. The Bank of Japan's latest economic and price projections (Outlook for Economic Activity and Prices; October 2017), forecasts that the 2% price stability target will be achieved in fiscal 2019. This strong possibility of the target's realization in the next approximately two years represents the BOJ's main scenario. However, if we take the mechanism of substitution of labor by capital into consideration, there is considerable uncertainty as to whether the target will be realized within this period. It would not be at all surprising if the pace of development of ICT accelerated, and the period for realization of the 2% target was further prolonged.

If a considerable period is necessary for the achievement of the 2% price stability target, should the target itself be reduced? The thing that must be borne in mind is that even if the further development of ICT will hypothetically suppress increases in the labor share and prices, the economic pie as a whole and growth potential are increasing. A joint government/BOJ statement in January 2013 indicated the following:

"The Bank recognizes that the inflation rate consistent with price stability on a sustainable basis will rise as efforts by a wide range of entities toward strengthening competitiveness and growth potential of Japan's economy make progress. Based on this recognition, the Bank sets the price stability target at 2 percent in terms of the year-on-year rate of change in the consumer price index."

In fact, the vigor of the Japanese economy and its growth potential have steadily increased over this period in accordance with the recognition outlined in this joint statement. This can also be surmised from the improvement in corporate profitability and the expansion in domestic capital investment and research and development investment and other factors indicated by the figures above. The 2% price stability target based on the recognition that the economy's growth potential and competitiveness will display an ongoing increase remains an achievable target, and one towards which we should aim.

Future policy guidance has a powerful easing effect

The Bank of Japan should maintain its 2% price stability target, and tenaciously pursue its existing monetary easing policy. In doing so, it will be essential for the Bank to focus more intensively on both the effects and the secondary risks of a prolongation of large-scale monetary

easing than has previously been the case.

Looking first at the effects, the continuation of monetary easing measures is expected to strengthen policy effects in future. If capital investment and investment in R&D become steady and the growth potential of the economy increases, the neutral equilibrium interest rate (the natural rate of interest) will display a moderate increase. This will boost the effects of monetary easing.

Of course, as part of today's unconventional monetary easing policies, national central banks officially provide guidance regarding future policy (forward guidance regarding, for example, policy interest rates and balance sheet policy), and these announcements themselves are employed as a policy tool. The "overshoot commitment" in the BOJ's current framework, which will see the Bank continue to expand the monetary base until the actual inflation rate stably exceeds the 2% target, is an example. By declaring that the BOJ will maintain its policy of expanding the future balance sheet in linkage with the 2% target (i.e. in an open-ended form, without setting a predetermined period), this guidance in itself is having a powerful easing effect. It can be assumed that this strong easing effect is extending to financial conditions as a whole, including exchange rates and stock prices.

Conversely, we must be sufficiently aware of the fact that correction of future policy guidance or of the 2% target framework itself would compel correction of expectations already held by individuals and already incorporated in the market, and this would create the risk of sudden change in the financial conditions⁶. Both theoretical and empirical considerations support the view that contemporary unconventional monetary policy, in particular balance sheet policy involving large-scale and open-ended purchase of government bonds, can have a clear and sustainable effect on the economy⁷.

The risk of adverse secondary effects, for example in relation to public finances, must be examined in greater depth

At the same time, it is essential to focus attention on the risk of adverse secondary effects that may be produced by a prolongation of monetary easing. The main risks associated with unconventional monetary policy can be indicated as (i) financial imbalances (asset price bubbles, etc.), (ii) impact on the financial system (decline in profits for financial institutions, etc.), and (iii) effects related to fiscal policy (risks related to monetary financing, etc.).

Risk (i), the impact on asset prices, is concomitant with policy effects. If we look at past experiences of the formation of bubbles, for example the Japanese bubble in the second half of the 1980s, the IT bubble in the early 2000s, and the US housing bubble that triggered the global financial crisis, we see a common factor in each case: In the background an increase in productivity or technological innovation improves economic fundamentals, and sentiment becomes bullish. In

⁶ The so-called "Bernanke shock," the rapid spiraling of the long-term interest rate to close to 1% following a May 2013 statement by the Federal Reserve Bank's Chairman Ben Bernanke that suggested the Fed would correct its large-scale asset purchase program, remains fresh in the memory.

⁷ See Miyao, R., *Hidentouteki kin'yu seisaku (Unconventional Monetary Policies)* (Yuhikaku Publishing, 2016), in particular Chapters 2 and 3.

Japan at present, factors including an aging population and population decline act to suppress growth, but positive factors also exist, including the increased growth potential and competitiveness of the corporate sector and the further development of ICT, as discussed in this paper. The latter positive factor is also acting overseas. Against the background of an improvement in economic fundamentals, it will be necessary to exercise sufficient caution in relation to the risk of domestic or overseas asset price bubbles, monitoring to check that sentiment does not become bullish and that this does not lead to expansion of credit.

Regarding risk (ii), if we take an overview of the financial system as a whole, stability has been secured in terms of both equity capital and liquidity (Bank of Japan, Financial System Report, October 2017). However, there is a possibility that the low-profit environment for financial institutions will be structurally maintained, and it will be essential to carefully monitor whether vulnerability increases.

I will consider risk (iii), risks related to public finance, in two parts. First, the concern that efforts to realize fiscal soundness will lag behind as large-scale monetary easing continues, raising the specter of monetary financing. With regard to this concern, the Japanese government has clearly delineated its principles in relation to fiscal soundness, and the Bank of Japan maintains independence from government finance and implements policy based on its own judgment. With Japan's current account balance maintaining a surplus and net foreign assets increasing, the possibility that safe haven status will be maintained into the future is high. At present, it is difficult to imagine an increase in risk to the credibility of Japanese government bonds or Japan's currency (liabilities issued by the government and the Bank of Japan).

At the same time, there is no guarantee that this situation can continue indefinitely. Outstanding government debt cannot be increased infinitely, and there must be an upper limit to the debt-to-GDP ratio (at present around 190%). Beyond this limit point lie the dangerous states of fiscal dominance and fiscal inflation. Fiscal discipline would be lost, and monetary policy would be subordinated to government finance, systemically forced to accept, for example, direct underwriting of government bonds and helicopter money policy. The risk of falling into this state can be considered low at present, but it cannot be entirely dispelled. In addition to further strengthening the economy's growth potential, it will be essential for the Japanese government to maintain fiscal discipline.

One further concern in relation to government finance is the potential for worsening of the Bank of Japan's balance sheet and the consequent fiscal burden when an exit is sought in future. If interest rates are increased at the exit, the cost of interest payments to financial institutions will increase, and at the same time, because the interest rate on the BOJ's government bond holdings is low, a negative spread may occur. Whether such a negative spread will actually occur, and its scale if it were to occur, depend on a variety of factors, including the future pace of purchase of government bonds, the pace of increase in interest rates at the exit, and the level of long-term interest rates. If, at the exit, the economy or prices become overheated to an extent that forces a sharp increase in interest rates, there will be a consequent sudden increase in interest expenses. However, taking into consideration factors including the inflationary trend and the pace of interest rate increase in the US economy, the level of long-term interest rates in the US, and global

sluggishness in increases in wages and prices, at least as far as it is possible to judge at present, a moderate exit scenario is considerably more likely than a sudden one.

In any event, the ultimate exit, involving the shrinking of the balance sheet, will come into view only when we approach realization of the 2% target. Analysis and evaluation of the actual economy and the status of prices will be essential to advancing a constructive and realistic discussion regarding the exit. As has been emphasized in this paper, the development of ICT and supply-side trends (growth potential, etc.) will be key factors in this process.

Monetary policy should play a role in undergirding the recovery of the economy into the future

Viewing Japan's economy and price situation broadly, while we are some distance from realizing the 2% price stability target, steady improvement centering on the corporate sector is ongoing. Efforts to bolster growth potential and competitiveness are proceeding well, and this looks set to continue into the future. Based on this view of the situation, a 2% inflation rate is an achievable target, and one which we should continue to aim towards.

As corporate performances continue to improve, monetary policy must continue to play a role in undergirding recovery in the Japanese economy. Recovery is continuing in overseas economies, and the movement towards normalization of monetary policy in the US and Europe is advancing. In Japan, "quantity" is no longer an official operational target, and there is already an adequate margin with regard to the pace of JGB purchases operations. If domestic and overseas economies remain steady, the adjustment of the operational target for the long-term interest rate (currently around 0%) will also finally become a possibility. What is demanded of monetary policy in Japan is a flexible but tenacious maintenance of the current framework, with careful attention to both the effects and the risks of the continuation of monetary easing measures.

Ryuzo Miyao

Professor Miyao took his Ph.D. in economics from Harvard University, and teaches in The University of Tokyo's Graduate School of Economics. He is a former Member of the Policy Board of the Bank of Japan (March 2010 – March 2015). His fields of specialization are monetary economics and empirical macroeconomic analysis.

This is a translation of a paper originally published in Japanese.
NIRA bears full responsibility for the translation presented here. Translated by Michael Faul.