Asset Price Fluctuations, Structural Adjustments, and Sustained Economic Growth: Lessons from Japan's Experience since the Late 1980s

Kunio Okina and Shigenori Shiratsuka

In this paper, we examine implications of asset price fluctuations and resultant structural adjustments on sustained economic growth, based on Japan's experience since the latter half of the 1980s. In doing so, we offer the view that the protracted economic stagnation in Japan can be seen as a result of the incomplete economic adjustments to significant changes in relative prices, in part triggered by the bursting of the asset price bubble. Such changes in relative prices include movements in both intertemporal and cross-sectional dimensions, which interacted crucially to lower the economy's trend growth. This aspect of Japan's asset price bubble, with its consequences for structural adjustments since the 1990s, is important because it illustrates the specific environment in which the Bank of Japan has to conduct monetary policy: namely, not a standard stabilization policy around a stable growth trend. Rather, it has operated in an environment of unanswered policy management questions coupled with hampered sustained growth.

Kunio Okina: Director-General, Institute for Monetary and Economic Studies, Bank of Japan (E-mail: kunio.okina@boj.or.jp)
Shigenori Shiratsuka: Deputy Director and Senior Economist, Institute for Monetary and Economic Studies, Bank of Japan (E-mail: shigenori.shiratsuka@boj.or.jp)

I. Introduction

In this paper, we examine the implications of asset price fluctuations and resultant structural adjustments on sustained economic growth, based on Japan's experience since the latter half of the 1980s.

Japan's experience of the emergence, expansion, and bursting of an asset price bubble since the latter half of the 1980s is typically seen as an example in which a boom-and-bust cycle of asset prices severely impacts the business cycle. This view, however, does not capture the full story.[1] That is, Japan's economic predicament in the 1990s is better understood as a significant downward shift in trend growth, beyond a boom-and-bust cycle, rather than an amplified business cycle alone. Although the importance of cyclical aspects cannot be denied, further declines in asset prices after the mid-1990s seem to reflect the downward shift in trend growth beyond the boom-and-bust cycle of the asset price bubble.

In the late 1990s, excessive optimism, the main feature of a major asset price bubble, induced businesses to build up their capital stocks, payrolls, and debts to an extent that would have made sense only in a sustained environment of accelerated growth. When the bubble burst, however, the ensuing adjustments were all the more painful and prolonged. At the moment, mild deflation of less than 1 percent per annum has attracted public attention, but it is asset price deflation, which has continued for 10 years at an annual rate of close to 10 percent, that has likely exerted the most significant pressure on the economy.

We propose the view that the protracted economic stagnation in Japan can be seen as a result of the incomplete economic adjustments to significant changes in relative prices, partly triggered by the bursting of the asset price bubble. Such changes in relative prices occur in intertemporal as well as cross-sectional dimensions. On the one hand, relative prices in the intertemporal dimension are relative prices between current and future prices. This is observed as changes in relative prices between consumer prices and asset prices, as documented by Alchian and Klein (1973). On the other hand, relative prices in the cross-sectional dimension are relative prices across goods and services as well as factors of production. Moreover, it should be noted that a crucial interaction arises between intertemporal and cross-sectional relative prices which has implications for how resources are allocated in the economy.

The above aspect of the asset price bubble, with its consequences for the structural adjustment since the 1990s, is important because it illustrates the specific environment in which the Bank of Japan (BOJ) has to conduct monetary policy.[2] If a significant and unforeseen slowdown in the potential output growth rate were due to structural problems, monetary policy would inevitably be required to differ greatly from stabilization policy in normal circumstances.

This paper is organized as follows. Section II reviews asset price deflation in Japan and summarizes discussions on Japan's economic stagnation. Section III examines

1. See Okina, Shirakawa, and Shiratsuka (2001) for a detailed examination of the emergence and expansion of the asset price bubble in the late 1980s.
2. See the series of our previous studies, including Fujiki, Okina, and Shiratsuka (2001), Fujiki and Shiratsuka (2002), Okina (1999), and Okina and Shiratsuka (2002, 2003, 2004), for research on Japan's monetary policy during this period.

interpreting the long-lasting stagnation from the viewpoint of misguided relative price information both in the intertemporal dimension and the cross-sectional dimension. Section IV explores the effects of insufficient structural adjustments on economic growth, based on the extended framework of growth accounting under factor market distortions; it also discusses the policy implications of structural adjustments. Section V offers a concluding discussion.
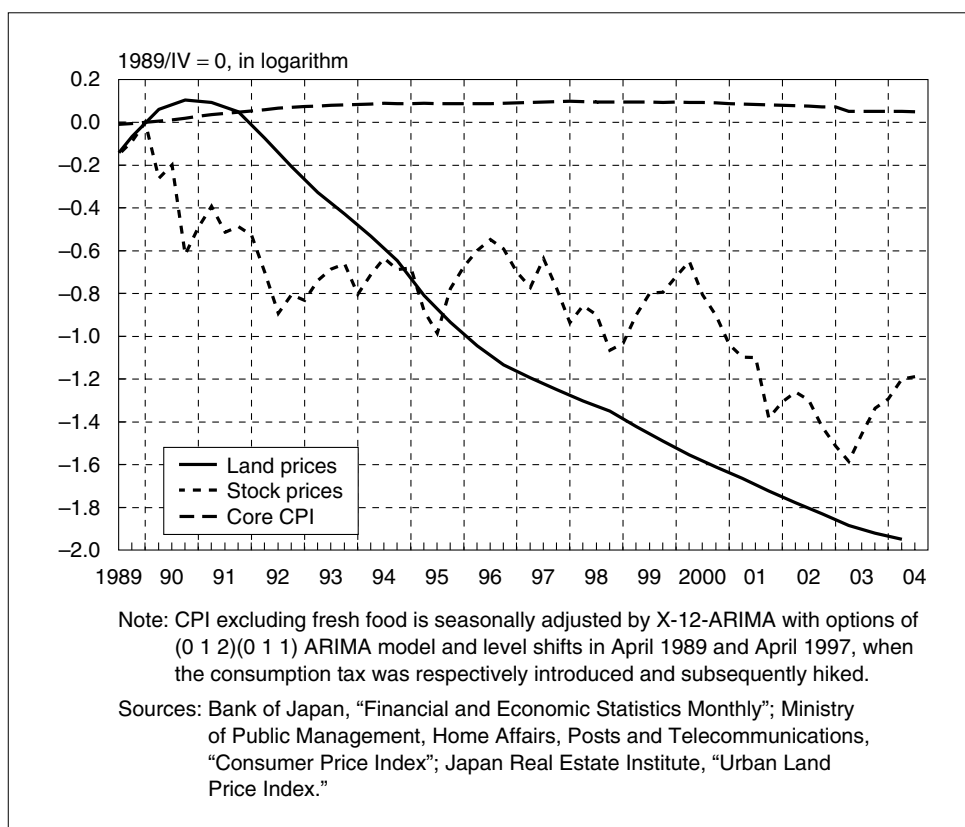
II. Viewpoints on Japan's Asset Price Deflation and Economic Stagnation

In this section, we review the development of asset price deflation in Japan, and summarize arguments as to what lies at the root of Japan's economic predicament.

A. Asset Price Deflation and Reduced Growth Trend

Asset prices have continued to decline remarkably for a decade since the bursting of the asset price bubble at the beginning of the 1990s, while consumer prices have remained almost constant (Figure 1).

Figure 1 Asset Price Deflation

Note: CPI excluding fresh food is seasonally adjusted by X-12-ARIMA with options of (0 1 2)(0 1 1) ARIMA model and level shifts in April 1989 and April 1997, when the consumption tax was respectively introduced and subsequently hiked.

Sources: Bank of Japan, "Financial and Economic Statistics Monthly"; Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Consumer Price Index"; Japan Real Estate Institute, "Urban Land Price Index."

Among these developments, mild deflation of less than 1 percent per annum has attracted public attention. However, we should stress that asset price deflation is deemed far more significant than mild deflation. Stock prices plunged in the early 1990s and have since followed a downward trend, albeit with continual ups and downs. Land prices started declining with a two-year lag relative to stock prices, and subsequently have kept declining at an annual rate of around 10 percent.

In addition, the standard deviation of stock price changes across industries (Figure 2) initially declined after the bursting of the bubble, while it has begun to increase since 1997. Stock prices show more divergent movements since 1997, with a mild downward trend and some weak cycles. Land prices also show fairly divergent movements by area and type of usage (Figure 3).

Figure 2 Cross-Sectional Volatility of Equity Prices
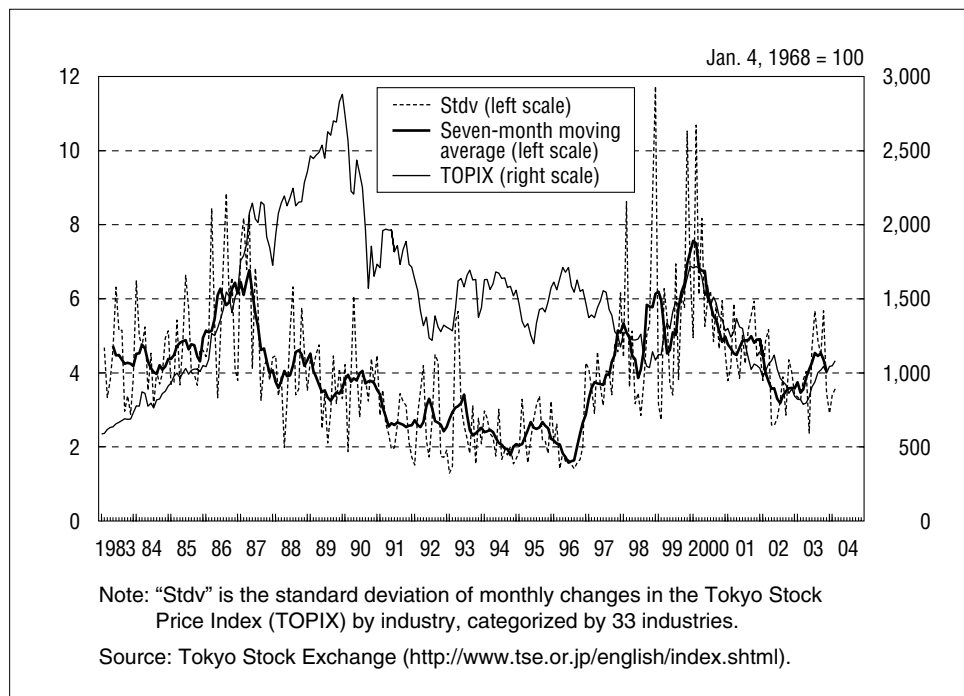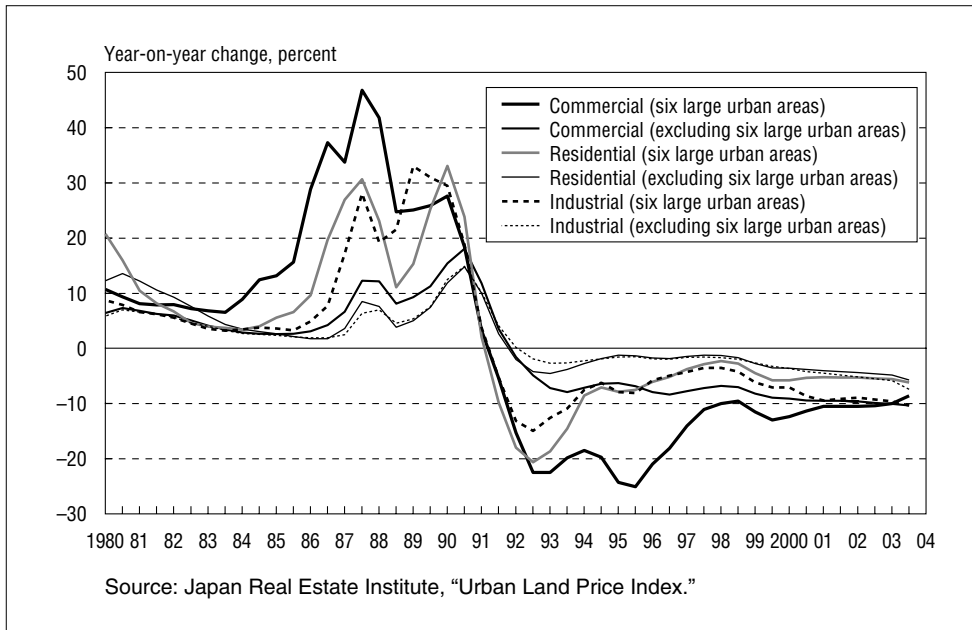

Note: "Stdv" is the standard deviation of monthly changes in the Tokyo Stock
        Price Index (TOPIX) by industry, categorized by 33 industries.
Source: Tokyo Stock Exchange (http://www.tse.or.jp/english/index.shtml).

Figure 3 Land Prices

Source: Japan Real Estate Institute, "Urban Land Price Index."

At the same time, trend growth tended to shift downward during the 1990s (Figure 4). The volatility of the output growth rate expanded in the 1990s, compared with that in the 1980s. Although some temporary high-growth periods were observed, such cyclical upturns were not strong enough to lead to self-sustainable growth. The average duration of expansions was short, and the growth rate declined remarkably, and as a result, the Hodrick-Prescott (HP) filtered trend kinked downward in the 1990s.

As of the writing of this paper, Japan's economy has entered its third recovery phase since the bursting of the bubble. The question remains as to whether the cyclical upturn this time will lead to self-sustaining higher growth, which did not happen during the previous upturns in the 1990s.
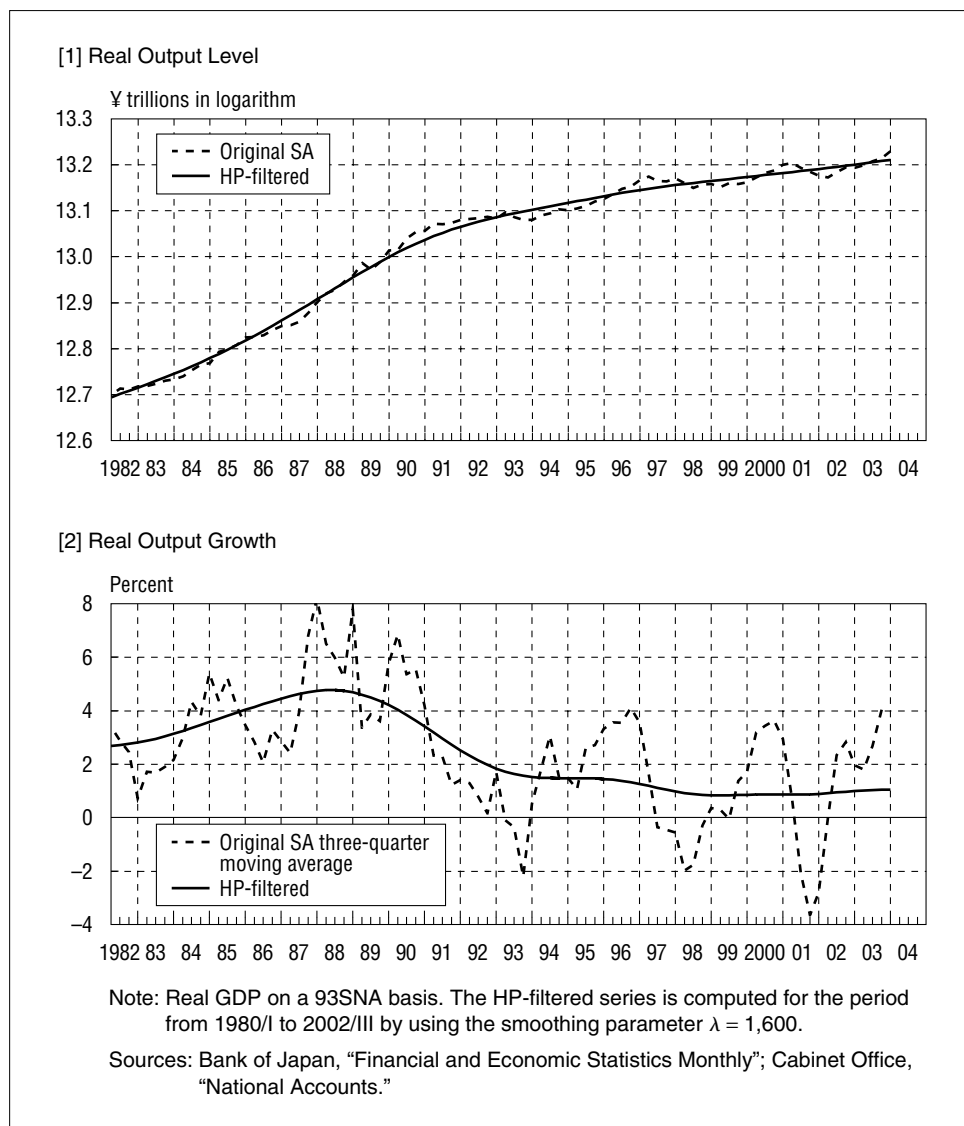
B. Two Views on Japan's Stagnant Economic Conditions

In considering monetary policy management in a period of continuing stagnation, it is necessary to specify the most significant factor hampering sustainable economic growth. Broadly speaking, there are two views on this.

One view considers insufficient aggregate demand as the essential problem. The basis for this view seems to be that, even though there are structural problems, since the economy will shortly return to a sustainable growth path as insufficient demand is resolved by expanding effective demand, structural policy should be implemented pending recovery of the economy.

Based on the above view, it is important for Japan's economy to create effective demand. In this case, the problem boils down to the question of how economic policy authorities, especially a central bank, which is bound by the non-negativity constraint of nominal interest rates, can create further effective demand.

Figure 4 Trend Growth Rate

[1] Real Output Level

¥ trillions in logarithm

[2] Real Output Growth

Percent

Note: Real GDP on a 93SNA basis. The HP-filtered series is computed for the period
     from 1980/I to 2002/III by using the smoothing parameter $\lambda = 1,600$.

Sources: Bank of Japan, "Financial and Economic Statistics Monthly"; Cabinet Office,
         "National Accounts."

Another view regards structural problems as the most important factor. If this is
the case, it is necessary to work steadily toward resolving structural problems to raise
the growth trend.

The list of structural problems in Japan includes rigid corporate governance, ineffi-
ciency of the non-manufacturing sector, the issue of nonperforming assets associated
with the generation and bursting of the asset price bubble, and the savings-investment
imbalance.[3] In addition, significant structural changes in the economic environment
also occurred during the 1990s: for example, the changing pattern of the division of

----

3. See Maeda, Higo, and Nishizaki (2001) for a more comprehensive analysis of structural problems. (Unfortunately,
   this paper is available only in Japanese.)

labor between Japan and its East Asian neighbors, a rapidly aging population, and advances in information and communications technology.

To resolve the above problems, it is a crucial question whether the government can continuously implement policy actions consistent with the overall picture of structural reform, including resolution of the nonperforming-loan (NPL) problem. However, it is extremely difficult to fully carry out such structural policies, as they are very likely to be accompanied by deflationary effects in the short term, even though positive effects will follow in the medium to long term. Therefore, to execute all the necessary structural policy measures, an important point at issue is their sequencing: in what order specific policies should be implemented. In this regard, macroeconomic policy is required to maintain an expansionary stance capable of mitigating the deflationary effects stemming from the pursuit of structural policies.

Given that mild deflation in Japan is associated with low economic growth, it is undeniable that insufficient aggregate demand was one of the major causes of weak price development in the late 1990s. However, it should be noted that the nature of insufficient demand is not just temporal but more persistent. In this case, separation of supply and demand factors in the medium to long term is incredibly difficult because of their dynamic interaction.[4]

Notwithstanding which view is valid as to the most significant factor hampering sustained economic growth, it is hard to deny that structural impediments affect the persistent economic stagnation seen in Japan and that expansionary macroeconomic policy is required. Economic stagnation, in turn, makes it increasingly difficult to resolve the structural problems. Although the necessary structural adjustments, such as reorganization of corporate management and reallocation of economic resources, were deferred by the emergence of the asset price bubble, their resolution became urgent when the bubble burst. In addition, the bursting of the asset price bubble not only triggered the adverse effects but also amplified them as time passed, thereby making such structural adjustments more difficult.
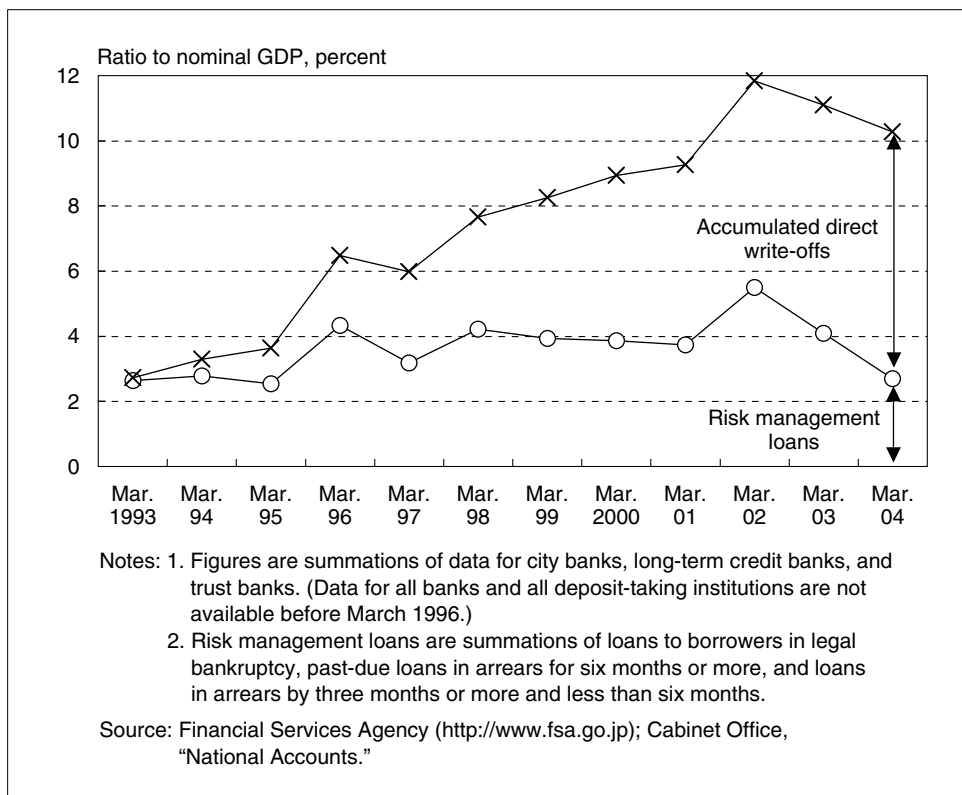
C. Structural Changes

Although it is hard to deny that the emergence and bursting of the bubble played an important role in economic fluctuations from the early 1990s, the above observations suggest that structural impediments to the smooth reallocation of economic resources could be fundamental reasons for the current deflationary economic situation.

1. NPLs and the low profitability of Japanese firms

NPLs of major financial institutions continued to increase up until end-March 2002 (Figure 5). NPLs of major Japanese banks reached 11.9 percent of nominal GDP by end-March 2002, calculated as the sum of risk management loans (5.5 percent) and

---

4. Mio (2002) estimates a bivariate output-price structural vector autoregression model for Japan to decompose the inflation rate time-series into two components, explained by aggregate demand (AD) and aggregate supply (AS) shocks. He finds that the coincidence of negative AS and AD shocks explains the combination of price stability and output stagnation soon after the bursting of the asset price bubble in the early 1990s. We update his results by using newly revised 93SNA (System of National Accounts) data, and succeed in reproducing qualitatively equivalent results. We also produce similar but puzzling results for the dynamic response of prices due to AS shocks. That is, it initially shows a negative response, but turns positive after about two years. These results seem to indicate the difficulty of identifying the effects of AD and AS shocks in the medium to long term because of their dynamic interaction.

Figure 5 Nonperforming Loans

Notes: 1. Figures are summations of data for city banks, long-term credit banks, and
trust banks. (Data for all banks and all deposit-taking institutions are not
available before March 1996.)
2. Risk management loans are summations of loans to borrowers in legal
bankruptcy, past-due loans in arrears for six months or more, and loans
in arrears by three months or more and less than six months.

Source: Financial Services Agency (http://www.fsa.go.jp); Cabinet Office,
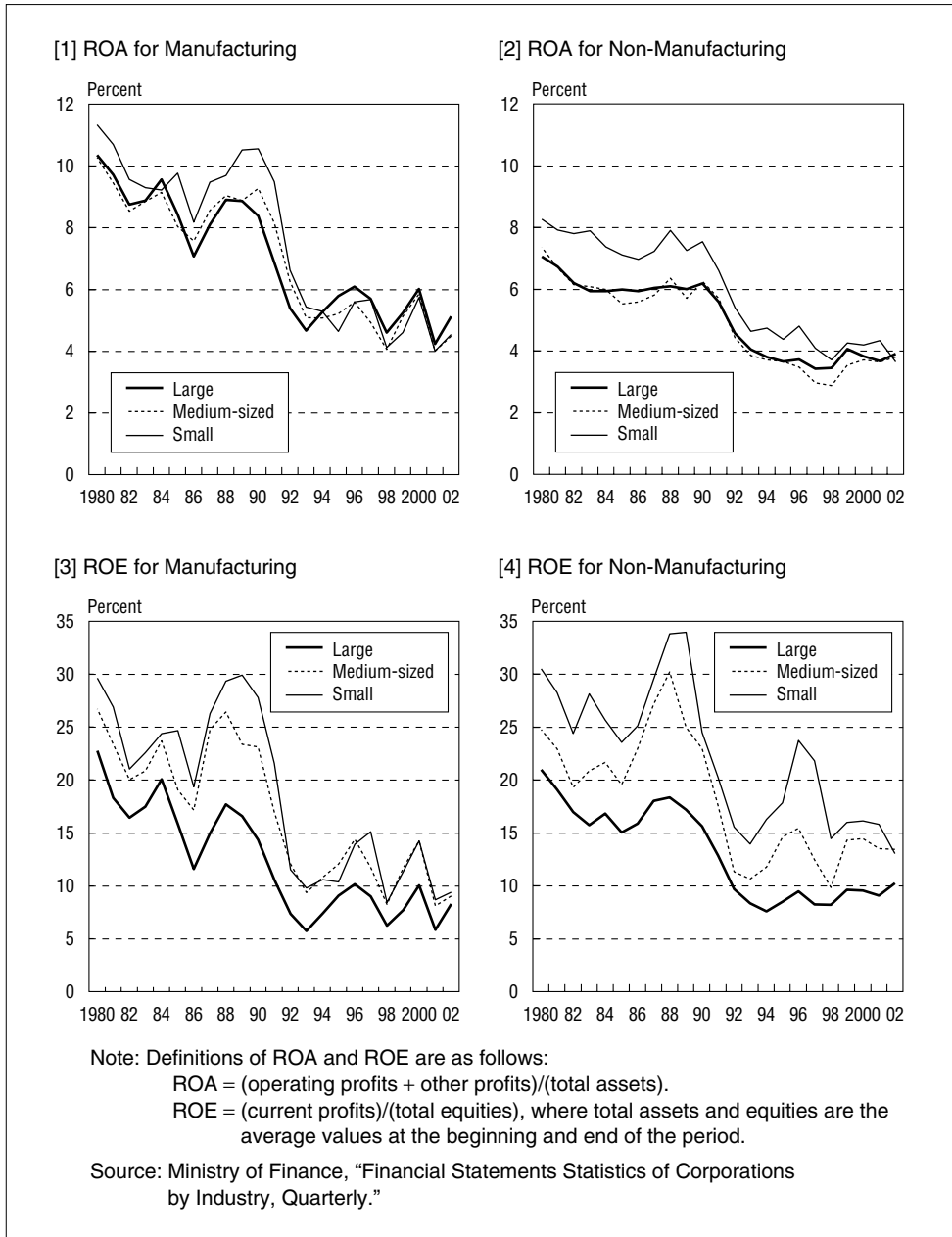"National Accounts."

the accumulated direct write-offs since fiscal 1992 (6.4 percent). Substantial progress
in dealing with the NPL problem has occurred only very recently, during the past
year or so. Although the pace of disposal has varied across individual institutions, on
average major banks have made considerable progress in disposing of NPLs. Regional
banks have also made progress in reducing NPLs, but the pace of disposal has been
much slower than that at major banks.

One of the major causes of Japan's long-term stagnation since the early 1990s is
lending forbearance to inefficient firms that finally caused deterioration in the sound-
ness and efficiency of Japan's economy (as described by Sekine, Kobayashi, and Saita
[2003] and Caballero, Hoshi, and Kashyap [2003]). Continued forbearance lending
that permits "zombie" firms to exist indicates the existence of incentives to resist factor
reallocation, even though economic adjustments are necessary for the economy to
return to its long-term sustainable growth path. In other words, the malfunctioning
of financial intermediation prevents the resource allocation mechanism in financial
markets from working smoothly.

To examine the capital efficacy of the corporate sector in Japan, Figure 6 plots
the return on assets (ROA) and return on equity (ROE) for the manufacturing and
non-manufacturing sectors over time. We can see from this figure that profitability in
the corporate sector has remained low since the early 1990s, and does not yet show signs
of recovery. This observation suggests that a structural shift in the Japanese economy

Figure 6 Profitability of Enterprises

[1] ROA for Manufacturing

[2] ROA for Non-Manufacturing

[3] ROE for Manufacturing

[4] ROE for Non-Manufacturing

Note: Definitions of ROA and ROE are as follows:

ROA = (operating profits + other profits)/(total assets).

ROE = (current profits)/(total equities), where total assets and equities are the average values at the beginning and end of the period.

Source: Ministry of Finance, "Financial Statements Statistics of Corporations by Industry, Quarterly."

from declining industries to growing industries is unlikely to proceed smoothly during this period of continuing economic stagnation.

2. Globalization

Ongoing globalization, including the incorporation of the Chinese and other developing economies into the system of the international division of labor, influences relative prices in the global economy. The rapid rise of the Chinese and other

economies puts pressure on the global economy to reallocate production bases as well as creates and destroys employment opportunities.[5] To be sure, international reallocation of production and employment is beneficial for all countries in the long run. Nevertheless, such developments are often mistaken for the importation of unemployment and deflation from these countries, especially from China.

To enjoy the benefit from reallocation, the Japanese economy is required to shift its industrial structure in response to changes in its comparative advantages due to the rise of these economies. Such adjustments in industrial structure will surely pay off in the long term by improving the terms of trade. In the case of the rise of the Chinese economy, for example, we expect that a broad range of products, such as clothing, daily necessities, and agricultural and livestock products, will become available at lower prices.

Some cautions, however, are in order regarding the adjustment process in the short term. First, the pains of economic reform are most likely to be concentrated among firms and employees in the declining industries. The prevention of changes to relative prices and forbearance lending to declining firms and industries tend to result in locked-in resources in the declining industries, thereby hindering economic growth. Second, international competition is less likely to function as pressure to improve the productivity and efficiency in non-tradable goods industries.

Figure 7 is a scatter plot of general price levels against per capita GDP across member countries of the Organisation for Economic Co-operation and Development (OECD). In this figure, general price levels and per capita GDP are defined as the ratio of PPP to exchange rates, and per capita nominal GDP deflated by PPP, respectively.[6] This figure shows the so-called Balassa-Samuelson effect of a positive correlation between domestic price level and per capita income.[7] This effect arises because economic growth induces a structural shift from manufacturing industries to non-manufacturing industries with relatively low productivity. It is often pointed out that non-manufacturing industries lack incentives to improve their efficiency, because they are isolated from international competitive pressures due to regulation and other protections.

A closer look at Figure 7 offers the observation that Japan is an outlier located far above the upward trend line. In other words, Japan's price level is still far higher than the international standard level, even after taking into account its high per capita income. This implies the wide productivity differences between the manufacturing and non-manufacturing sectors in Japan, reflecting the low productivity and inefficiency of the non-tradable goods industries.

3. Population growth
Demographic factors, such as the rapid decline in the birth ratio and an aging society, are also often cited as factors behind declining trend growth.

5. Another often-cited example is U.S. firms in the information and communications industry that make active use of outsourcing to Indian firms in software development.
6. PPP is calculated using price and expenditure data collected by the Eurostat-OECD PPP Programme. The basket of goods and services is a sample of all goods and services covered by GDP, including consumer goods and services, government services, equipment goods, and construction projects. PPP is computed as a geometric mean of price relatives of various products in the basket.
7. In the time-series dimension, a real exchange rate for a nation with higher economic growth tends to appreciate more rapidly.

Figure 7 Per Capita GDP and Price Levels

General price levels, OECD average = 100

Notes: 1. General price levels and per capita GDP are defined as the ratio of PPP to
exchange rates, and per capita nominal GDP deflated by PPP, respectively.
2. Figures are indexed to the United States (equal to 100), and averaged from
1996 to 2002.

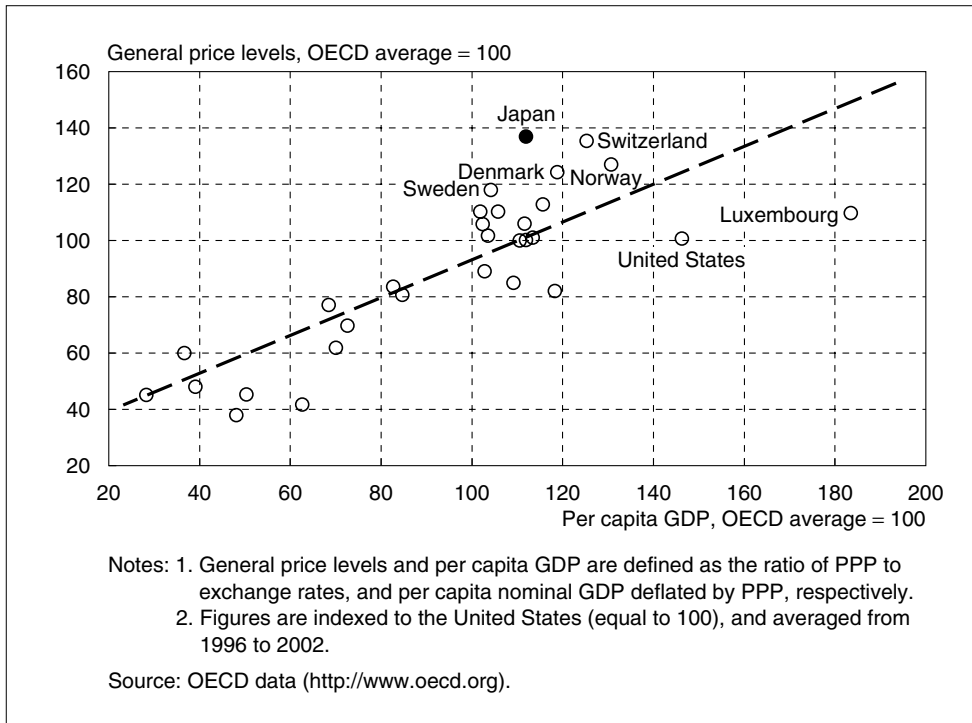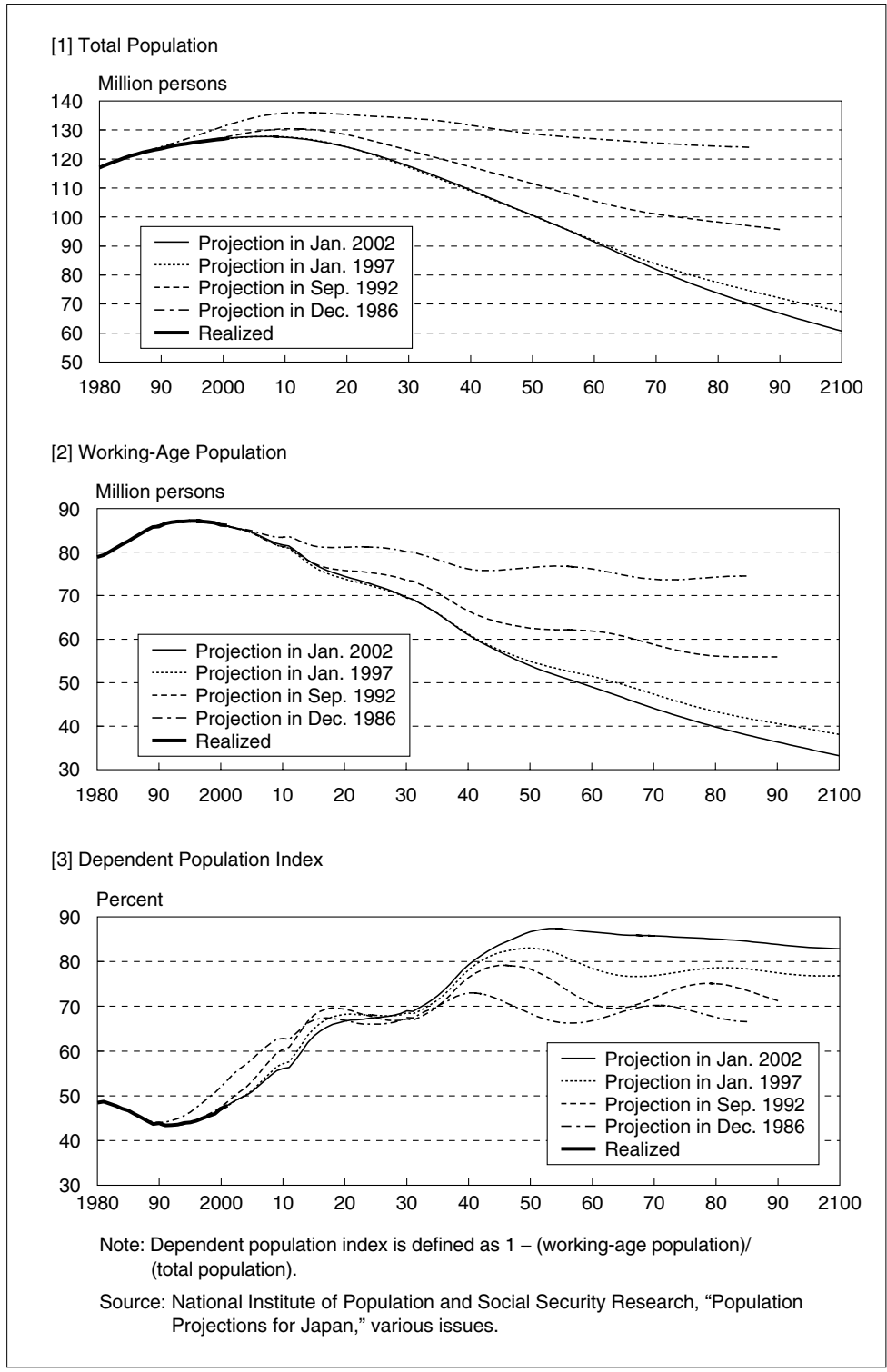Source: OECD data (http://www.oecd.org).

Figure 8 plots the official projections of Japan's future population, compiled by the National Institute of Population and Social Security Research. The projections have been revised downward continually, as new projections are released every five years.

Based on the projections in January 2002,[8] total population is projected to peak at 128 million in 2006 and continue to decline thereafter until it reaches 61 million at the end of the projection in 2100 (Figure 8 [1]). The working-age population (15–64 years old) started declining after peaking at 87 million in 1995, and is projected to decline by half to 43 million in 2072, and to 33 million in 2100 (Figure 8 [2]). As a result, the dependent population index, defined as the ratio of the non-working-age population (total population minus working-age population) to the total population, is projected to increase until 2053 when it peaks at 87.4 percent, and remain high afterward (Figure 8 [3]).

Even if the growth rate of per capita GDP remained unchanged, a population decline in Japan would result in a slowdown in economic growth. The rise in the dependent population index implies a decline in the work force in the economy. It suggests a constraint on economic growth, because more resources are shifted into service sectors where it is difficult to improve productivity, such as the care of aged persons.

8. In the baseline projection (median variant) published in January 2002, total fertility is assumed to decline initially from 1.36 in 2000 to 1.31 in 2007, and then gradually start reversing and reach 1.39 in 2049.

153

Figure 8 Population Projections

[1] Total Population

Million persons

Projection in Jan. 2002
Projection in Jan. 1997
Projection in Sep. 1992
Projection in Dec. 1986
Realized

[2] Working-Age Population

Million persons

Projection in Jan. 2002
Projection in Jan. 1997
Projection in Sep. 1992
Projection in Dec. 1986
Realized

[3] Dependent Population Index

Percent

Projection in Jan. 2002
Projection in Jan. 1997
Projection in Sep. 1992
Projection in Dec. 1986
Realized

Note: Dependent population index is defined as 1 − (working-age population)/
      (total population).

Source: National Institute of Population and Social Security Research, "Population
        Projections for Japan," various issues.

III. Two-Dimensional Changes in Relative Prices and Reduced Potential Output

Protracted economic stagnation in Japan is deeply related to the asset price deflation and structural changes mentioned above. The problems created by asset price deflation and structural changes (except for the population growth issue) can be seen as the incomplete economic adjustments to significant changes in relative prices.

Such changes in relative prices occur in both the intertemporal dimension and the cross-sectional dimension. On the one hand, relative prices in the intertemporal dimension are relative prices between the current prices of goods and services and their future prices.[9] This is exactly the aforementioned observation of changes in relative prices between consumer prices and asset prices. On the other hand, relative prices in the cross-sectional dimension are relative prices among goods and services as well as production factors, including terms of trade with foreign trading partners. Moreover, it should be noted that a crucial interaction exists in the aforementioned changes in relative prices in two dimensions.

A. Relative Price Changes in the Intertemporal Dimension

The first point regarding relative price changes concerns implications of changes in relative prices in the intertemporal dimension. Asset price deflation has continued for the last 10 years at an annual rate of close to 10 percent. As a result, relative prices in the intertemporal dimension have dramatically changed under extremely stable consumer prices since the mid-1980s.

As an inflation measure for incorporating the dynamic elements of price fluctuation, Alchian and Klein (1973) propose the idea of an intertemporal cost of living index (ICLI). This index traces the intertemporal changes in the cost of living that are required to achieve a given level of intertemporal utility. Consumer behavior possesses a dynamic nature such that current consumption depends on not only current prices and incomes but also the future path of prices and incomes. When considering the intertemporal maximization problem for a household, it can be seen that its budget constraint is its lifetime income.[10] In this case, we can take asset prices as a proxy for the future prices of goods and services.

More precisely, Alchian and Klein (1973) assume that consumer preference depends on both current and future consumption expenditure, as expressed by the following utility function:

$$U = U(x_{11}^A, \ldots, x_{n1}^A, \ldots, x_{it}^A, \ldots) \quad \text{for } i = 1, \ldots, n; t = 1, \ldots, \infty, \quad (1)$$

where x_{it}^A represents the consumption expenditure for good i at time t with economic condition A.

---

9. See Alchian and Klein (1973), Shibuya (1992), and Shiratsuka (1999) for details on measures for intertemporal price changes.
10. A necessary condition for this discussion is that there exists a perfect capital market, which makes it possible to borrow money against collateral of all tangible and intangible assets.

The consumer's budget constraint corresponds to total assets (W^A), including both tangible and intangible assets as follows:

$$W^A = \sum_{t=1}^{\infty} \sum_{i=1}^{n} p_{it}^A x_{it}^A = \sum_{j=1}^{m} q_j^A y_j^A, \tag{2}$$

where p_{it}^A, q_j^A, and y_j^A represent the current price of good i at time t under economic condition A,[11] and the price and quantity of asset j at time t under economic condition A.

Suppose that a price of a current or future good changes, and the new economic condition B is realized. As a result, suppose also that the required asset value for the consumer to achieve the same utility level as under economic condition A becomes W^B. The ICLI between the economic conditions A and B is defined as

$$ICLI^{AB} = \frac{W^B}{W^A} = \frac{\sum_{t=1}^{\infty} \sum_{i=1}^{n} p_{it}^B x_{it}^B}{\sum_{t=1}^{\infty} \sum_{i=1}^{n} p_{it}^A x_{it}^A} = \frac{\sum_{j=1}^{m} q_j^B y_j^B}{\sum_{j=1}^{m} q_j^A y_j^A}. \tag{3}$$

Shibuya (1992) extends the ICLI into a practical index formula, and names it a dynamic equilibrium price index (DEPI). To this end, he employs a one-good and time-separable Cobb-Douglas utility function, instead of the general form of preference assumed in Alchian and Klein (1973). Then, he derives the DEPI as a weighted geometric mean of the changes in the current price index (the GDP deflator: p_t) and the changes in asset prices (the value of the national wealth: q_t),[12] as shown in equation (4):

$$DEPI_{0t} = \left(\frac{p_t}{p_0}\right)^{\alpha} \left(\frac{q_t}{q_0}\right)^{1-\alpha}, \tag{4}$$

where α represents the weighting used for current goods and services $\alpha = \rho/(1 + \rho)$, and ρ represents the time preference.[13]
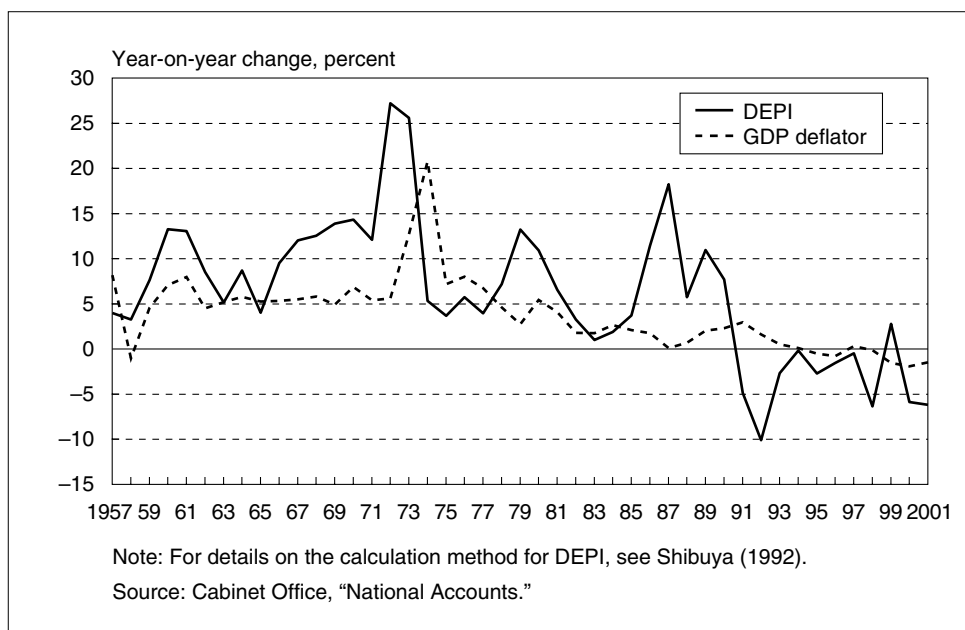
Figure 9 shows the movements of the DEPI from 1957 to 2001, which updates the estimation in Shiratsuka (2001). This figure portrays the large divergence between the DEPI and the GDP deflator during the late 1960s, the early and late 1970s, and the early 1980s. Focusing on developments since the mid-1980s, the DEPI rises sharply from 1986 to 1990 and then starts declining in 1991. During this period, although

---

11. This is the present value of the future product and service prices discounted by the discount factor.
12. In calculating the DEPI, we should use asset prices to represent the value of total assets, which includes all the intangible assets, such as human capital. Shibuya (1992) used the data on national wealth in the SNA statistics, which have the broadest coverage among the readily available data sources. However, the coverage of intangible assets, which consist largely of households' assets, is very limited.
13. α can be written as $\alpha_t = (1+\rho)^{-t}/\sum_{s=0}^{\infty}(1+\rho)^{-s}$ in general form. It corresponds to the standardizing factors of time preference, which add up to one. Following Shibuya (1992), we assume the rate of time preference ρ as 0.03, which deducts the rate of depreciation (0.06), the growth rate of labor (0.01), and the rate of technological progress (0.03) from the real return on assets (0.13).

Figure 9 Dynamic Equilibrium Price Index (DEPI)

Note: For details on the calculation method for DEPI, see Shibuya (1992).
Source: Cabinet Office, "National Accounts."

the GDP deflator remains relatively stable, the inflation rate measured by the GDP deflator accelerates until 1991 and then remains subdued from 1992. This development of the DEPI can be interpreted as an understatement in conventional inflation measures regarding the inflationary pressure that occurred in the late 1980s and the deflationary pressure that has continued since the early 1990s.

Alternatively, the aforementioned development of the DEPI can be viewed as a large swing in relative prices in the intertemporal dimension. Although current prices of goods and services, measured by the consumer price index and GDP deflator, remain stable, expected prices of future goods and services, observed by asset prices, increased dramatically in the late 1980s and then continued to decline in the 1990s. An interpretation of this from the standpoint of intertemporal relative price changes suggests that the intertemporal misallocation of resources due to misguided information on intertemporal relative prices was behind the emergence, expansion, and bursting of the asset price bubble.

B. Relative Price Changes in the Cross-Sectional Dimension
Let us next turn to the second point regarding changes in relative prices in the cross-sectional dimension.

Figure 10 graphically depicts the relationship between output growth and price changes by industry. The horizontal and vertical axes plot annualized output growth and inflation by industry, respectively. Observations shown as circles and crosses, respectively, indicate data for the period from 1980 to 1990 and that from 1991 to 2001. An overall negative relationship between output growth and inflation suggests that supply-side factors play an important role in determining cross-sectional

Figure 10 Output Growth and Inflation by Industry

Source: Cabinet Office, "National Accounts."
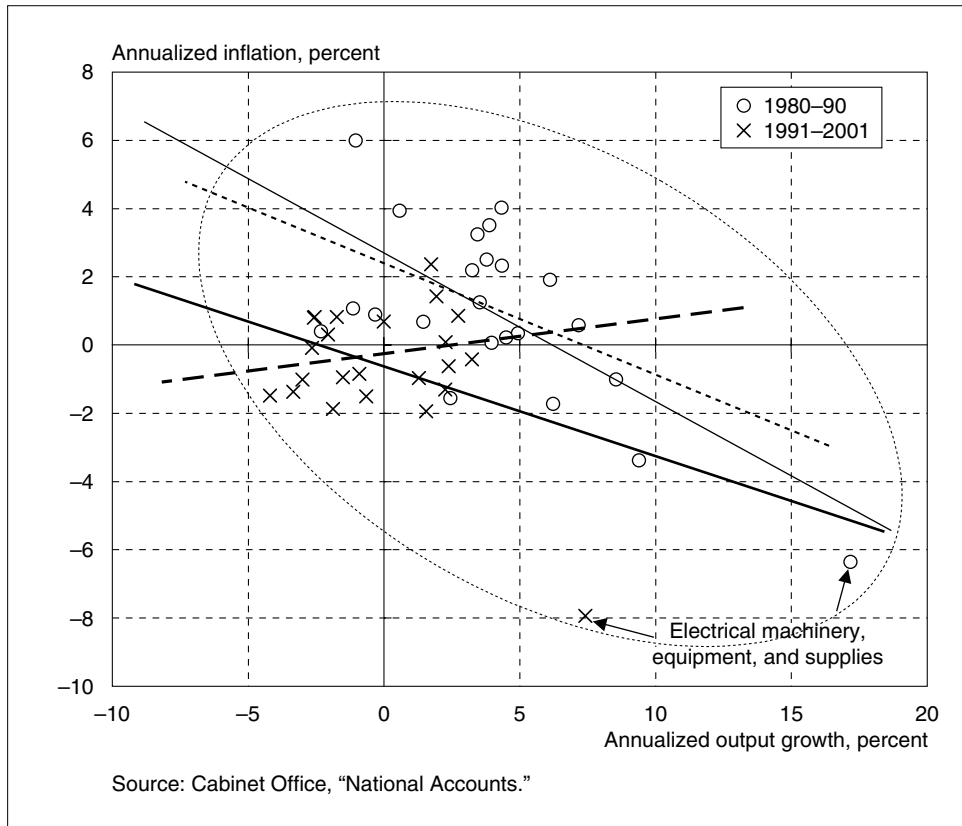
differences in the rate of inflation over the long term. Resources are allocated to growing industries where relative prices are declining, reflecting their relatively higher productivity growth.

A closer look at the figure, however, reveals that the above negative relationship between output growth and inflation varies between two periods. The figure also shows four regression lines through the scatter plots: thin and bold solid lines for the observations for the periods 1980–90 and 1991–2001, respectively; and thin and bold dashed lines for the observations for the corresponding periods but excluding electrical machinery, equipment, and supplies. The slopes of the observations for the period 1980–90 are negative, regardless of inclusion or exclusion of the outlier observation for electrical machinery, equipment, and supplies. In contrast, the slope of the observations for the period 1991–2001 turns slightly positive, if the outlier observation for electrical machinery, equipment, and supplies is excluded.

To gauge distortions in the cross-sectional dimension, Nakakuki, Otani, and Shiratsuka (2004) propose an indicator for factors' marginal productivity differential across industries. Suppose the production function of each sector is homogeneous of degree one and is defined by the equation

$$Y_i = A_i F_i(K_i, L_i), \tag{5}$$

where the subscript i denotes the industry, and Y, A, K, and L represent output, total factor productivity (TFP), capital stock, and labor input, respectively. Dividing the above equation by labor input yields labor productivity ($y = Y/L$), which can be expressed by the capital-labor ratio ($k = K/L$) as follows:

$$y_i = A_i f_i(k_i), \tag{6}$$

where $f_i(k_i)$ is $F_i(K_i/L_i, 1)$.[14] Since the ratio of wages (w_i) to rate of return on capital (r_i) in sector i is equal to the ratio of labor's marginal productivity to capital's marginal productivity, the following equation holds:

$$\frac{w_i}{r_i} = \frac{f_i(k_i) - f_i'(k_i)k_i}{f_i'(k_i)}. \tag{7}$$

The labor share in industry i (α_i) equals $1 - f_i'(k_i)k_i/f_i(k_i)$, and the capital share ($1 - \alpha_i$) equals $f_i'(k_i)k_i/f_i(k_i)$. Using these, equation (7) can be transformed as follows:

$$\frac{w_i}{r_i} = a_i k_i, \tag{8}$$

where a_i corresponds to $\alpha_i/(1 - \alpha_i)$. Under perfect factor markets, the ratios of wages to rate of return on capital are identical in all industries. In the discussion below, we assume the ratio of wages to rate of return on capital for industry i is $1/\gamma_i$ times that of the base industry ($i = 1$, $\gamma_1 = 1$). In this case, the ratio of relative factor prices in sector i to the base sector can be expressed as follows:

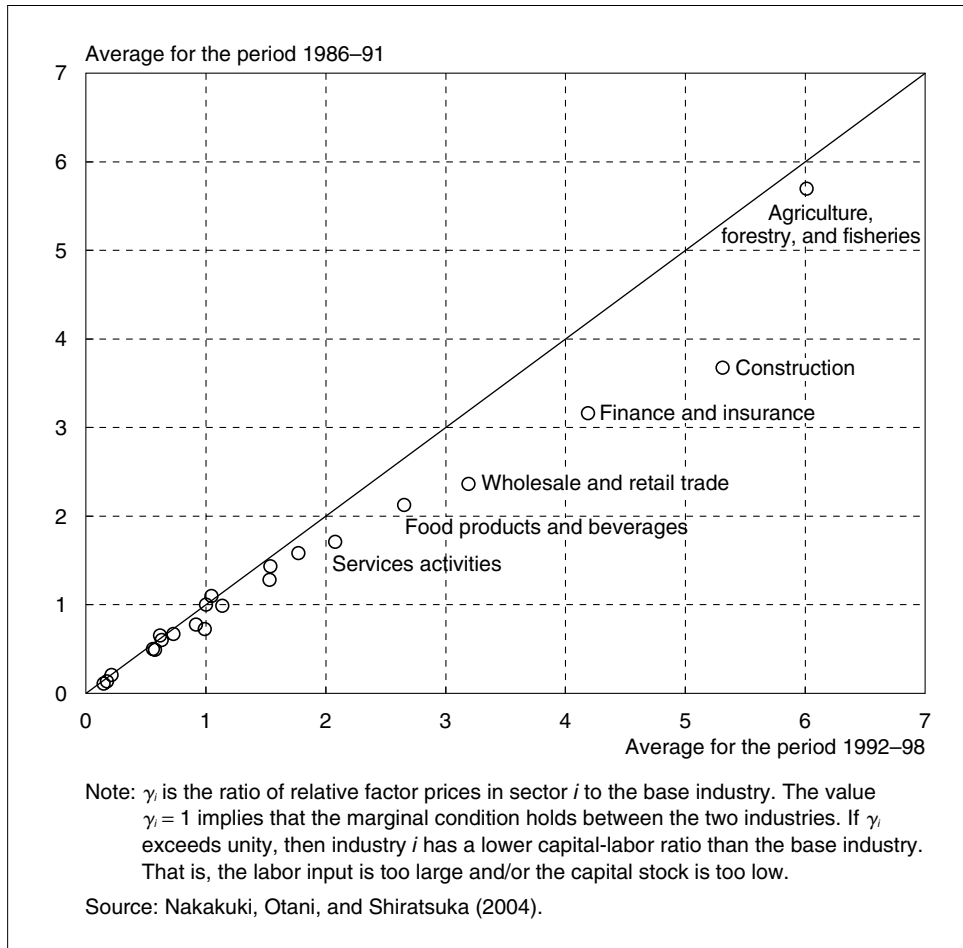$$\gamma_i = \frac{a_1 k_1}{a_i k_i}. \tag{9}$$

The value $\gamma_i = 1$ implies that the marginal condition holds between the two industries. If γ_i exceeds unity, then industry i has a lower capital-labor ratio than the base industry. That is, the labor input is too large and/or the capital stock is too low. Conversely, if γ_i is less than unity, it means that the capital-labor ratio of industry i is too high.

Figure 11 is a scatter plot of the estimates of γ in each industry for both the bubble period (1986–91) and the post-bubble period (1992–98).[15] We can see from the figure that the estimates of γ for many industries in the non-manufacturing sector, such as agriculture, forestry, and fisheries, construction, wholesale and retail trade, finance and insurance, and services activities, increase in a range significantly higher than unity. In contrast, those for the manufacturing sector, except food products and beverages,

---

14. In the following discussion, it is assumed that Inada's condition holds, i.e., if $k_i \to 0$, $f'(k_i) \to \infty$ and if $k_i \to \infty$, $f'(k_i) \to 0$.
15. Nakakuki, Otani, and Shiratsuka (2004) employ the electrical machinery industry as the base industry to compute γ, based on their presumption that this industry is the most efficient of all industries in Japan.

Figure 11 Changes in Estimates of γ by Industry

Average for the period 1986–91

Agriculture,
forestry, and fisheries

Construction

Finance and insurance

Wholesale and retail trade

Food products and beverages

Services activities

Average for the period 1992–98

Note: γ_i is the ratio of relative factor prices in sector *i* to the base industry. The value
 $\gamma_i = 1$ implies that the marginal condition holds between the two industries. If γ_i
 exceeds unity, then industry *i* has a lower capital-labor ratio than the base industry.
 That is, the labor input is too large and/or the capital stock is too low.

Source: Nakakuki, Otani, and Shiratsuka (2004).

remain almost unchanged in the range close to unity. Figure 12 shows the standard deviation of γ across industries for each year. We can see from this figure that the standard deviation jumps in the early 1990s and remains high thereafter, reflecting these larger deviations of γ from unity in the non-manufacturing sector.

These observations imply that the capital-labor ratios for these sectors remain considerably below the optimum level that the marginal condition indicates (either capital accumulation has been too small or labor input has been too large).

C. Interaction of Relative Price Changes in Two Dimensions

As discussed above, protracted economic stagnation in Japan can be seen as the incomplete economic adjustments to significant changes in relative prices in two dimensions: the intertemporal and cross-sectional dimensions. In addition, it should be stressed that a crucial interaction exists in the aforementioned changes in relative prices in two dimensions. The cross-sectional and intertemporal resource misallocation interacts to amplify the negative impacts of the structural factors on the economy as a whole.

In general, frictions and distortions in factor markets lead the economy to exhibit inefficient resource allocations. Figure 13 illustrates the economic intuition for this point. Suppose that the economy produces two goods, denoted by *M* and *N*. To keep the graph simple, assume further that the supplies of capital and labor are fixed. The production possibilities frontier (PPF) shows all feasible pairs of two goods. Now suppose that an economy is at the efficient allocation at point *A* under relative prices

Figure 12 Standard Deviation of Estimates of γ across Industries

Note: Figures are the standard deviation of γ across industries for each year, based on the estimates in Nakakuki, Otani, and Shiratsuka (2004).
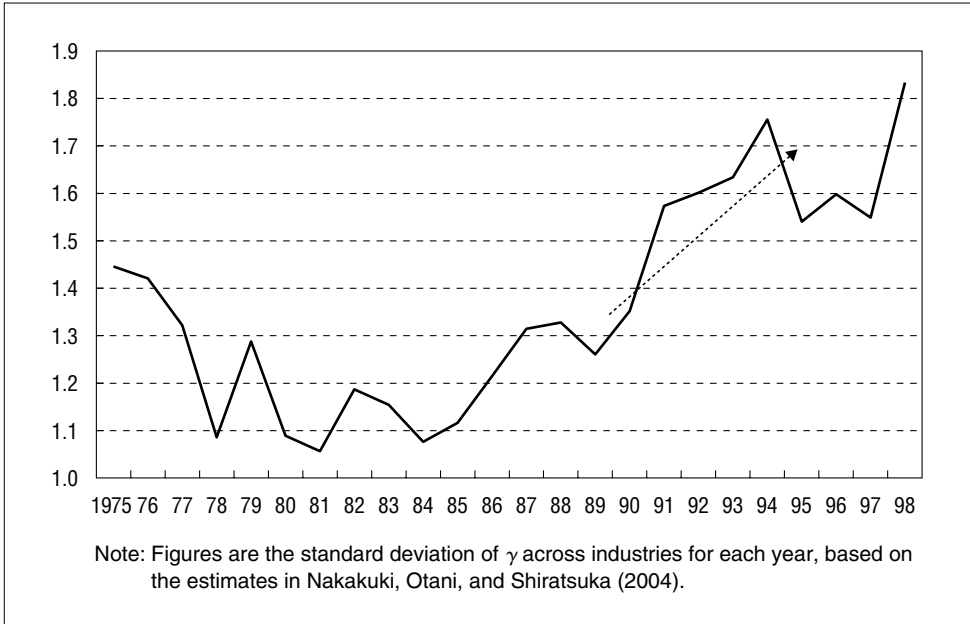
Figure 13 Production Possibilities Frontier
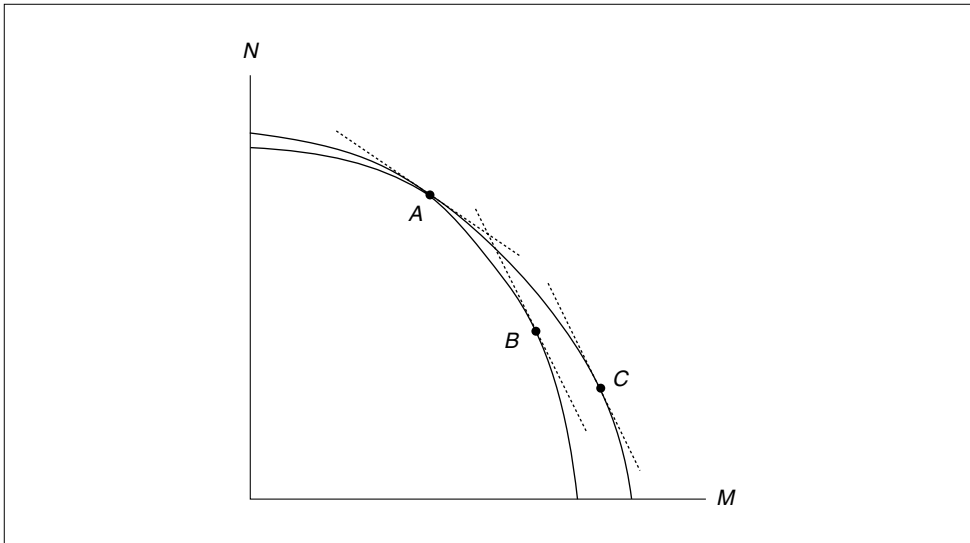
P_m/P_n, and relative price changes occur. Point C is attained if no frictions and distortions exist, while point B is attained if frictions and distortions prevent resource reallocation.

The above argument implies that distortions in factor markets lead an inward shift of the nation's PPF and lower attainable output. In this case, without reallocating resources from declining sectors to ones enjoying high productivity, asset prices, which correspond to the discounted present value of future cash flow, can hardly be expected to recover. As long as productivity growth rates remain stagnant, ROE will continue to be depressed.

Moreover, as discussed earlier, the relative price of asset prices to general prices means intertemporal relative prices. Thus, the economic situation in which asset prices drastically decline while general prices remain relatively stable can be interpreted as one in which downward pressure on the prices of future goods works to influence intertemporal resource allocation. It follows that downward pressure on the trend growth rate strengthens as the capital accumulation in high-productivity sectors declines.

To sum up, in a situation in which inefficient firms survive and the economy's PPF continues to expand very slowly over the long term, not only does the trend growth rate fall but also downward pressure on the asset prices influences the economy.

IV. Structural Adjustments and Reduced Economic Growth

In this section, based on the empirical study by Nakakuki, Otani, and Shiratsuka (2004), we first summarize the extended framework of growth accounting to incorporate the effects of factor market distortions, and quantitative assessment of the impacts of such distortions on Japan's economic stagnation. We then discuss policy implications of structural adjustments.

A. Effects of Factor Market Distortions on Economic Growth
Research on growth accounting in Japan, however, has not focused on the implications of structural impediments; rather, many studies assume perfect markets, thereby regarding the difference between the observed output growth and the hypothetical output growth under perfect utilization of resources as TFP growth. As a result, if structural impediments do exist, then contributions of factor accumulations are overstated, and TFP growth shows the sum of positive impacts of technology growth and negative impacts of structural impediments. Thus, the contribution of technological progress in growth accounting is underestimated when the TFP is solely attributable to technological progress.

For example, Hayashi and Prescott (2002) argue that economic stagnation in Japan in the 1990s is attributable to declines in both the TFP growth rate and working hours. They then conjecture that policies to subsidize inefficient firms and declining industries result in lower productivity, and discourage investment to improve productivity. It should be noted, however, that their analysis assumes the slowdown of TFP growth as exogenous, and does not explicitly deal with structural impediments against more efficient resource allocation.

B. Growth Accounting That Incorporates Factor Market Distortions

To quantify the impacts of distortions in factor markets during the period of continuing economic stagnation in the 1990s in Japan, Nakakuki, Otani, and Shiratsuka (2004) propose an analytical framework to incorporate factor market imperfections into growth accounting.

Real GDP, denoted by Y, is expressed by using the labor input, labor input share of each sector, and labor productivity of each sector, as follows.

$$Y = \sum_{i=1}^{n} Y_i = \sum_{i=1}^{n} L S_i A_i f_i(k_i), \tag{10}$$

where Y_i, L, and S_i denote real output of sector i, labor input of the economy on a man-hour basis, and the share of labor input in sector i, respectively. In addition, the production functions of each sector are assumed to be homogeneous of degree one. Transforming equation (10) into growth rate form yields equation (11) below.

$$\frac{\Delta Y}{Y} = \sum_{i=1}^{n} \frac{Y_i}{Y} \frac{\Delta A_i}{A_i} + \frac{\Delta L}{L} + \sum_{i=1}^{n} \frac{L S_i A_i f_i(k_i)}{Y} \frac{\Delta S_i}{S_i} + \sum_{i=1}^{n} \frac{L S_i A_i f_i'(k_i) k_i}{Y} \frac{\Delta k_i}{k_i}. \tag{11}$$

Under imperfect factor markets, the ratios of wages to rate of return on capital differ across sectors. By using a ratio of relative factor prices for sector i to a benchmark sector, γ_i, defined in equation (8), further decomposition of the terms of ΔS_i and $\Delta k_i / k_i$ yields equation (12) below.

$$\frac{\Delta Y}{Y} = \sum_{i=1}^{n} \frac{Y_i}{Y} \frac{\Delta A_i}{A_i} + \frac{\Delta L}{L} + (1 - \alpha) \frac{\Delta k}{k}$$

$$- \sum_{i=1}^{n} \frac{Y_i}{Y} (1 - \alpha_i) \left\{ \frac{\Delta \gamma_i}{\gamma_i} - \sum_{j=1}^{n} \left(\frac{S_j}{\gamma_j a_j} \middle| \sum_{m=1}^{n} \frac{S_m}{\gamma_m a_m} \right) \frac{\Delta \gamma_j}{\gamma_j} \right\} \tag{12}$$

$$- \sum_{i=1}^{n} \frac{Y_i}{Y} \left[(1 - \alpha_i) \left\{ \sum_{j=1}^{n} \left(\frac{S_j}{\gamma_j a_j} \middle| \sum_{m=1}^{n} \frac{S_m}{\gamma_m a_m} \right) \frac{\Delta S_j}{S_j} \right\} - \frac{\Delta S_i}{S_i} \right].$$

In the above equation, the first to third terms on the right-hand side correspond to the growth accounting formula without any distortions. The fourth and fifth terms are added to reflect the effects of factor market distortions. The fourth term represents the impact of intersectoral capital allocation induced by changes in γ when the capital-labor ratio for the economy is held constant. The fifth term indicates the effect of changes in labor input share.[16]

---

16. The effect of the change in labor input shares consists of two parts. One is the indirect effect of the changes in labor input on the GDP growth rate through the changes in the capital-labor ratio in individual sectors. The other is the direct effect of labor share changes among high- and low-productivity sectors on the GDP growth rate.

Table 1 shows the results of decompositions of GDP growth in Japan since the 1980s, based on equation (12), shown in Nakakuki, Otani, and Shiratsuka (2004).[17,18] We can see from the table that, in addition to the declines in TFP growth and in number of workers, capital accumulation and distortions in factor markets contribute to lowering GDP growth in the 1990s. From the bubble period to the post-bubble period, the total decline in GDP growth is –3.6 percent. The contribution from TFP growth is estimated at –1.6 percent, that from the capital deepening is –1.3 percent, that from the number of workers is –0.9 percent and that from factor market distortions is estimated at –0.5 percent, respectively. In this sense, the results are broadly in line with Hayashi and Prescott (2002).

Factor market distortions can account for one-seventh of the decline in the GDP growth rate from the bubble period to the post-bubble period. On the face of it, a contribution of one-seventh of the decline in the GDP growth rate may look small, compared with other factors mentioned above. It should be noted, however, that the above result shows the estimate of the direct impacts of factor market distortions, so that it ignores the indirect impacts. As Hayashi and Prescott (2002) argue, inefficient resource allocation results in lower productivity, and discourages investment that could improve productivity. In other words, the cross-sectional resource misallocation induces intertemporal resource misallocation, and then amplifies the negative impact on the economy. In particular, downward pressure on the trend growth rate, partly due to persistent distortions in factor markets, is likely to result in a decline in capital accumulation in high-productivity sectors. Thus, negative indirect effects of distortions in factor markets are likely to be counted as the effects of other factors such as the decline in capital deepening.

Table 1 Effects of Distortion in Factor Markets on Labor Productivity

	1980–85	1986–91 (bubble period) (a)	1992–98 (post-bubble period) (b)	(b) – (a)
GDP growth	3.96	4.82	1.24	–3.58
TFP	1.39	2.18	0.61	–1.58
Capital deepening	1.51	2.77	1.45	–1.32
Number of workers	0.79	1.29	0.34	–0.94
Working hours	0.04	–1.85	–1.12	0.73
Distortions	0.23	0.44	–0.03	–0.47
Relative MP	0.18	0.11	–0.15	–0.26
Labor input share	0.06	0.32	0.12	–0.21

Source: Nakakuki, Otani, and Shiratsuka (2004, table 2).

....

17. Data used in labor productivity decompositions are as follows: Y: real GDP (SNA), L: number of workers times working hours (SNA), K: real capital stock times capital utilization rate (Japan Industry Productivity Database [JIP Database]), α: nominal compensation for workers divided by nominal gross domestic income (SNA). See Fukao *et al.* (2003) for the details of the JIP Database. Note that capital stock and capital utilization rate in the JIP Database are available only up to 1998.
18. It should be noted that the quality of workers is assumed to be constant over all industries. Thus, labor reallocation from a low-productivity sector to a high-productivity sector results in an increase in aggregate labor productivity.

C. Policy Implications of Structural Adjustments

The aforementioned aspect of Japan's asset price bubble, with its consequences for structural adjustments since the 1990s, is important because it illustrates the specific environment in which the BOJ has had to conduct monetary policy. What the BOJ has faced is not a standard stabilization policy around a stable trend growth path, but unanswered policy management questions in an environment in which sustained growth has been hampered due to insufficient structural adjustments in response to significant changes in relative prices. In other words, the Japanese economy is suffering from a large-scale and quite persistent adverse shock within the framework of a standard macroeconomic model.

As we have emphasized up to now, the cross-sectional resource misallocation induces intertemporal resource misallocation, which then amplifies the negative impact on the economy. This observation implies that structural factors are more important than cyclical factors as the major cause of the economy's plunge into a deflationary economic environment. It also suggests that the elimination of structural factors themselves is a more effective policy response than measures taken to offset cyclical factors. In other words, monetary policy is no panacea for the economic decline and cannot substitute for policies designed to resolve the structural problems that exist on the supply side.[19]

In the case of a downward shift in the potential growth rate, the economy is likely to fall into deflation and a zero interest rate environment again, since the rate of growth and the natural rate of interest in the steady state are low. It should be noted, however, that this does not necessarily mean that a central bank becomes powerless. Even in such a situation, a central bank can reduce the burden of transition to the new steady state by stimulating aggregate demand mainly through its policy commitments. It may be the case that such structural policies trigger a significant adverse shock in the short term. A central bank could make an unprecedented commitment to assist in correcting a distortion in the economy if the commitment helped the government and firms take consistent actions to restore the potential growth that could make monetary policy meaningful.

In this regard, it is crucial to understand the nature of the adverse shock to the economy. Japan's experience indicates that the economy is suffering continuing stagnation not only because the magnitude of the shock is quite large but also because the shock is quite persistent. Although the central bank can alleviate any large one-time adverse shock, it should be emphasized that it cannot offset a permanent shock to the economy.

V. Concluding Remarks

In this paper, we have examined implications of asset price fluctuations and resultant structural adjustments on sustained economic growth, based on Japan's experience since the latter half of the 1980s.

---

19. See Yamaguchi (1999) and Shirakawa (2000) for further discussion in the context of Japan. As Bhagwati (1971) discusses, the basic policy response to structural problems is to directly attack their sources and induce a transfer of economic resources from agents that gain to those that lose, thereby promoting structural reform.

In doing so, we proposed that asset price deflation in Japan in the 1990s is better understood as a reflection of a significant downward shift in trend growth rather than the bursting of a gigantic bubble which amplified the business cycle. A significant downward shift in the growth trend can at least partly be seen as the result of incomplete economic adjustments to significant changes in relative prices in two dimensions: the intertemporal and cross-sectional dimensions. In this regard, it should be noted that a crucial interaction exists in the changes in relative prices in two dimensions, resulting in a decline in the trend growth rate. Put differently, a downward shift in the growth trend resulting from the incomplete economic adjustments to significant changes in relative prices in the Japanese economy can be regarded as a large-scale and quite persistent adverse shock.

The above observation implies that structural factors are more important than cyclical factors as the major cause of the Japanese economy's plunge into a deflationary economic environment. This aspect of the asset price bubble, with its consequences for the structural adjustments in the 1990s, is important because it illustrates the specific environment in which the BOJ has had to conduct monetary policy.

The lesson from the BOJ's experience since the 1990s is that, if a significant and unforeseen slowdown of the potential output growth rate were due to structural problems, monetary policy would inevitably differ greatly from stabilization policy in normal circumstances. Under such circumstances, it is also stressed that the elimination of the structural impediments themselves is a more effective policy response than measures taken for a sustained period to offset cyclical factors. Whether Japan's current economic recovery will turn into sustained economic growth and put an end to deflation depends on its progress in eliminating structural impediments. Of course, monetary policy could assist in correcting a distortion in an economy in transition, but is no panacea for all types of economic maladies and cannot substitute for policies designed to resolve the fundamental structural problems that exist on the supply side.

References

Alchian, Armen A., and Benjamin Klein, "On A Correct Measure of Inflation," *Journal of Money, Credit and Banking*, 5 (1), 1973, pp. 173–191.

Bhagwati, Jagdish, "The Generalized Theory of Distortion and Welfare," in Jagdish Bhagwati, ed. *Trade, Balance of Payments, and Growth: Papers in International Economics in Honor of Charles P. Kindleberger*, Amsterdam: North-Holland, 1971, pp. 69–90.

Caballero, Ricardo J., Takeo Hoshi, and Anil K. Kashyap, "Zombie Lending and Depressed Restructuring in Japan," mimeo, 2003.

Fujiki, Hiroshi, and Shigenori Shiratsuka, "Policy Duration Effect under the Zero Interest Rate Policy in 1999–2000: Evidence from Japan's Money Market Data," *Monetary and Economic Studies*, 20 (1), Institute for Monetary and Economic Studies, Bank of Japan, 2002, pp. 1–31.

———, Kunio Okina, and Shigenori Shiratsuka, "Monetary Policy under Zero Interest Rate: Viewpoints of Central Bank Economists," *Monetary and Economic Studies*, 19 (1), Institute for Monetary and Economic Studies, Bank of Japan, 2001, pp. 89–130.

Fukao, Kyoji, Tsutomu Miyagawa, Hiroshi Kawai, Tomohiko Inui, Ximing Yue, Yoshinobu Okumoto, Masakatsu Nakamura, Masahide Hayashida, Kazuyoshi Nakata, Takeyoshi Hashikawa, Naoki Okumura, Yukako Murakami, Sumio Hamagata, Yuki Yoshizawa, Shiko Maruyama, and Chikako Yamauchi, "Sangyobetsu Seisansei to Keizaiseicho: 1970–1998 (Productivity and Economic Growth by Industry: 1970–1998)," *Keizai Bunseki* (Economic Analysis), 170, Economic and Social Research Institute, Cabinet Office, 2003 (in Japanese).

Hayashi, Fumio, and Edward C. Prescott, "The 1990s in Japan: A Lost Decade," *Review of Economic Dynamics*, 5, 2002, pp. 206–235.

Maeda, Eiji, Masahiro Higo, and Kenji Nishizaki, "Wagakuni no 'Keizai Kozo Chosei' ni tsuite no Ichi Kosatsu (An Examination of Japan's 'Economic Structural Adjustments')," *Nippon Ginko Chousa Geppo* (Bank of Japan Monthly Bulletin), Public Relations Department, Bank of Japan, July, 2001 (in Japanese).

Mio, Hitoshi, "Identifying Aggregate Demand and Aggregate Supply Components of Inflation Rate: A Structural Vector Autoregression Analysis for Japan" *Monetary and Economic Studies*, 20 (1), Institute for Monetary and Economic Studies, Bank of Japan, 2002, pp. 33–56.

Nakakuki, Masayuki, Akira Otani, and Shigenori Shiratsuka, "Distortions in Factor Markets and Structural Adjustments in the Economy," *Monetary and Economic Studies*, 22 (2), Institute for Monetary and Economic Studies, Bank of Japan, 2004, pp. 71–99.

Okina, Kunio, "Monetary Policy under Zero Inflation: A Response to Criticisms and Questions Regarding Monetary Policy," *Monetary and Economic Studies*, 17 (3), Institute for Monetary and Economic Studies, Bank of Japan, 1999, pp. 157–182.

———, and Shigenori Shiratsuka, "Asset Price Bubbles, Price Stability, and Monetary Policy: Japan's Experience," *Monetary and Economic Studies*, 20 (3), Institute for Monetary and Economic Studies, Bank of Japan, 2002, pp. 35–76.

———, and ———, "Japan's Experience with Asset Price Bubbles: Is It a Case for Inflation Targeting?" in William C. Hunter, George G. Kaufman, and Michael Pomerleano, eds. *Asset Price Bubbles: The Implications for Monetary, Regulatory, and International Policies*, Cambridge, Massachusetts: MIT Press, 2003, pp. 81–99.

———, and ———, "Policy Commitment and Expectation Formations: Japan's Experience under Zero Interest Rates," *North American Journal of Economics and Finance*, 15 (1), 2004, pp. 75–100.

———, Masaaki Shirakawa, and Shigenori Shiratsuka, "The Asset Price Bubble and Monetary Policy: Japan's Experience in the Late 1980s and the Lessons," *Monetary and Economic Studies*, 19 (S-1), Institute for Monetary and Economic Studies, Bank of Japan, 2001, pp. 395–450.

Sekine, Takatoshi, Keiichiro Kobayashi, and Yumi Saita, "Forbearance Lending: The Case of Japanese Firms," *Monetary and Economic Studies*, 21 (2), Institute for Monetary and Economic Studies, Bank of Japan, 2003, pp. 69–92.

Shibuya, Hiroshi, "Dynamic Equilibrium Price Index: Asset Price and Inflation," *Monetary and Economic Studies*, 10 (1), Institute for Monetary and Economic Studies, Bank of Japan, 1992, pp. 95–109.

Shirakawa, Masaaki, "Kin'yu Seisaku wa Kozo Kaikaku made wa Daitai Dekinai (Monetary Policy Cannot Substitute for Structural Policy)," *Shukan Daiyamondo*, January 29, 2000 (in Japanese; English translation is available at http://www.boj.or.jp/en/ronbun/kwp00e01.htm).

Shiratsuka, Shigenori, "Asset Price Fluctuation and Price Indices," *Monetary and Economic Studies*, 17 (3), Institute for Monetary and Economic Studies, Bank of Japan, 1999, pp. 103–128.

———, "Asset Prices, Financial Stability and Monetary Policy: Based on Japan's Experience of the Asset Price Bubble," in *Marrying the Macro- and Microprudential Dimensions of Financial Stability*, BIS Paper No. 1, Bank for International Settlements, 2001, pp. 261–284.

Yamaguchi, Yutaka, "Monetary Policy and Structural Policy: A Japanese Perspective," remarks by Yutaka Yamaguchi, Deputy Governor of the Bank of Japan, before Colloque Monétaire International at Banque de France, October 8–9, 1999 (http://www.boj.or.jp/en/press/koen044.htm).

Comment

CHARLES L. EVANS
Federal Reserve Bank of Chicago

The subject of this interesting paper by Kunio Okina and Shigenori Shiratsuka is the protracted economic stagnation that has occurred in Japan since the late 1980s. The source of this slowdown continues to be much debated, and following the contributions of papers such as this one, will continue to be discussed for some time to come. The secular slowing is captured well in Figure 4 [2] of the paper, where the Hodrick-Prescott trend growth rate falls from above 4 percent in the late 1980s to around 1 percent in 2004. The authors pursue an explanation that attributes this slowing to incomplete adjustments in response to significant changes in relative prices. This is a provocative explanation that puts changes in technology front and center in this debate.
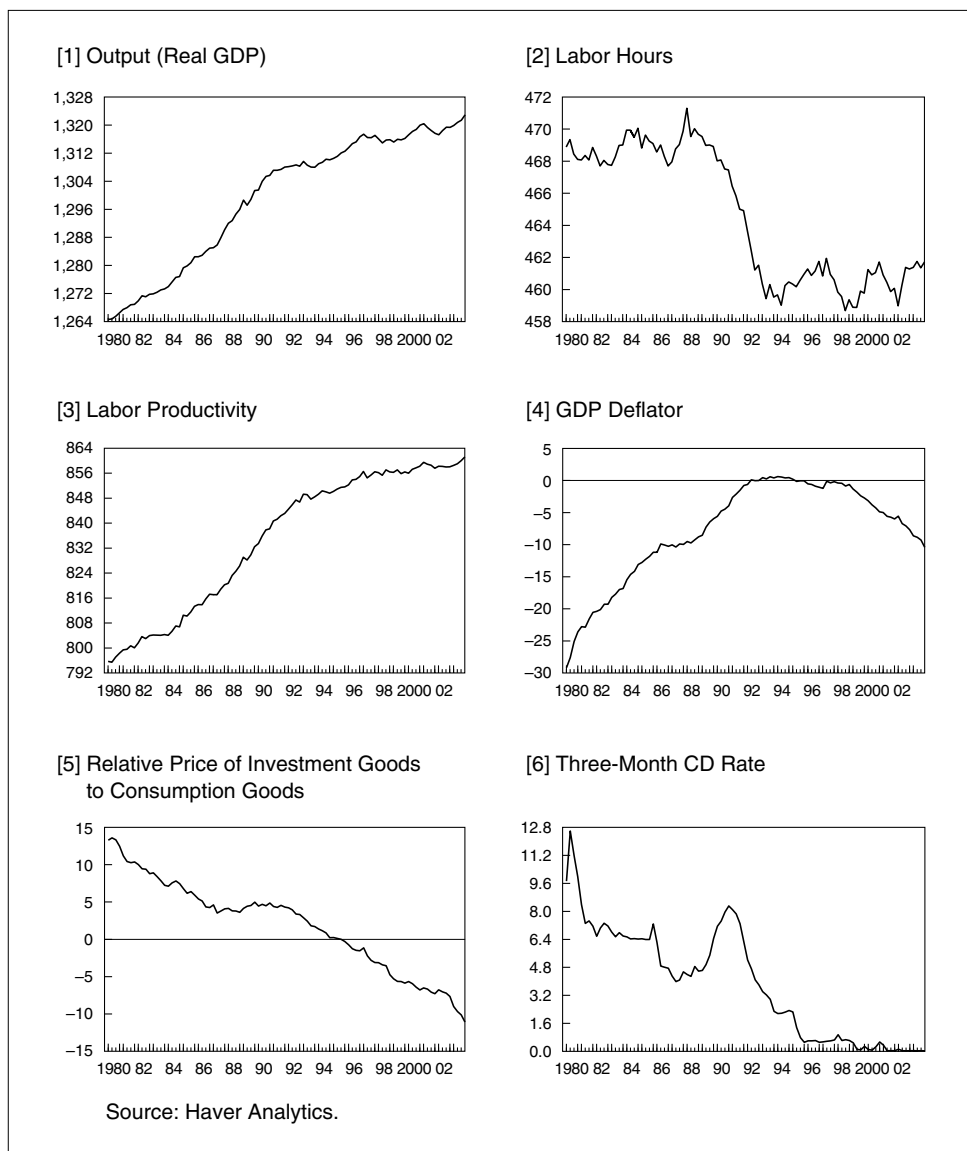
In my comments on this paper, I want to take this technological explanation very seriously. It is, after all, not the conventional viewpoint. There are two prominent views of the Japanese economic stagnation. One perspective is that following the collapse of the asset bubble economy, there was insufficient aggregate demand for the economy to return to potential output growth rates, even with approximately nominal interest rates of zero. A second perspective is that structural problems in the economy were more important, and prevented the return to higher growth rates. Inefficiencies in financial markets and lending undoubtedly contributed to this structural explanation. But the structural deficiencies could also be proxying for more fundamental technological changes. Due to the similar findings of the authors and Hayashi and Prescott (2002), I want to pursue the technological explanation a bit further.

With such an information disadvantage about the workings of the Japanese economy, my approach is to simply fall back on the methods of an empirical macroeconomist. By looking at simple plots of the data, I will search for clues about the driving process for economic fluctuations in Japan during the 1990s. This is also the empirical method of the authors.

My first figure displays times series in Japan for output (real GDP), labor hours, labor productivity, the GDP deflator, the relative price of investment goods to consumption goods, and a short-term nominal interest rate (Figure 1).[20] Of course, one of the first clues about the driving shocks involves the behavior of output and the price level. The slowing in output growth and falling prices suggest that negative aggregate demand shocks have been predominantly hitting the Japanese economy since the collapse of the bubble economy. Another possible explanation, however, is that substantial negative technology shocks have occurred. If these adverse supply shocks are occupied by substantial endogenous falls in aggregate demand, then the

---

20. The data are from income and product accounts as reported by Haver Analytics. Output is real GDP; the price level is the GDP deflator; labor hours are for the manufacturing sector; labor productivity is computed as output per labor hour; the relative price of investment goods is the deflator for investment goods divided by the consumption goods deflator, and the short-term interest rate is a three-month CD rate. As the text mentions, data mismatches in this analysis offer wide scope for improving the analysis here. For example, the assumption that aggregate hours moved proportionally to manufacturing hours may be false.

Figure 1 Macroeconomic Data

[1] Output (Real GDP)

[2] Labor Hours

[3] Labor Productivity

[4] GDP Deflator

[5] Relative Price of Investment Goods
to Consumption Goods

[6] Three-Month CD Rate

Source: Haver Analytics.

price level could fall as output growth is slowing. Taking this view seriously requires looking at additional macroeconomic data beyond prices and output.

Other data in Figure 1 provide *prima facie* support for productivity explanations. The level of productivity clearly slows beginning in the early 1990s. Labor hours also fell sharply during this period and remained low throughout the decade. These observations are important ingredients in the results of Hayashi and Prescott (2002). They interpret the reductions in total factor productivity (TFP) and hours as exogenous shocks for the Japanese economy. Working with a calibrated neoclassical growth model for Japan, Hayashi and Prescott (2002) find that these two shocks account for most of the reductions in aggregate output in the 1990s. In other words,

aside from the adverse consequences for aggregate demand that are generated from these shocks, only productivity and labor supply shocks are necessary to generate substantial, persistent economic downturns. Their findings leave for further research the matter of deducing more precisely the sources of this technological regress.

Okina and Shiratsuka (2004) provide a good bit of evidence on these additional supply channels. Figure 10 in their paper shows the relationship between output growth and price changes by industry. Technological innovations are typically associated with falling relative prices within the industries that are growing rapidly. Such a negative relationship is apparent in the 1980s, but the 1990s show a positive relationship if electrical machinery, equipment, and supplies are excluded. If technological improvements have continued during this period, the positive relationship suggests an impediment between the innovation and the use of that technology in production. Rising relative prices are signs of obstacles or inefficiencies. Interestingly, Figure 11 shows that most industrial sectors have smaller capital-labor ratios in the 1992–98 period relative to 1986–91. In their analysis, Okina and Shiratsuka (2004) show that this is associated with either too little capital or too much labor relative to the efficient frontier. This strongly suggests impediments to the implementation of new technological innovations.

In Table 1 of their paper, the authors report calculations that confirm the negative contributions of TFP and reductions in labor hours for Japan in the 1990s, also finding that factor market distortions contributed to this slowdown. Clearly, an economy facing supply constraints of this sort is also facing gale-force negative aggregate demand effects. In this context, stimulative aggregate demand policies would seem essential for averting disinflationary and deflationary consequences. In this sense, the supply shock explanation is likely just one piece of the explanation for the post-bubble experiences of Japan in the 1990s.

But this is the piece on which I want to focus a bit more. Returning to my Figure 1, the plot of investment goods prices relative to consumption goods prices shows a downward trend until the late 1980s. For several years into the 1990s, there is an increase in investment goods prices. Research by Greenwood, Hercowitz, and Krusell (1997) and Fisher (2002) finds that this pattern may be indicative of negative technology shocks to the investment goods producing sector. Such a pattern of negative shocks when combined with persistent propagation and additional negative aggregate demand consequences could help account for the negative measured TFP shocks. And for the United States, Fisher (2002) finds that negative investment-technology shocks account for a large percentage of fluctuations in labor hours at business-cycle frequencies. Neutral TFP shocks account for less than 10 percent of these fluctuations in labor hours. So one question is what does the pattern of investment-technology shocks look like for Japan during this period?

Fisher (2002) shows how these shocks can be identified within a vector autoregression (VAR) containing data on labor productivity, investment goods prices, and other macroeconomic variables. The identifying restrictions are relatively easy to implement. The restrictions are that both neutral TFP and investment-technology shocks are the only exogenous shocks that influence the long-run level of labor productivity. In addition, only the investment-technology shock affects the long-run

relative price of investment goods. Fisher (2002) provides a relatively standard neoclassical analysis of an economy in which these restrictions hold. He also provides a discussion about why other shocks, like capital tax shocks, are unlikely to have empirically affected productivity in the long run for the United States. Using a VAR with Japanese data, I estimated these I-shocks for Japan, and they are displayed in my Figure 2. Positive shocks increase the relative price of investment goods and indicate negative technological effects. Looking at the figure, contractionary I-shocks (positive) hit the economy in the late 1980s, as would seem evident from the simple plot showing that investment goods prices increased during this period. But then in the

Figure 2 Identified Investment-Technology Shocks
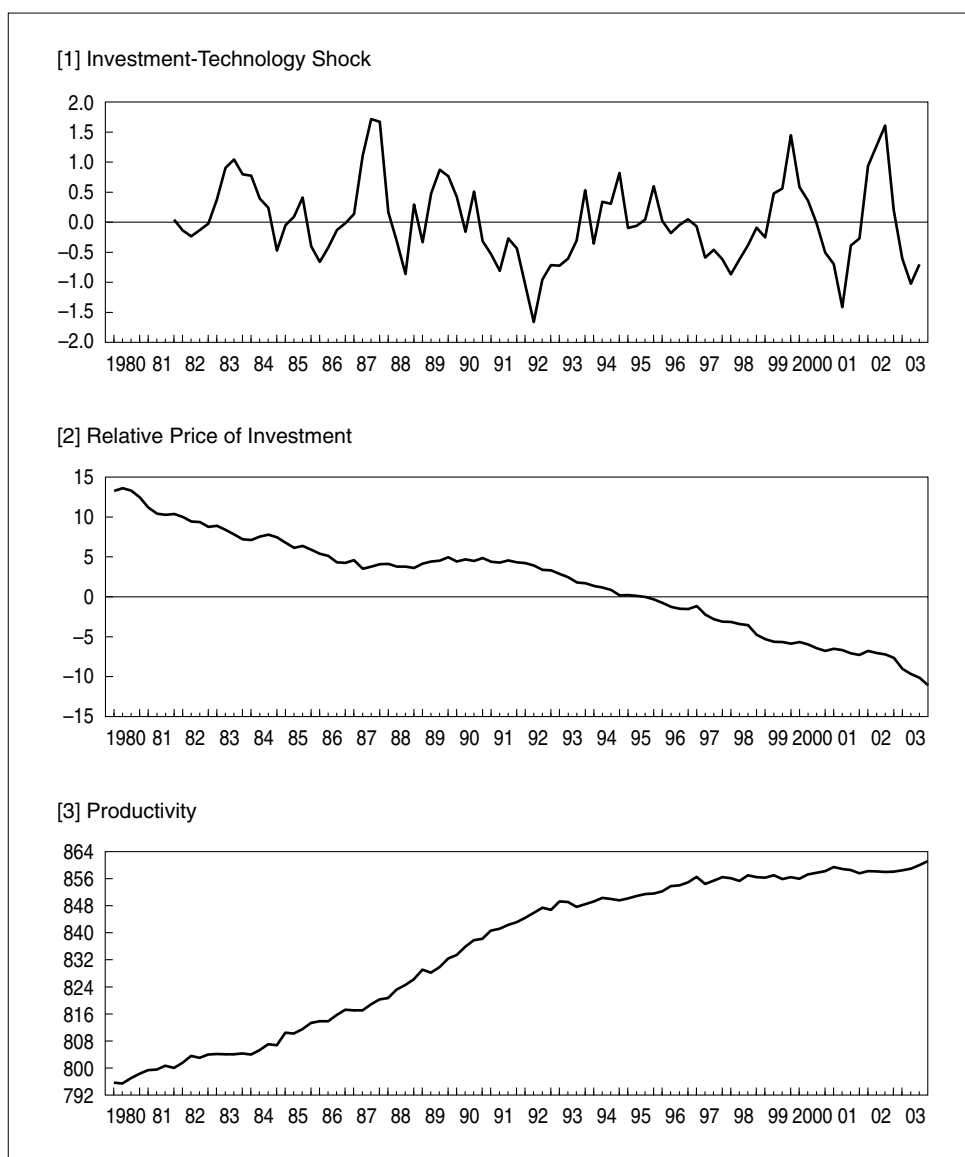
early 1990s, expansionary I-shocks (negative) arrived. Presumably, these expansionary I-shocks would have boosted the Japanese economy in the mid-1990s. Such an acceleration in real growth did not occur. So there are a number of issues that should be addressed more fully to evaluate this channel.

(1) How likely is it that the contractionary 1980s shocks kicked off a series of events that led to an unusually persistent period of decline? Could there have been an unusual confluence of events tied to the bursting of the asset bubble and these I-shocks?

(2) Did negative aggregate demand shocks arrive in the 1990s to outweigh the expansionary I-shocks during this period?

(3) The data underlying my analysis are very poor. For example, Fisher (2002) points out that many methodological breakthroughs were necessary for Greenwood, Hercowitz, and Krusell (1997) to measure investment goods prices well. My quick analysis here does not benefit from access to appropriate quality-consistent goods data throughout the period. Would better measurements improve or refute this investment-shock channel?

I think these are interesting issues for further pursuit. They seem to be in a similar spirit to the explanations offered by Okina and Shiratsuka (2004). More research might prove useful, and help flesh out the importance of the sluggish adjustment channels in response to a variety of shocks.

References

Fisher, Jonas, "Technology Shocks Matter," Federal Reserve Bank of Chicago Working Paper No. 02-14, Federal Reserve Bank of Chicago, 2002.

Greenwood, Jeremy, Zvi Hercowitz, and Per Krusell, "Long-Run Implications of Investment-Specific Technological Change," *American Economic Review*, 87 (3), 1997, pp. 342–362.

Hayashi, Fumio, and Edward C. Prescott, "The 1990s in Japan: A Lost Decade," *Review of Economic Dynamics*, 5, 2002, pp. 206–235.

Okina, Kunio, and Shigenori Shiratsuka, "Asset Price Fluctuations, Structural Adjustments, and Sustained Economic Growth: Lessons from Japan's Experience since the Late 1980s," *Monetary and Economic Studies*, 22 (S-1), Institute for Monetary and Economic Studies, Bank of Japan, 2004, pp. 143–167 (this issue).

Comment

PHILIP W. LOWE
Reserve Bank of Australia

I have always found papers by Kunio Okina and Shigenori Shiratsuka both enjoyable to read and thought-provoking. This one is no exception!

Before commenting on the paper I should note, in the interest of full disclosure, that I am not an unbiased commentator. In particular, due to some previous work that I have done, my position when I started reading this paper was that the problems in Japan over the past decade or so are fundamentally rooted in the bursting of the asset

price bubble and the resulting weakness in *demand*. My reading of this paper is that it challenges this view, or at a minimum, it says things are much more complicated. In particular, what is going on on the supply side of the economy is very important, perhaps the central story.

The basic argument of the paper is well spelled out in the introduction:

> We propose the view that the protracted economic stagnation in Japan can be seen as a result of the incomplete economic adjustments to significant changes in relative prices, partly triggered by the bursting of the asset price bubble.[21]

I find two aspects of this hypothesis intriguing. The first is that the real roots of the Japanese problem lie on the supply side—or in relative prices—not on the demand side. And the second—and I think quite novel idea—is that the problems with relative prices and resource allocation that exist in Japan today are linked to the asset price bubble. This means that the asset price bubble is by no means blameless, but that its main harmful effect is not through hurting the demand side of the economy, but by distorting the supply side of the economy.

In my comments, I would like to explore these two intriguing ideas.

The first issue that I would like to touch on is what are the relative prices that matter? The paper discusses at least four.

The *first* is the price of goods today relative to the prices of goods tomorrow. For this relative price, asset prices are taken as a proxy. The *second* is the price of goods produced domestically relative to the price of goods produced overseas. The *third* is the price of tradable goods relative to the price of non-tradable goods. And the *fourth* is the price of labor relative to capital (although the paper focuses more on the allocation of labor and capital between sectors).

So where have the really serious problems been, and where are they now?

The obvious starting point must be asset prices. The depressed level of prices today suggests that the price of future goods is low relative to current goods. A decade and a half ago, the reverse was the case. While I am not sure that I fully agree with the idea that asset prices give us a good read on the relative price of goods today and tomorrow, there can be no disputing the idea that the large swings in asset prices have significantly distorted resource allocation. This distortion has come not so much because people misjudged the price of goods and services today versus tomorrow, but because the movements in asset prices—and the wave of optimism and pessimism that has driven them—have greatly distorted the balance sheets of many firms, households, and financial institutions. Correcting these distortions has turned out to be a difficult and frustratingly slow process. Understanding the nature of this correction is central to understanding the Japanese experience.

As the authors note, the other relative prices are cross-sectional prices. Where Japan really stands out here is the relative price of non-tradable to tradable goods and the relatively high use of labor—given relative factor prices—in a number of the non-tradable industries, as well as agriculture. The results in this paper seem to

---

21. Okina and Shiratsuka (2004, p. 144).

suggest that there is significant scope for a more efficient allocation of resources in these areas. I suspect few would disagree.

But the paper also argues that it is difficult to achieve this reallocation because of the ongoing effects of the movement in asset prices. As I noted before, this points to an often-ignored consequence of the bursting of asset price bubbles—that is, the sand that it can throw in the wheels of ongoing structural adjustments in the economy. When there is a need for considerable structural adjustments—as in the case of Japan—this sand can cause, or at least amplify, a long-lasting slowdown in the growth rate of the economy.

While as a discussant one always hesitates to suggest that more be added to a paper, I would be interested to know what weight the authors give to the asset price bubble as a factor inhibiting reform relative to other standard candidates, including inflexibilities in the labor market, competition policy, and other structural rigidities. Is there any way of assessing, or better still quantifying, the relative importance of these various factors?

The second issue is the vexed debate over whether it is supply or demand. The paper makes a convincing case that the potential growth rate of the Japanese economy has slowed, partly because of problems with resource allocation. But is this the full explanation of the outcomes over the past decade or so? I suspect the answer is no.

The reason I say this is because of what has happened to the prices of goods and services. These are not discussed much in the paper, perhaps because the facts are well known. Since 1990, consumer price index (CPI) inflation in Japan has averaged 0.5 percent, although since 1998 it has averaged –0.5 percent. The CPI today is 3.25 percentage points lower than its peak in late 1997; the GDP deflator is around 10 percentage points lower.

At a very simple—perhaps even simplistic—level, this seems to pose a challenge to the view that the outcomes are largely due to the supply side. In the 1970s, when productivity growth around the world slowed unexpectedly, we ended up with considerable inflation. And in the second half of the 1990s, when the reverse happened and productivity growth unexpectedly accelerated in a number of countries—including the United States and Australia—inflation turned out to be lower than expected. These experiences suggest that when productivity growth slows unexpectedly, inflation is the outcome, and when productivity growth accelerates unexpectedly disinflation is the outcome. What has gone on in Japan, though, is the reverse of this: the productivity slowdown—of which at least some part must be unexpected—has been associated with a decline, not only in inflation, but also in the price level.

What can explain this unusual outcome? *Prima facie* it suggests that the demand side of the economy has grown less quickly than the lowered growth of the supply side of the economy. After all, prices fall if supply exceeds demand!

The fact that prices have fallen for a number of years seems to give extra weight to the argument that, whatever has been going on on the supply side, demand has been weaker still. I think it would be interesting to explore why this is so.

One answer is that the reconstruction of balance sheets has been tremendously difficult, particularly in an environment of low potential growth. Another more nuanced argument is that confidence and demand have been held down by the

enormity of the structural issues in Japan. A third is that real interest rates have remained positive, despite the problems. With official rates having been at zero for some time, the scope for demand stimulus through conventional channels has been largely exhausted. There are no doubt other explanations as well.

So after reading, have I changed my preexisting views? The answer is somewhat, but not completely. What I have learned is that there is a new mechanism through which unwinding of bubbles can harm the economy—that is, the effect that the unwinding can have in inhibiting structural reform. In my opinion, that just adds to the case for doing something about imbalances in credit and asset markets before they become too large.

I say not completely, because I am struggling to understand why prices have been so weak if the story is mainly one about supply. And I am not sure how important the unwinding of the boom is in delaying structural adjustments, relative to other candidate explanations. Perhaps the discussion will be useful here!

Reference

Okina, Kunio, and Shigenori Shiratsuka, "Asset Price Fluctuations, Structural Adjustments, and Sustained Economic Growth: Lessons from Japan's Experience since the Late 1980s," *Monetary and Economic Studies*, 22 (S-1), Institute for Monetary and Economic Studies, Bank of Japan, 2004, pp. 143–167 (this issue).

General Discussion

As a rejoinder to the discussants, Kunio Okina stated that both of them referred to insufficient aggregate demand in Japan in the late 1990s as the cause of weak price developments. He stressed that the paper focused mainly on the supply side of the economy, but did not deny the importance of demand factors. Rather, he added that since the late 1980s, the weak response of consumer prices to demand conditions was puzzling.

In addition, Shigenori Shiratsuka emphasized the difficulty of separating supply and demand factors in the long term because of their dynamic interaction. He expressed his uncertainty regarding Hayashi-Prescott's assumptions in estimating total factor productivity (TFP), including a one-sector model with no friction. This motivated him to quantify other factors in the latter stages of the lost decade. Along those lines, he mentioned work by Takuji Kawamoto that showed no slowdown in technological growth, and how other structural factors worked in the 1990s.[22]

In the general discussion, Hiroyuki Hino (International Monetary Fund) agreed with the authors that the supply side of the Japanese economy had not been sufficiently analyzed. He also suggested that the decline in asset prices reduced productivity growth through reduced investment expenditures. Gregory D. Hess

---

22. See Takuji Kawamoto, "What Do the Purified Solow Residuals Tell Us about Japan's Lost Decade?" IMES Discussion Paper No. 2004-E-5, Institute for Monetary and Economic Studies, Bank of Japan, 2004.

(Claremont McKenna College) insisted that supply and demand factors were hard to separate in Japan, because it had two economies: an extremely efficient export sector and a distorted non-tradable goods sector. Meanwhile, Jean-Philippe Cotis (Organisation for Economic Co-operation and Development) pointed out that similar movement in return on equity (ROE) in the manufacturing and non-manufacturing sectors seemed to contradict arguments in the paper about insufficient factor mobility across sectors.

Stefan Gerlach (Hong Kong Monetary Authority) cautioned that output gaps were very difficult to estimate under protracted adverse shocks to aggregate demand. Assaf Razin (Tel Aviv University and Cornell University) pointed out that TFP was basically a mixture of technology shocks and changes in markups. He called for a research strategy that would tease out the effects of technological changes from the residuals, otherwise the changes in markups could be misconstrued as technological changes. Shiratsuka responded that analysis in the paper focused on distortions in factor markets, while Kawamoto focused on distortions in product markets, including the effects of markups.

Regarding problems with structural adjustment and the role of monetary policy, Hino pointed out that the effects of a forbearance policy in banking system problems seemed to be larger than previously thought. Okina replied that this point was closely related to the previous day's discussion of Franklin Allen and Hiroko Oura's paper.

Vincent R. Reinhart (Board of Governors of the Federal Reserve System) pointed out that there were escalating outsized earning expectations behind Japan's asset bubble of the late 1980s, which were created by the economic environment of the time. Shiratsuka agreed that Japan's asset price bubble of the late 1980s was backed by extremely bullish expectations for future economic activities. Otmar Issing (European Central Bank) noted that the decline in asset prices over a decade in Japan contrasted sharply with the case of the U.S. collapse in 1929. Okina responded that the Japanese case was one of prolonged adjustments and therefore not easily compared directly with the United States in 1929. Shiratsuka added that the decade-long decline in asset prices in Japan resulted from the amplified adverse effects of incomplete adjustments to intertemporal and cross-sectional relative price changes.

Robert H. Rasche (Federal Reserve Bank of St. Louis), the chairperson of the session, expressed his concerns about what had occurred before and after the late 1980s in Japan since the standard deviation of the ratio of relative factor prices across sectors increased after the mid-1980s. Okina agreed and suggested that the asset price bubble in Japan might have created a misallocation of resources both before the bubble developed and after it burst.

To analyze asset prices from a viewpoint of the intertemporal dimension, Gerlach proposed testing the information content of asset prices as proxies for future inflation. Simon Price (Bank of England) agreed with the authors by stating that land prices reflected expected future prices. On the other hand, noting that high relative asset prices in Japan in the late 1980s did not seem to indicate inflationary pressure afterward, Cotis insisted that an intertemporal interpretation of asset prices was not very conclusive. Okina stated the need for further research regarding the relationships between asset prices and future prices.

Hermann Remsperger (Deutsche Bundesbank) asked how to interpret the current upturn in the Japanese economy and the role played by the financial industry. Okina responded that one major difference from previous recoveries in the 1990s was that resolution of the nonperforming-loan problem had advanced significantly. Finally, Okina stressed that even if monetary policy could not offset all shocks, we should find ways that work.