

**FOR  
AGENDA**

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Supplement 1

CONTAINS CONFIDENTIAL  
INFORMATION

July 13, 1994

To: Members of the Executive Board

From: The Acting Secretary

Subject: Japan - Staff Report for the 1994 Article IV Consultation

The attached supplement to the staff report for the 1994 Article IV consultation with Japan (SM/94/167, 7/1/94) has been prepared on the basis of additional information.

Mr. Baumgartner (ext. 37307) or Mr. Meredith (ext. 37771) is available to answer technical or factual questions relating to this paper prior to the Board discussion.

Unless the Documents Preparation Section (ext. 36760) is otherwise notified, the document will be transmitted, in accordance with the procedures approved by the Executive Board and with the appropriate deletions, to the GATT Secretariat and the Organisation for Economic Cooperation and Development (OECD), following its consideration by the Executive Board.

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JAPAN

Staff Report for the 1994 Article IV Consultation  
Supplementary Information

Prepared by the Central As a Department

Approved by Bijan B. Aghevli

July 12, 1994

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## I. The Medium-Term Outlook and Alternative Long-Run Scenarios

### 1. Introduction

This chapter describes more fully the medium-term outlook presented in the staff report, and examines the long-run implications of population aging for the Japanese economy. The demographic issue is of particular importance, given that the proportion of the elderly in Japan's population will rise more rapidly over the next 25 years than in any other major industrial country. <sup>1/</sup> Since Japan's overall fiscal position reflects large surpluses in the social security accounts, the implications of population aging for future social security receipts and payments is especially relevant. As shown below, the sharp future swing in the social security balance underscores the need to take a forward-looking view of fiscal sustainability.

To summarize the long-run scenarios, the increasing share of the elderly will result in major spending pressures in terms of both social security benefits and medical care. Under the current program structure, the ratio of pension benefits to GDP would rise from 5 percent of GDP in 1995 to 13 percent in 2020, while medical spending would rise by 2 percentage points of GDP. <sup>2/</sup> In the absence of a compensating increase in the contribution rate, the social security surplus would be eliminated shortly after the year 2000. Thereafter, rising benefits would lead to a primary social security deficit of 9 percent of GDP by 2020. Together with growing debt-servicing payments, unchanged policies would imply an overall government deficit of 16 percent of GDP by 2020, and a rise in net government debt to 150 percent of GDP.

To avoid such a debt explosion, actions must eventually be taken to reform the pension system, and to cut spending and/or raise revenues. The magnitude of the adjustments needed to achieve a sustainable long-run fiscal position--defined as a stable ratio of debt to GDP--is estimated at 6 1/2 percent of GDP if implemented now (beyond the measures implied by the current tax reform proposal). In other words, combined measures to raise revenues and/or reduce spending by this amount would be needed to put the fiscal position on a sustainable track. The longer the required adjustments

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<sup>1/</sup> See, for instance, "Pension Liabilities in the Seven Major Economies," OECD Working Paper No. 142, 1993.

<sup>2/</sup> Long-run scenarios are subject to many uncertainties and provisos regarding, for instance, productivity growth and inflation. In Japan's case, however, over four fifths of all public pension benefits are ultimately indexed to wage growth, so different assumptions about economic growth would have little effect on the relative magnitude of future transfers to the elderly. In this case, the burden of an aging population depends more on the projected share of the elderly in the overall population, which is relatively robust to alternative demographic assumptions over the horizon considered here.

are postponed, the larger they would ultimately need to be, given the intervening build-up in government debt.

Current proposals to reform the pension system through a phased-in rise in contribution rates, reduction in benefits, and postponement of the eligibility age would go far in addressing the fiscal imbalance. Past attempts to introduce reforms, however, have been blocked by political opposition, and the prospects for approval of the initial stages of the latest proposals are uncertain. <sup>1/</sup> Even the full implementation over the next 30 years of these (ambitious) changes to the pension system would not be sufficient to put the fiscal position on a sustainable path. Further measures, totalling almost 2 percent of GDP if implemented now, would be needed to fully offset the burden of population aging. Of course, these conclusions are subject to the many provisos and uncertainties surrounding long-run projections. Nevertheless, the baseline projections provide strong warning signals about the future fiscal situation.

## 2. Medium-term outlook

Charts 1 and 2 illustrate some properties of the medium-term projection. The gap between actual and potential output, after widening to 6 percent of GDP in 1994-95, closes gradually during 1996-99, as projected GDP growth averages 4 percent compared with potential growth of 2 1/2 percent. The slowdown in potential from the 4 percent pace observed during 1985-91 is due to lower growth in the business capital stock following the unsustainably high investment rates during the bubble period, and a sharp reduction in growth of the working-age population and thus the labor force (see Chapter II of this supplement).

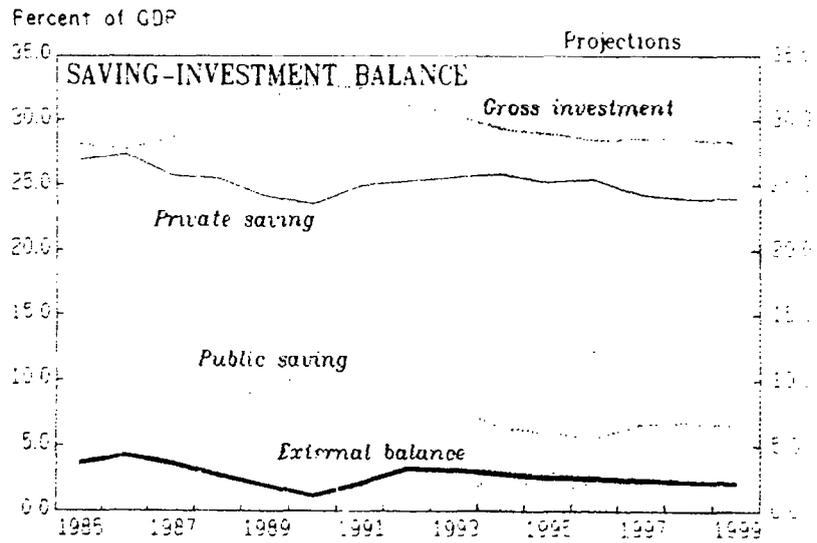
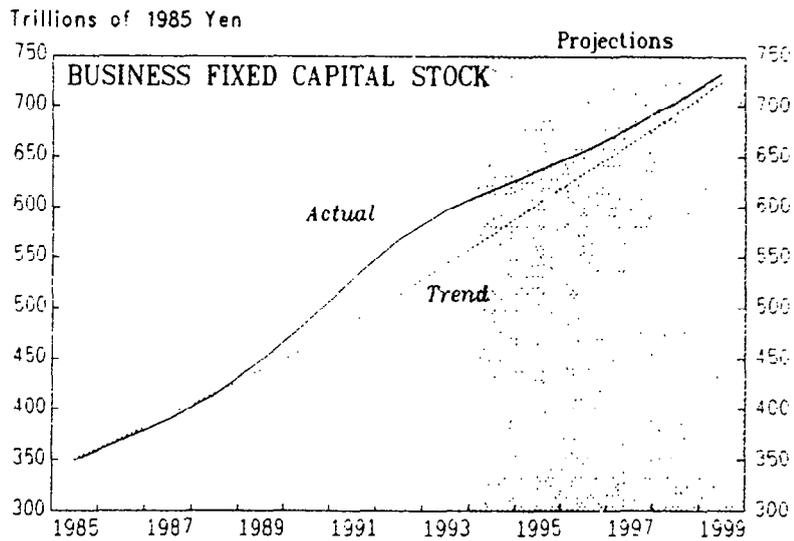
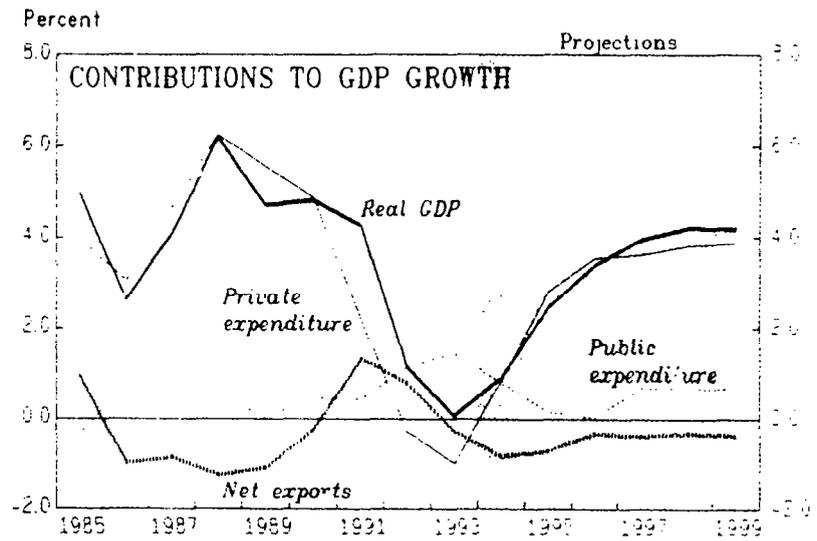
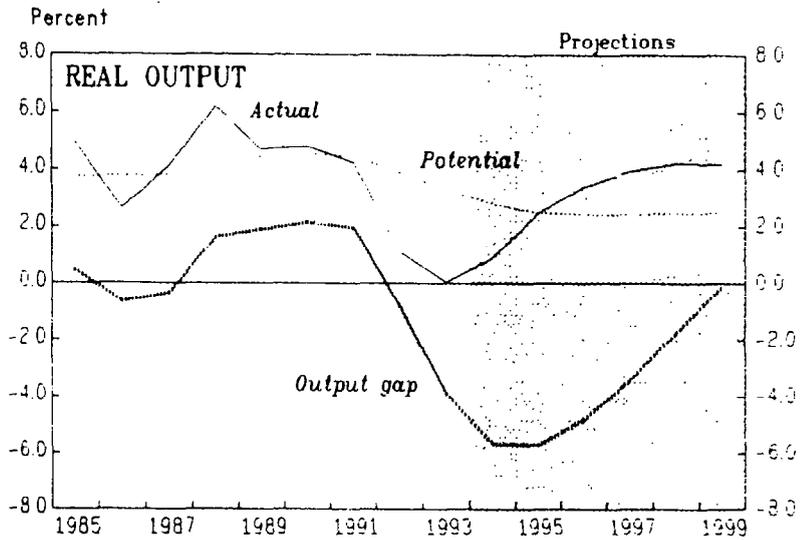
Private demand provides the main impetus to growth beyond 1994. This recovery in spending reflects: the completion of stock adjustments at both firm and household levels; the effect of the income tax cut on consumption; and improvements in private balance sheet positions. As discussed in Chapter III, the dynamics of business capital stock adjustment have been one of the main factors underlying the length and depth of the recession (and the associated forecasting errors). Chart 1 shows that the assumed profile for business investment--a mild recovery over the medium term following the 17 percent decline from 1991 to 1994--is consistent with a gradual convergence of the capital stock to its trend level. <sup>2/</sup> The income tax cut boosts private consumption by over 1 percent from 1994-95 through 1996:

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<sup>1/</sup> For instance, attempts in 1979 and 1989 to raise the eligibility age for pension benefits were both rejected by the Diet. In the near term, the changes proposed for implementation later this year were not passed during the last session of the Diet, and the prospects for future approval remain uncertain.

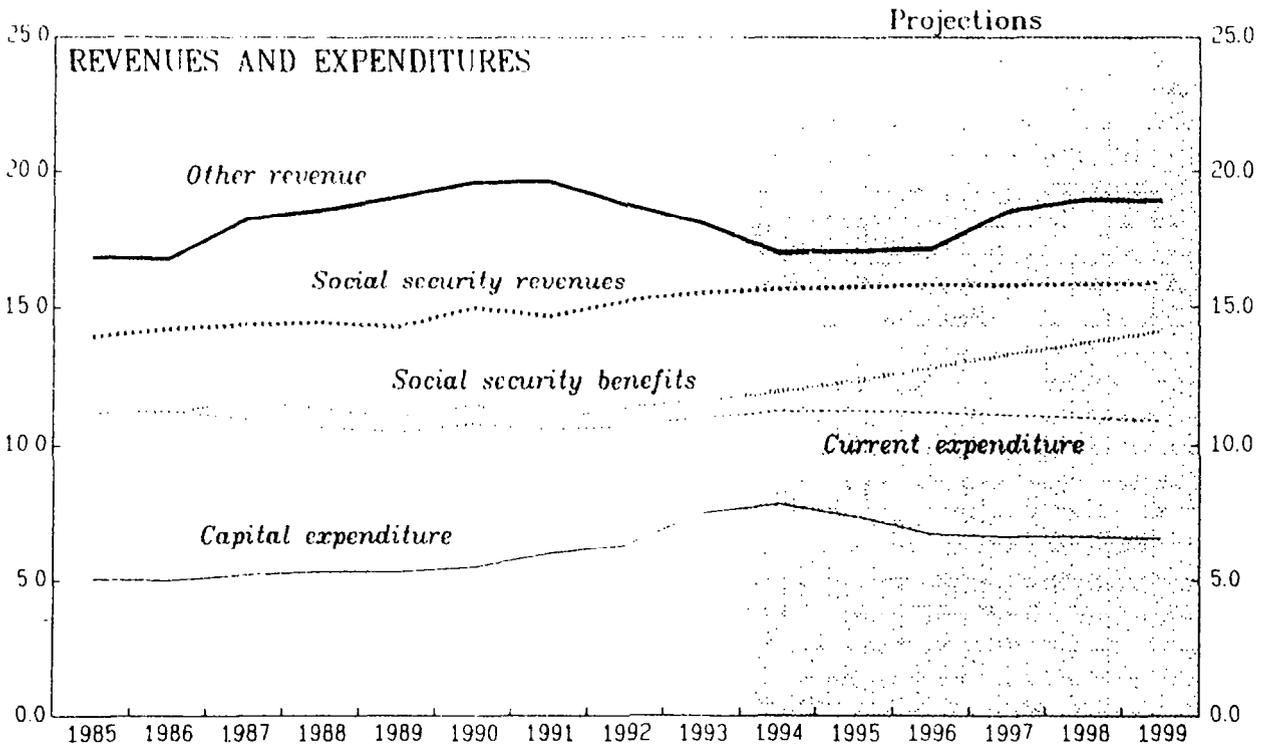
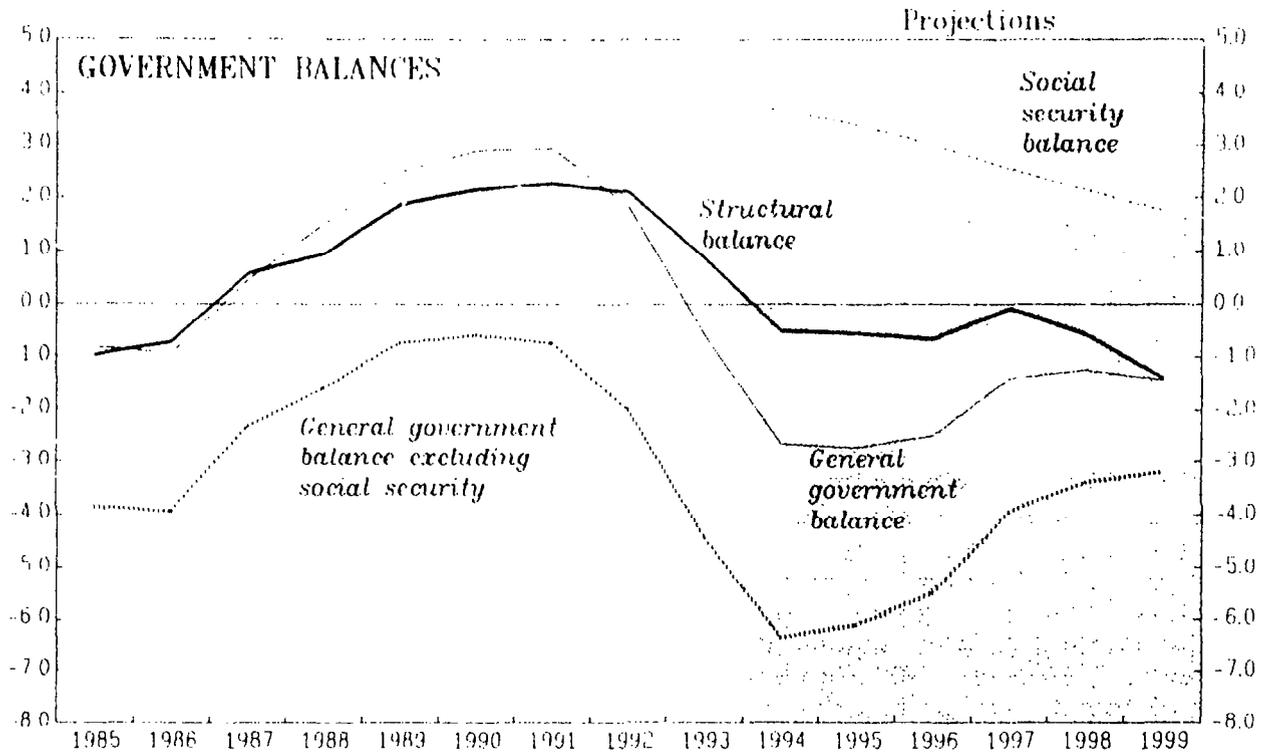
<sup>2/</sup> The trend is constructed by extrapolating the capital stock from the "pre-bubble" period based on growth in potential GDP and changes in the relative price of capital goods to aggregate output.

CHART 1  
JAPAN  
MEDIUM-TERM PROJECTIONS, 1985-99



Sources: Ministry of Finance; Economic Planning Agency; and staff estimates and projections.

MEDIUM-TERM FISCAL PROJECTIONS, 1985-99  
(In percent of GDP)



Sources: Ministry of Finance; Economic Planning Agency; and staff estimates and projections.

the dampening effect of the rise in the consumption tax in 1997 occurs when the recovery is firmly established, and thus only partially offsets already strong growth in demand. Finally, both consumption and investment are supported by the firming in equity prices since 1992-93 and the associated rise in financial wealth.

Net exports make a negative contribution to GDP growth in both 1994 and 1995, reflecting the continuing effects of yen appreciation. Over the medium term, their contribution remains (slightly) negative due to the recovery of Japanese demand. The fiscal support provided to growth during 1992-94 through higher public investment unwinds in 1995-96 in the absence of additional stimulative measures. From 1997 to 1999, however, the contribution again becomes positive due in part to the implementation of the medium-term public investment plan. Inflation falls below 1 percent in 1994-95 due to yen appreciation and weak demand conditions; from 1996 on, inflation stabilizes at 1 1/4 percent, as the effect of stronger growth in activity offsets that of the continuing gap between actual and potential output.

As shown in Chart 2, the overall government balance shifts from the surplus of 3 percent of GDP in 1991 to a deficit of 2 1/2 percent in 1994. Excluding social security, the deficit increases from 3/4 percent to 6 1/2 percent of GDP. This deterioration is due--in roughly equal measure--to cyclical weakness in revenues, and to counter-cyclical fiscal actions (i.e., additional public investment and the income tax cut in 1994). Over the medium term, the cyclical component of the deficit disappears. Two other factors also act to reduce the deficit over the medium term: capital spending falls by 1/2 percent of GDP; and implementation of the second phase of tax reform--with an assumed rise in the consumption tax rate from 3 percent to 7 percent--boosts revenues by 1 1/2 percent of GDP. Working in the other direction, social security benefits rise by 2 1/4 percent of GDP, and debt-servicing payments increase by 3/4 percent of GDP. Taken together, these developments imply a gradual widening in the overall structural deficit from 1/2 percent of GDP in 1994 to 1 1/2 percent by 1999.

Looking at the savings-investment balance, the external surplus declines from 3 percent of GDP in 1993 to 2 1/4 percent in 1999. Total saving declines by 2 1/2 percent of GDP, as government saving deteriorates due to higher social security payments (see Chart 2), while private saving is reduced by a rising share of the elderly in the population and increasing financial wealth. The drop in saving is partially offset by lower investment: the share of residential investment in GDP falls to a level consistent with trend growth in the housing stock; that of (nominal) business investment declines because of a downward trend in its relative price; and government investment falls from the peak reached in 1994, as the effect of stimulative packages wears off.

### 3. Alternative long-term scenarios

Previous work by the staff has focussed on various aspects of the impact of population aging in Japan: the long-run effects on output growth, saving, and investment; the impact on government debt dynamics and sustainability; and the interdependent effects between regions of the world economy. 1/ Here, we integrate and update the analysis of the effects of population aging on Japan's economic growth, fiscal position, and savings-investment balance over the period to 2025. 2/

#### a. Population dynamics and output growth

The upper panel of Chart 3 shows the magnitude of the rise in the old-age dependency ratio implied by the 1993 official population projections. 3/ The ratio is projected to more than double from 20 percent to almost 45 percent during 1994-2020. Expressed in terms of the ratio of the working population to the elderly, the number of people of working age for each elderly citizen will be more than halved from 5 in 1995 to 2 1/4 by 2020. As shown in the middle panel, growth in the working age population turns negative beyond 1995, with the pace of decline peaking at almost 1 1/2 percent per year in 2015.

The bottom panel of Chart 3 illustrates the implications for Japan's potential output growth of slower growth in the working-age population. This projection is based on the assumptions that: total factor productivity growth continues at the rate expected for the 1990s; the capital-to-output ratio increases in line with the declining relative price of capital goods; and the participation rate of the working-age population is roughly constant beyond the year 2000. Under these assumptions, potential growth drops gradually from 2 1/2 percent over the remainder of the 1990s to about 1 percent in 2015, before recovering to about 1 1/2 percent in 2025.

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1/ These issues were addressed in: SM/91/126 (6/19/91), Annex II; SM/92/131 (2/7/92), Chapter IV of Supplement 1; and SM/92/131 (2/7/92), Chapter VI of Supplement 1.

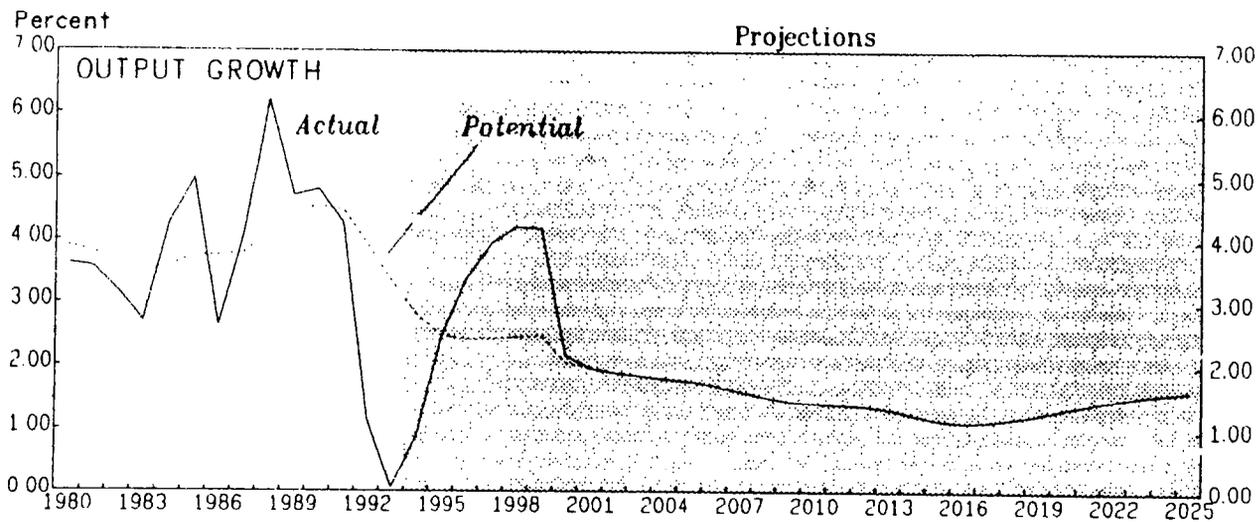
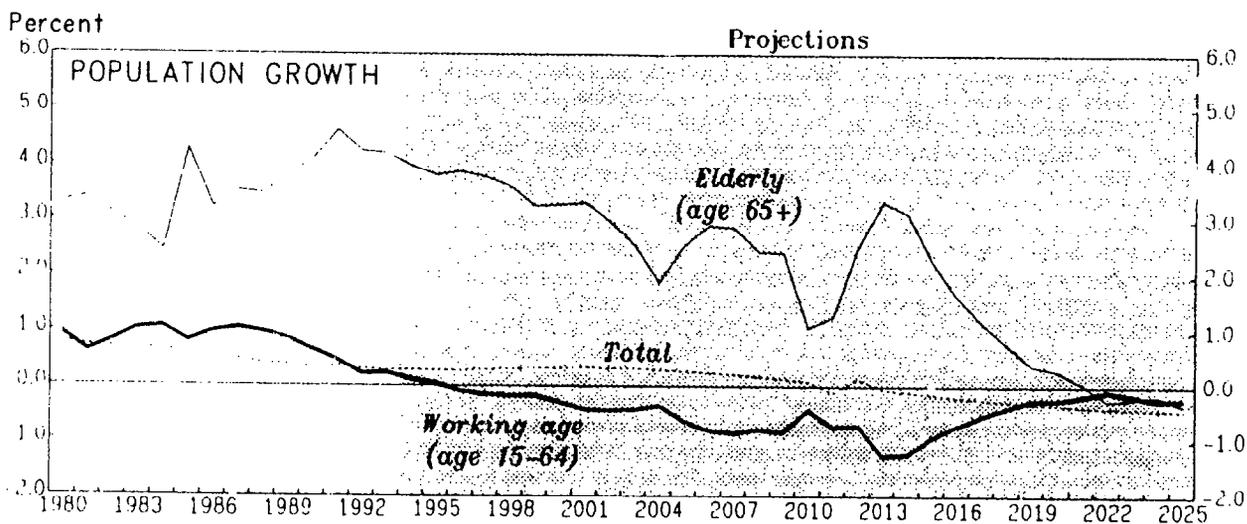
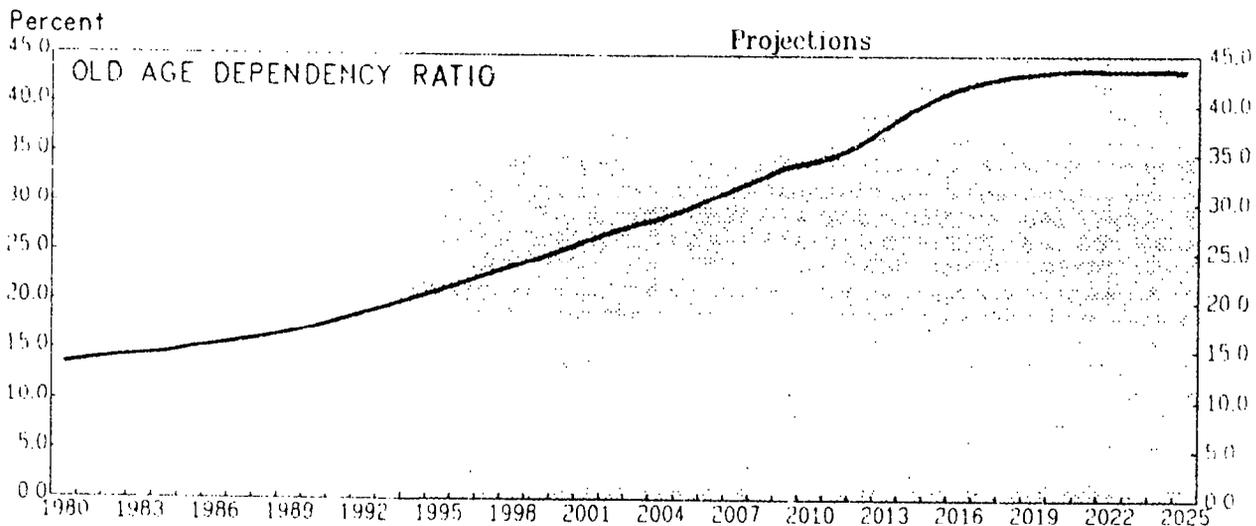
2/ Beyond 2025, the fiscal position would worsen further due to continuing increases in the old-age dependency ratio. However, because these very long-term results are sensitive to demographic assumptions, we focus here on the horizon over which the projected population structure is relatively robust to alternative assumptions.

3/ Based on the "middle series" published in 1993 by the Ministry of Health and Welfare. This projection assumes a recovery in Japan's fertility rate over the longer run to 1.8 births per woman from the current level of 1.5. If, instead, the fertility rate were to remain near the current level (as assumed in the Ministry's "low" projection), the rise in the old-age dependency ratio would be even larger, although most of the impact would be felt beyond the year 2020. Some analysts have expressed concern that even the "low" projection embodies too high a fertility rate, implying an even sharper rise in the old-age dependency beyond about 2015.

CHART 3

JAPAN

LONG-TERM PROJECTION, 1980-2025



Sources: Data provided by the Japanese authorities; and staff estimates.

b. Alternative fiscal scenarios

The most important direct impact of population aging on the fiscal position will occur through a rise in social security benefits for the Employees' Pension Insurance Scheme (EPIS) and the National Pension Scheme (NPS). 1/ Benefits will increase in relation to GDP, not only because of the growing share of the elderly in the population, but also due to the maturation of Japan's pension scheme. Assuming that the key parameters determining pension benefits remain unchanged--i.e., eligibility at age 60 and full indexation to wage and price growth 2/--the ratio of benefits to GDP would rise from 5 percent in 1994 to 6 3/4 percent by 2000, and then to 13 percent by 2020. Another source of spending pressures will come from higher medical and health insurance payments, which are expected to rise by 2 percent of GDP during 1995-2020. 3/

Under the assumption of unchanged program parameters, then, total spending on social security would rise from 12 percent of GDP in 1994 to 22 1/2 percent in 2020 (Chart 4; upper panel). Social security contributions, meanwhile, would remain stable at 9 1/2 percent of GDP. 4/ The other components of government spending--current spending (excluding debt-servicing payments), public investment, and other revenues--are assumed to grow in line with nominal GDP. These developments would dramatically alter the overall fiscal position, as shown in the middle panel of Chart 4. The increase in social security benefits implies a swing in the primary social security balance of 10 percent of GDP from 1995 to 2020; including debt-servicing costs, the overall social security balance would shift from the current surplus of 3 1/2 percent of GDP to a deficit of 12 percent. Adding to this the deficit on government operations excluding social security implies a rise in the overall deficit to 16 percent of GDP. The ratio of government debt to GDP grows slowly over the remainder of the 1990s and then accelerates sharply beyond 2000, rising to 150 percent of GDP by 2020.

These developments are clearly unsustainable, and significant measures will have to be taken to prevent an explosive rise in debt over the long run. An indication of the size of the required actions can be obtained by comparing the discounted present values of government revenues and spending

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1/ For a description of the operation of Japan's pension system see "The Social Security Pension and Health Insurance System" (SM/91/135, 7/3/91).

2/ Benefits under the EPIS are currently indexed to annual CPI inflation, with a rebasing every five years to reflect the gap between average wage growth and CPI inflation. NPS benefits are indexed to CPI inflation.

3/ See SM/92/131, Chapter IV of Supplement 1, for estimates of the rise in medical payments.

4/ Excluding net transfers from the central government and interest receipts.

(in the absence of additional measures). 1/ The resulting gap is a measure of the "fundamental" imbalance in the fiscal position, taking both current and future revenues and spending into account. Performing this exercise for Japan using the assumptions described above gives an imbalance of 6 1/2 percent of GDP as of 1995. In other words, if the required adjustments were made in 1995, either a permanent increase in revenues of 6 1/2 percent of GDP or a cut in expenditures of the same size (relative to the baseline scenario) would be needed to ensure that the debt stock does not rise without bound in the long run. If the adjustments are postponed, their ultimate size would need to be larger, as the debt stock and thus the debt-servicing burden would accumulate over the interval. 2/

To address the strains presented by population aging, the Ministry of Health and Welfare has proposed a package of reforms to the EPIS to be implemented in stages during 1995-2020. 3/ There are three key elements to this package: (i) an increase in the combined employer/employee contribution rate to the EPIS from the current 14 1/2 percent of earnings to 29 1/2 percent by 2020; 4/ (ii) a phased rise in the eligibility age for EPIS benefits from 60 to 65 starting in 2000; and (iii) a shift to the use of "net" earnings--after payment of social security taxes--to index EPIS benefits. In addition, it is proposed that monthly contributions to the NPS be roughly doubled in real terms by 2015, implying a rise of about 50 percent in contributions relative to household income.

The combined effect of these measures would be to raise social security contributions to 14 1/2 percent of GDP by 2020 from the 9 1/2 percent share in the absence of reform (see Chart 5). On the benefits side, pension payments would be reduced to 20 percent of GDP by 2020 from the "unchanged parameters" level of 22 1/2 percent. Together, these reforms would be sufficient to balance the EPIS and NPS components of the social security program. They would not, however, offset the rise in medical care costs, or the burden of rising government debt. This is evident in the middle panel of Chart 5, which shows that, while the overall deficit would narrow over

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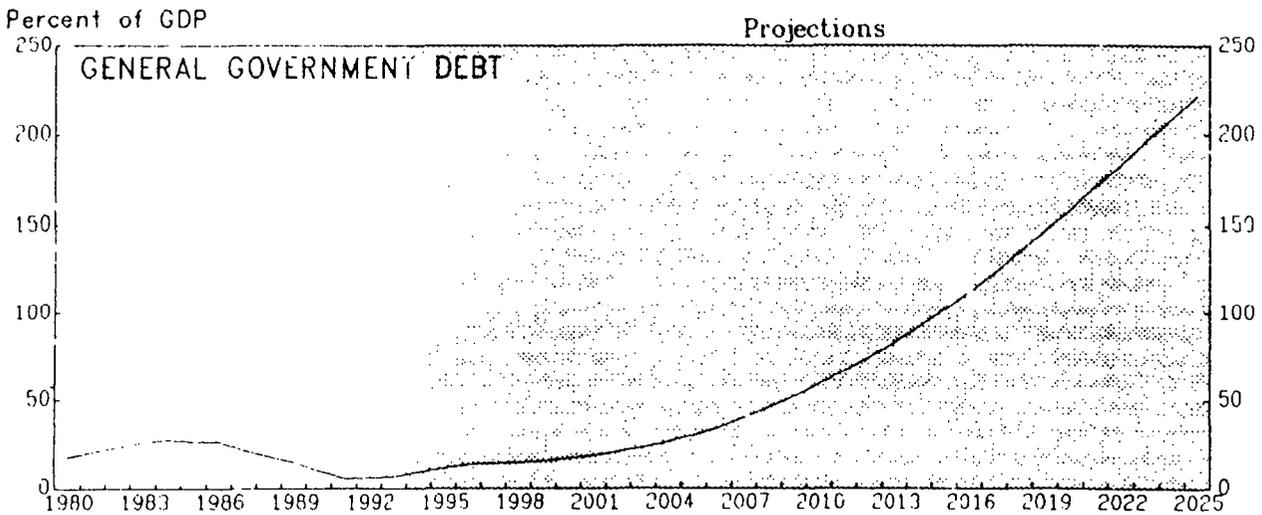
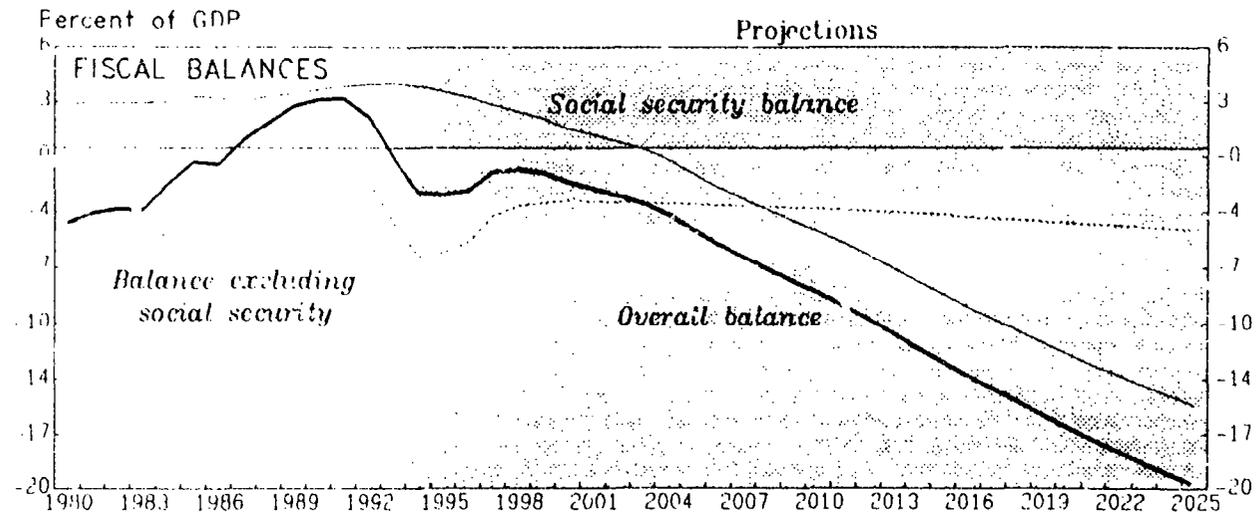
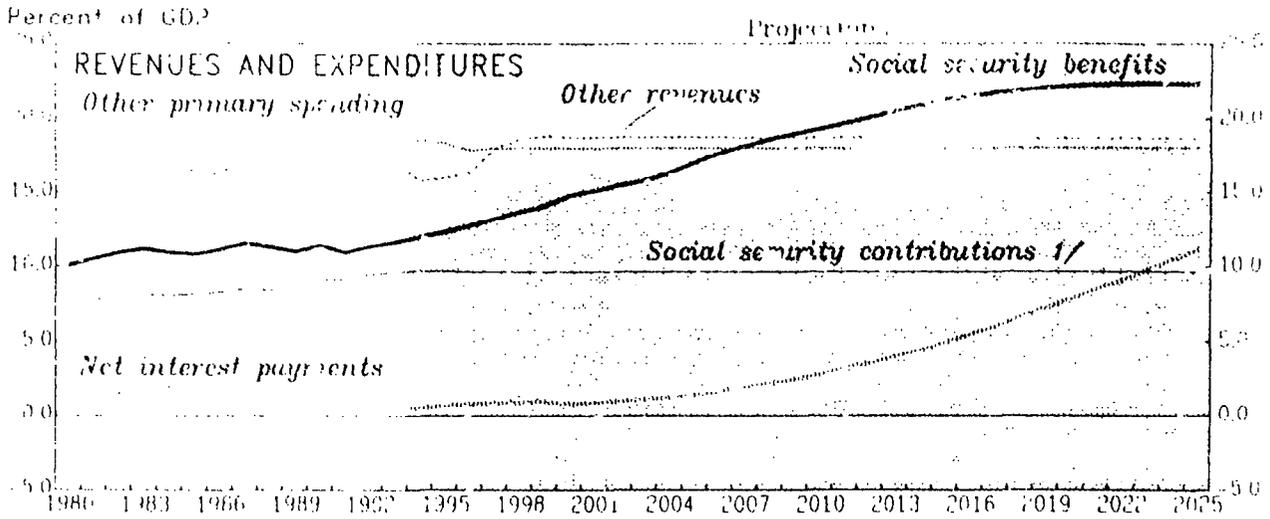
1/ Specifically, the present value of primary expenditures plus the level of the initial debt stock is subtracted from the present value of revenues. Dividing the result by the present value of GDP indicates the actions that need to be taken--as a share of GDP, on a present value basis--to stabilize the debt-to-GDP ratio over the long run and thus to achieve a sustainable fiscal position.

2/ For instance, if the required adjustments were postponed by five years until 2000, they would rise to 7 1/4 percent of GDP; if postponed until 2020, they would reach almost 11 percent of GDP.

3/ This long-term reform scenario has been constructed by the Ministry of Health and Welfare in conjunction with the latest five-year review of the pension system. The legislation for the first step of the reforms is currently under Diet deliberation.

4/ The contribution rate would be raised in increments of roughly 2 1/2 percentage points every five years, beginning in 1995-96.

JAPAN  
**LONG-TERM FISCAL PROJECTION, 1980-2025**  
 (Unchanged program parameters)



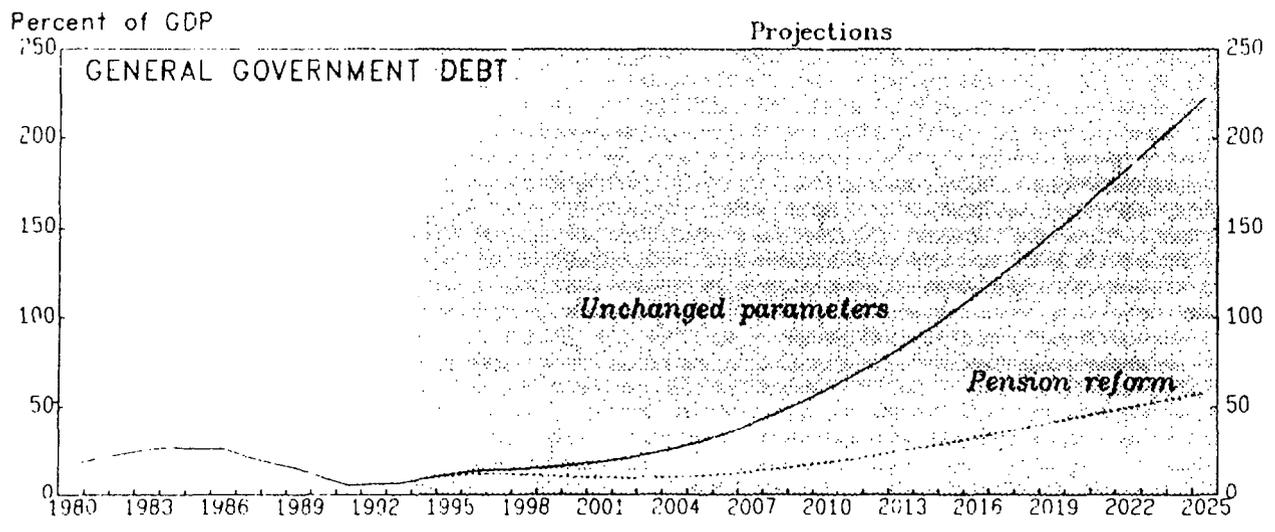
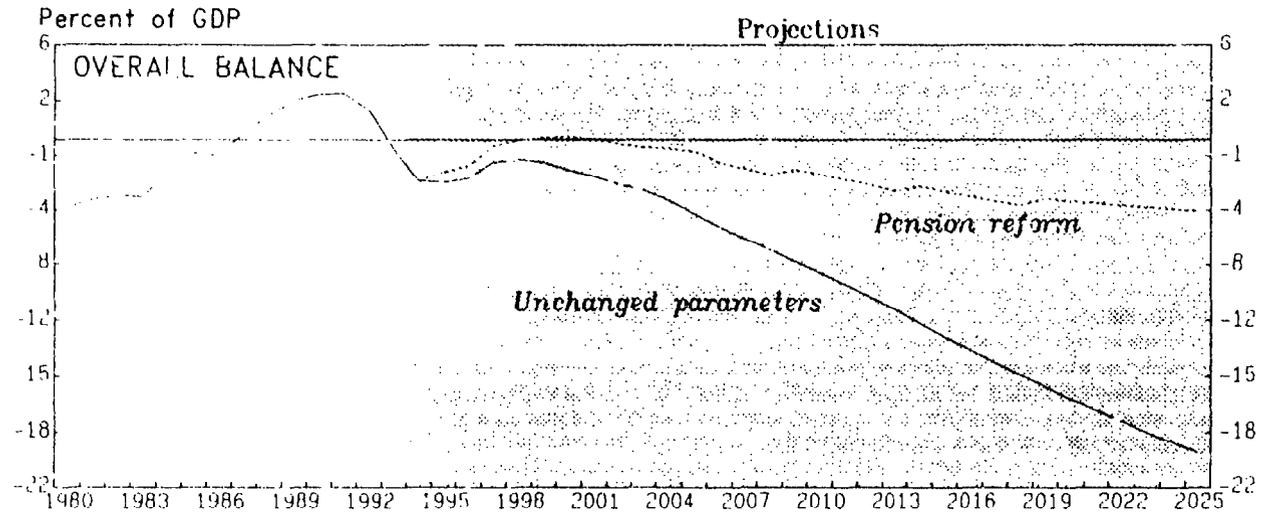
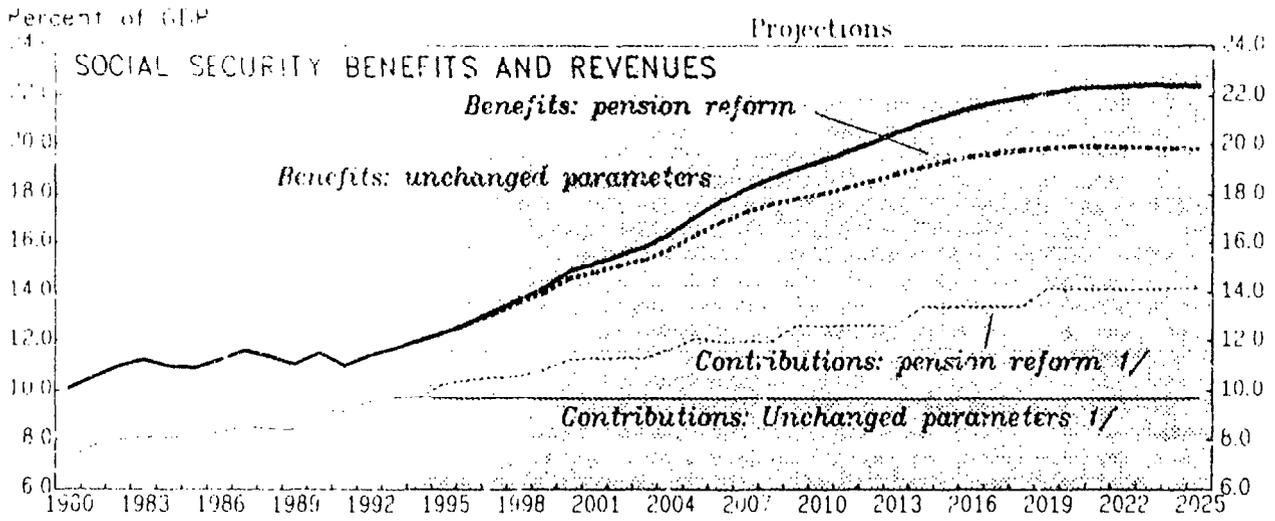
Sources: Data provided by the Japanese authorities; and staff estimates.

1/ Excluding interest receipts and central government transfers.

CHART 5

JAPAN

LONG-TERM FISCAL PROJECTION, 1980-2025  
UNCHANGED PROGRAM PARAMETERS VERSUS PENSION REFORM



Sources: Data provided by the Japanese authorities; and staff estimates.

1/ Excluding interest receipts and central government transfers.

the rest of this decade, it would start to widen beyond 2005. Though the subsequent rise in the deficit and the stock of debt in relation to GDP would be more gradual than in the absence of pension reform, it is apparent that further measures would be needed to achieve a sustainable long-run fiscal position.

On the present value basis described above, the remaining imbalance amounts to 1 3/4 percent of GDP. The required adjustment could be achieved in the form of either revenue or expenditure measures. Assuming that revenues are the source of adjustment, one solution would be to alter the consumption tax rate over the longer run to compensate for the rising social costs of population aging. Beyond the rise in the consumption tax rate to 7 percent in 1997 implied by the current tax reform proposal, a further increase to roughly 12 percent would be needed by the end of the decade to achieve the required adjustment. 1/ An alternative approach on the revenue side could involve eliminating the special deduction for pension income in the personal income tax system. 2/ While it is difficult to assess the precise impact of such a reform in the absence of microeconomic tax data, a hypothetical rise in the average tax rate on public pension benefits of 30 percent would also raise about 2 percent of GDP in additional revenues by 2000.

c. Implications for the savings-investment balance

The long-term prospects for Japan's saving and investment depend on the behavior of public and private saving, as well as overall investment. Public saving will be determined by the policy actions taken to address population aging: as discussed above, unchanged policies would lead to an explosive rise in the deficit and debt, while pension reform would moderate the size and timing of the fiscal deterioration. Private saving will be influenced by the shift in the demographic structure itself, asset accumulation, and expectations of future social security benefits and tax liabilities. Finally, investment will depend on the desired capital-to-output ratio, the trend growth rate of output, and the depreciation rate of the capital stock.

Operationally, the projection for (gross) public saving is obtained as the sum of the overall government balance plus the rate of (gross) public investment, based on the fiscal scenarios described above. Private saving

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1/ Based on the authorities' estimate that each percentage point rise in the consumption tax generates about 0.4 percent of GDP in additional revenues. An option that would moderate the required rise in the tax rate would be to bring into the consumption tax base small businesses, which are currently tax-exempt.

2/ In 1990, the tax-exempt threshold of a childless retired couple with a head aged 65 or over ranged from ¥ 3.1 trillion to ¥ 4.5 trillion, whereas for a working-aged couple the threshold ranged from ¥ 1.7 trillion to ¥ 2.3 trillion.

is determined residually as the difference between income and consumption: the latter moves in line with wealth, defined as the discounted value of labor income and social security benefits, less the discounted value of taxes and social security contributions, plus the stock of financial and physical wealth. In addition, consumption increases as the overall dependency ratio rises, with a response parameter given by staff work on the relationship between Japanese demographics and household behavior. <sup>1/</sup> The desired capital-to-output ratio continues to grow in line with the declining relative price of capital goods. Gross investment is then determined by the investment needed to keep the capital stock growing in line with potential output and the desired capital-to-output rate, and the depreciation rate (which is assumed to remain at its historical level).

The projections for the components of savings and investment along with the implied current account balance are shown in Chart 6. Under the assumption of unchanged social security parameters--and no other fiscal initiatives to deal with population aging--the dramatic rise in public dissaving is reinforced by a downward trend in the private saving rate. The investment ratio declines moderately until 2015, reflecting slowing growth in potential output, before rising slightly near the end of the projection horizon. The net result is a swing in the external balance from a surplus of slightly over 2 percent of GDP in 2000 to a deficit of 15 percent of GDP by 2020. Such a huge deterioration in the external balance would almost certainly not be "financeable" in reality; <sup>2/</sup> neither would the government deficits associated with an exploding debt stock find a ready market. Finally, predicting the response of private saving in the face of unsustainable fiscal policies is problematic when the eventual resolution of the situation is not specified. But the very unsustainability of these outcomes serves to underscore the imbalances that would potentially result from shifts in the Japanese demographic structure.

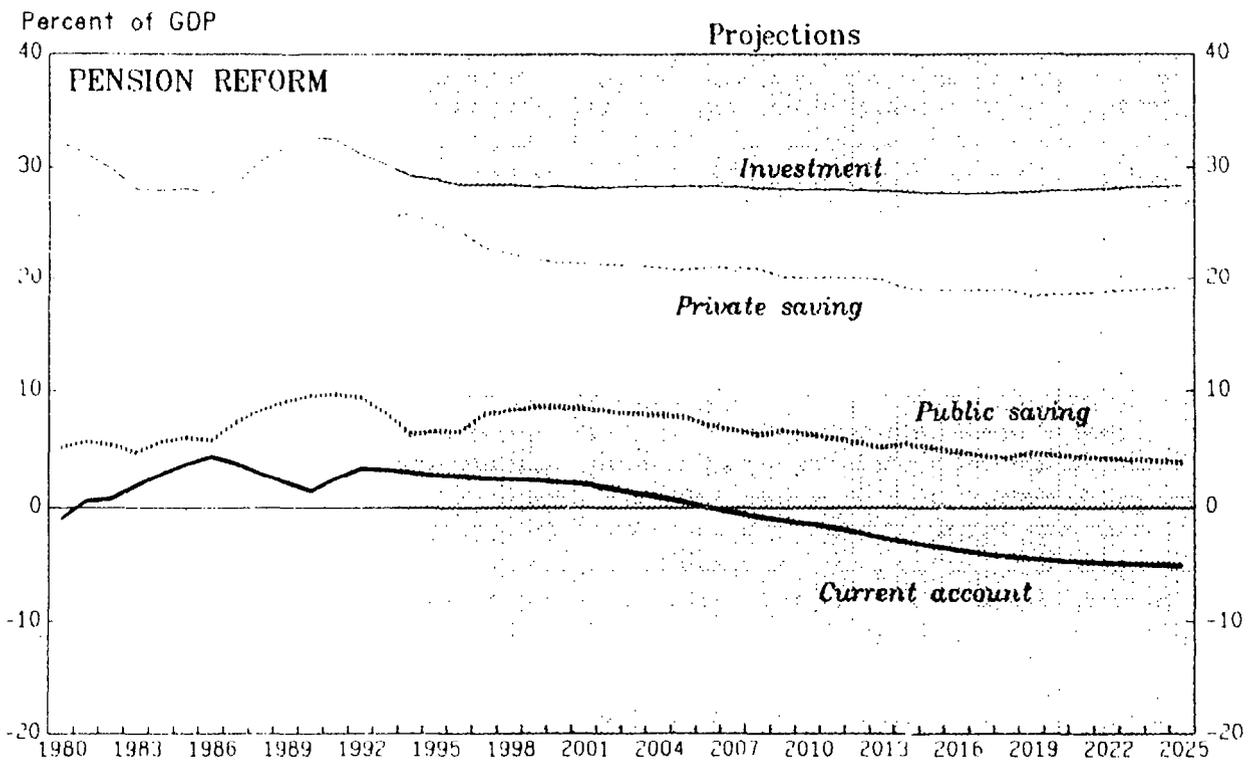
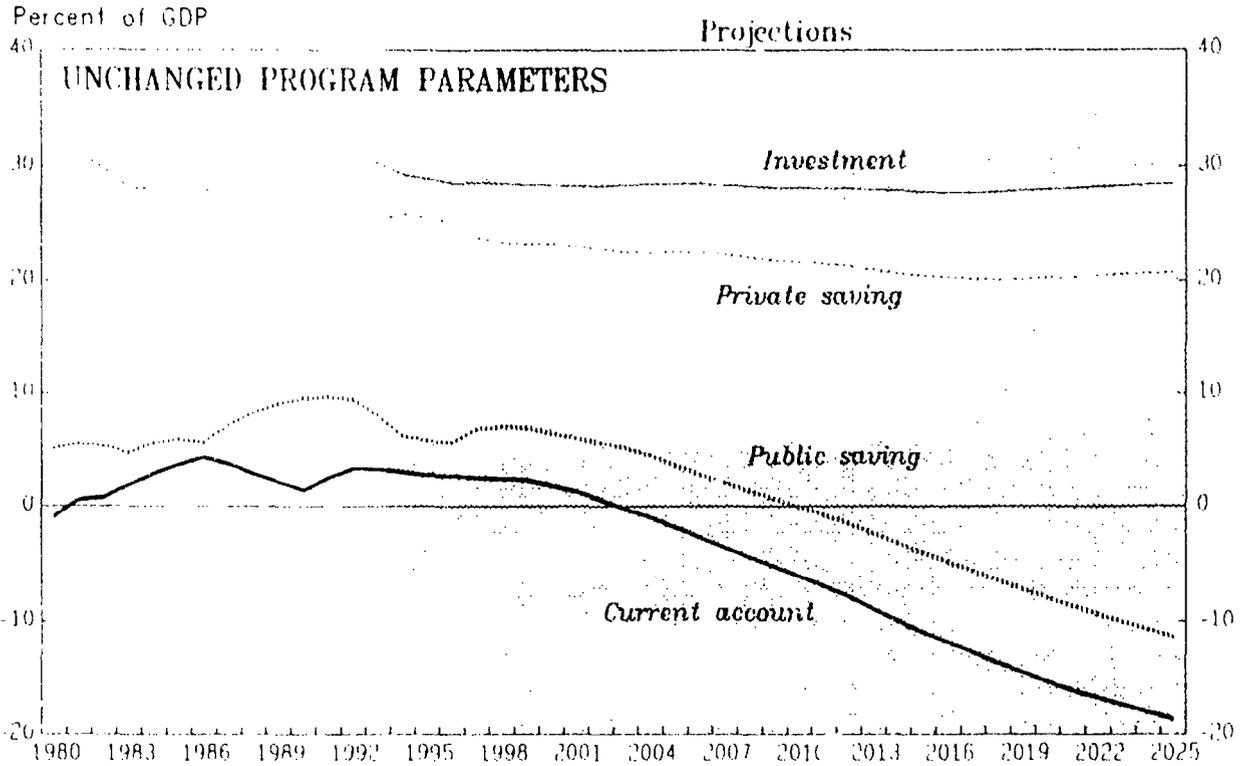
As shown in the lower panel of Chart 6, full implementation of the pension reform proposals sharply reduces the decline in public saving, which falls from 1/2 to 4 1/2 percent of GDP from 2000 to 2020. Nevertheless, combined with a 3 percentage point drop in the private savings rate over this period and roughly flat investment, the current account balance falls steadily to a deficit of about 5 percent of GDP by 2020. While the decline is smaller than in the previous scenario, it should be kept in mind that the underlying fiscal position would remain unsustainable, and further adjustments would be required to prevent both government debt and external liabilities from rising without bound beyond this horizon. Scenarios that incorporate the needed fiscal adjustments suggest that the current account deficit would stabilize in a range of 1-2 percent of GDP beyond 2015.

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<sup>1/</sup> See Chapter V of Supplement 1 to SM/92/131, 2/7/92.

<sup>2/</sup> Especially as several other large countries face problems associated with future population aging.

# LONG-RUN SAVINGS-INVESTMENT BALANCE, 1985-2025



Sources: Ministry of Finance; Economic Planning Agency; and staff estimates and projections.

## II. Estimates of Potential Output for Japan

### 1. Introduction and conclusions

Potential output is an important concept in assessing both short-term policy requirements and medium-term growth prospects. From a policy viewpoint, the consequences of stimulative or contractionary actions on prices and output depend on the initial level of resource utilization. Over the medium term, the growth rate of output consistent with the elimination of macroeconomic imbalances is determined by both growth in potential and the initial gap between actual and potential output.

This chapter of the supplement first describes the methodology used by the staff to construct potential output for Japan and the resulting "baseline" estimate; it then assesses the degree of uncertainty that exists regarding this estimate. To summarize the results, potential GDP growth is estimated to have slowed to 2 3/4 percent in 1994 from the pace of over 4 percent observed during the late 1980s. About two thirds of this slowdown is attributable to movements in the business capital stock, reflecting the bubble-period boom in investment followed by the sharp decline after 1991; the remainder is due to declining growth in the working-age population. A further reduction in potential growth to 2 1/2 percent is projected over the medium term due to weakening growth in the working-age population and the continuing effects of capital stock adjustment.

The baseline estimate of potential implies an output gap of 5 1/2 percent at end-1993. <sup>1/</sup> On the basis of current projections, the margin of slack would widen slightly over the short run to reach almost 6 percent of GDP in late 1994. A gap of this size suggests that the risk of economic overheating in the near term through stimulative policies or a stronger-than-expected autonomous rebound in demand is remote. Over the medium term, the large initial gap points to the scope for rapid economic growth for several years without supply constraints being reached: with GDP growth projected to average 4 percent during 1996-99, the output gap is not eliminated until 1999.

It is important to recognize, however, that estimates of potential are subject to uncertainty. Conceptually, potential output depends on available supplies of factors of production and the efficiency with which they can be employed. In practice, difficulties arise in constructing proxies for the "full-employment" levels of factor inputs. A common approach is to construct "trend" values that (presumably) reflect underlying movements in

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<sup>1/</sup> The terms "potential" and "full-employment" are used here to describe conditions consistent with an absence of either inflationary or deflationary pressures, as opposed to the maximum possible level of output or employment that could be achieved in the short run.

supply. 1/ Judging the appropriateness of such trends, though, is difficult at the end of the historical period, especially when the economy is well out of equilibrium.

We examine these uncertainties from two perspectives. The first compares current estimates of potential with those that would have been obtained in the past using only prior information. This exercise shows that the estimates produced by the staff's methodology can indeed be sensitive to the end points of the available data series. The average revision to the initial estimate would have been about 1 percent of GDP; also, extrapolations of potential would have systematically overstated the size of future output gaps. The second approach compares estimates that place different weights on backward- and forward-looking data. While the resulting output gaps vary from 3 percent to 6 percent of GDP as of end-1993, all of these estimates point to the persistence of a significant gap through 1995 based on the near-term projection for GDP growth. The results are more varied, however, as to the speed at which the gap closes over the medium term, underscoring the need for caution in undertaking longer-term counter-cyclical policies.

## 2. Construction of the "baseline" estimate of potential

The staff constructs potential output (YCAP) for Japan using a production function approach. A Cobb-Douglas function is used that has as factor inputs labor (L), the real business fixed capital stock (KBUS), and the residential capital stock (KRES). Each is weighted by its respective factor share; the total factor "bundle" is then multiplied by trend total factor productivity (TFP) to arrive at potential output: 2/

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1/ This approach is implicit, for instance, in the extrapolation of "peak-to-peak" movements in output, or in otherwise "smoothing" output fluctuations to remove cyclical influences. Some researchers have also attempted to identify the role of demand versus supply shocks by looking at co-movements between output and other variables. The staff has not used such models in a forecasting context because of the sensitivity of the results to specific assumptions, and difficulties in constructing projection data that are consistent with the historical methodology. However, the output gaps obtained using the staff's methodology are strongly correlated with future changes in inflation: a regression using annual data for 1970-93 of the change in CPI inflation on the lagged gap yields a coefficient of 1.1 with a t-statistic of 3.5.

2/ The capital stocks are obtained by cumulating real investment flows from national accounts data, adjusted for the average depreciation rates estimated by Japan's Economic Planning Agency. Estimation using time-series data suggested that the government capital stock has not played a significant role in explaining long-run movements in GDP, so government capital was not included in the production function. The labor input is measured as total employment, thus longer-run trends in hours worked and the composition of the labor force are subsumed in trend growth in total factor productivity. The factor shares are estimated from national accounts data.

$$YCAP = TFP L^{0.65} KBUS^{0.26} KRES^{0.09}$$

In the case of the two capital stocks, it is assumed that their observed levels represent the underlying available supplies. <sup>1/</sup> For labor and total factor productivity, in contrast, it is necessary to remove the cyclical component due to demand fluctuations. To do this, the staff constructs trends through the observed series using the time-series "filter" developed by Hodrick and Prescott, <sup>2/</sup> which has been extensively employed in other analyses of business-cycle behavior. This filter trades off the smoothness of the trend series against deviations of the actual series from trend. The staff has used a trade-off parameter that attaches a high weight to the stability of growth in the resulting trend. Currently, information is used up to the fourth quarter of 1993. Data over the forecast period are then obtained by: extrapolating productivity based on historical growth rates; projecting labor supply using demographic and participation rate trends; and cumulating projected investment flows to give growth in the capital stocks.

Chart 7 compares the estimated trends for employment and total factor productivity with their actual values of for the period 1971-93. It also plots the ratios of business fixed capital and residential capital to potential GDP to indicate their contributions to growth. Finally, it compares the series for potential and actual GDP. Since the fourth quarter of 1991, output has fallen an estimated 5 1/2 percent below potential. Almost all of this decline is associated with a plunge in actual productivity relative to trend, while employment has been relatively resilient thus far in the downturn. Comparing this experience with the last downturn of a similar magnitude in 1974-75, the drop in productivity has been roughly as large, while the employment adjustment has been somewhat smaller.

Looking at the evolution of potential output during and after the "bubble" period of rapid output growth in the late 1980s, the following tabulation indicates potential growth and the contribution of the various inputs (in percent change):

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<sup>1/</sup> Implying that lags between the timing of the investment process and the increase in effective production capacity are not significant.

<sup>2/</sup> Hodrick, Robert, and Edward C. Prescott, "Post-War U.S. Business Cycles: An Empirical Investigation," Carnegie-Mellon University Discussion Paper No. 451 (Pittsburgh: Carnegie-Mellon University, November 1980).

	Potential GDP growth	Contribution of:		
		Productivity	Labor	Capital
1987	3.8	1.2	0.8	1.8
1988	4.1	1.2	0.8	2.1
1989	4.4	1.1	0.9	2.4
1990	4.6	1.0	0.9	2.7
1991	4.5	0.9	0.9	2.7
1992	3.9	0.9	0.9	2.1
1993	3.3	0.8	0.9	1.5
1994	2.8	0.9	0.7	1.1
1995-99 average	2.5	1.0	0.3	1.2

The bubble was associated with a rise in potential growth to a peak of 4 1/2 percent in 1990: subsequently, growth has dropped sharply to 2 3/4 percent in 1994--well below the 1980s average of 4 percent, or the 6 percent rate observed during 1960-90. Almost all of the swing since 1990 is attributable to movements in the capital stock--in particular, business fixed capital--although slowing growth in the labor force has recently played a role. The capital stock cycle reflects the investment surge during the bubble and its subsequent collapse. In retrospect, this surge can be largely explained by easy financial conditions in the late 1980s, which led to the capital stock rising well above the underlying trend consistent with growth in productivity and the labor force, as illustrated in the top panel of Chart 8. <sup>1/</sup> Abstracting from this temporary surge in the capital-to-output ratio, "underlying" potential output growth is estimated to have averaged 3 3/4 percent during 1987-91.

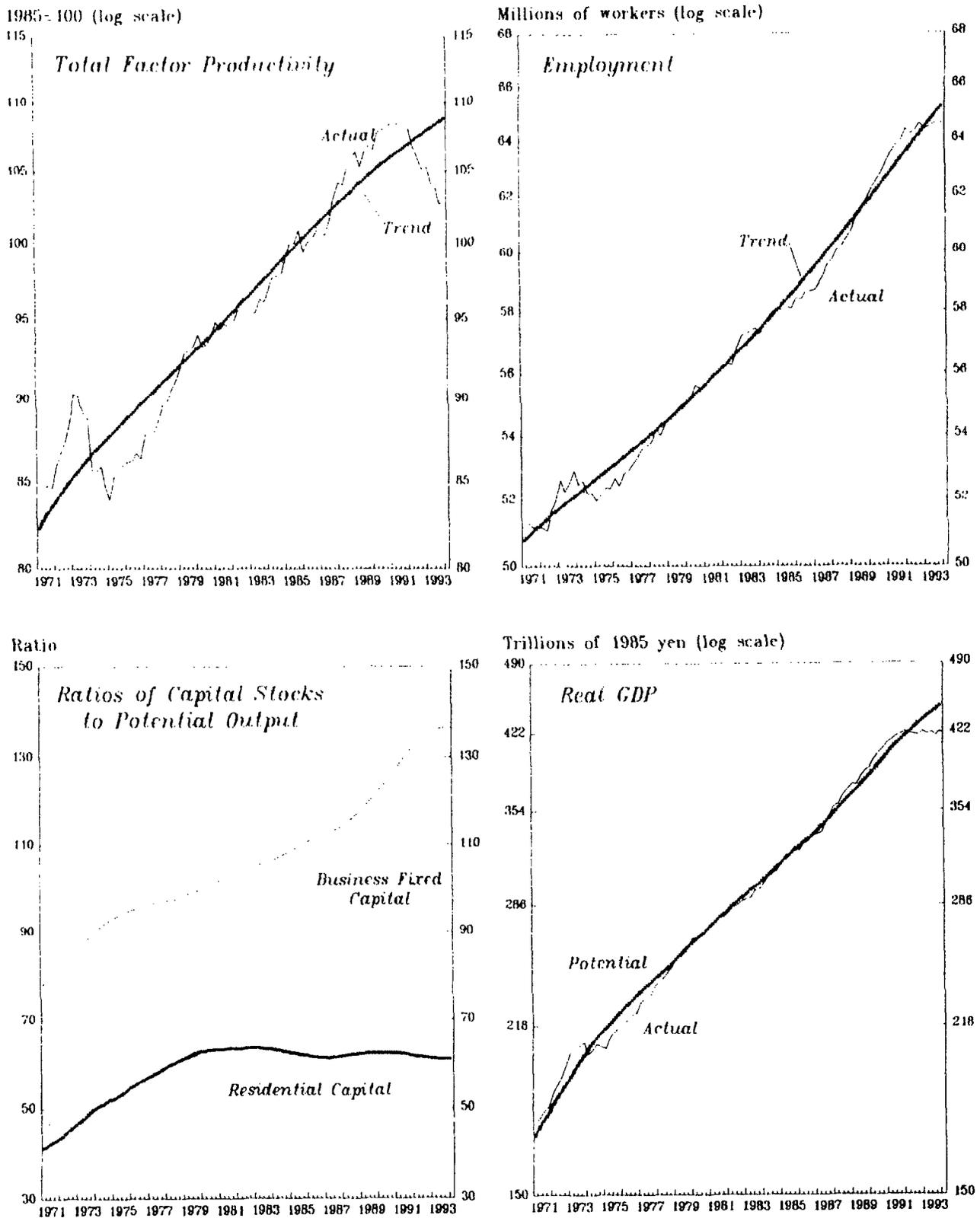
Over the medium term, the capital stock is projected to converge to trend, implying an average contribution to potential output growth of 1 1/4 percentage point. If, in contrast, the capital stock were growing at its trend rate, the capital contribution would be about 1/4 percentage point higher; the corresponding "underlying" potential growth rate averages about 2 3/4 percent over the medium term. Growth in the labor input slows noticeably, as the population aged 15-64 shrinks during 1994-99 following average growth of 3/4 percent during 1987-93. <sup>2/</sup> The participation rate, in contrast, is assumed to rise during 1994-99, continuing the trend increase observed since 1980 (Chart 8, middle panel). Total factor productivity growth picks up slightly from the recent pace to stabilize at 1 percent over the medium term. Nevertheless, the growth rate is below the 1960-90 average of 2 percent, reflecting an assumed end to the technological

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<sup>1/</sup> The upward slope of the trend reflects a secular decline in the relative price of capital goods, which implies a corresponding rise in the equilibrium real capital-to-output ratio.

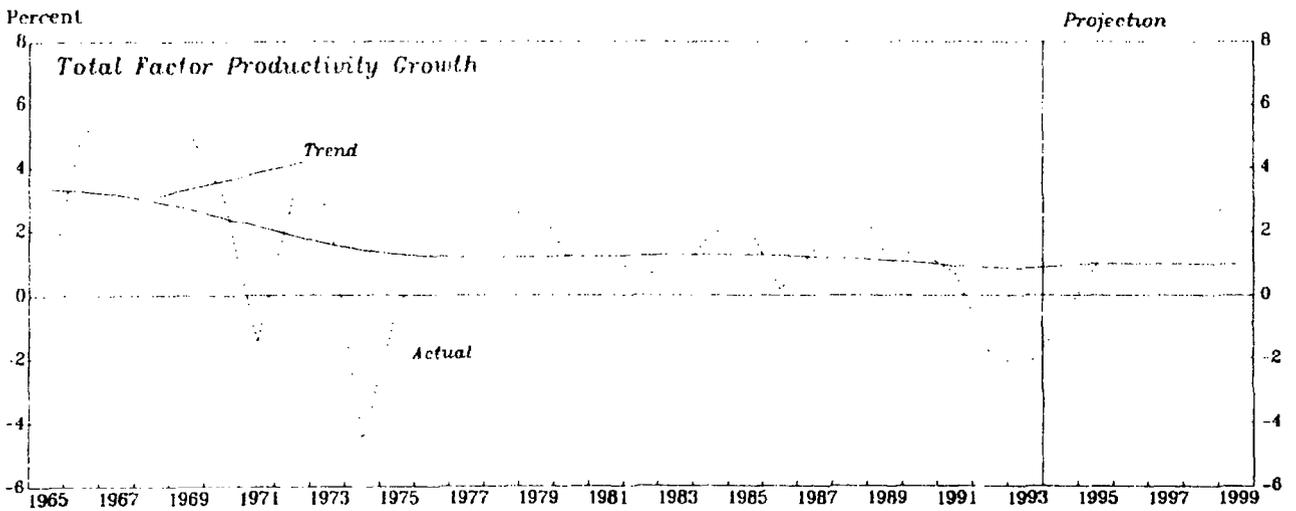
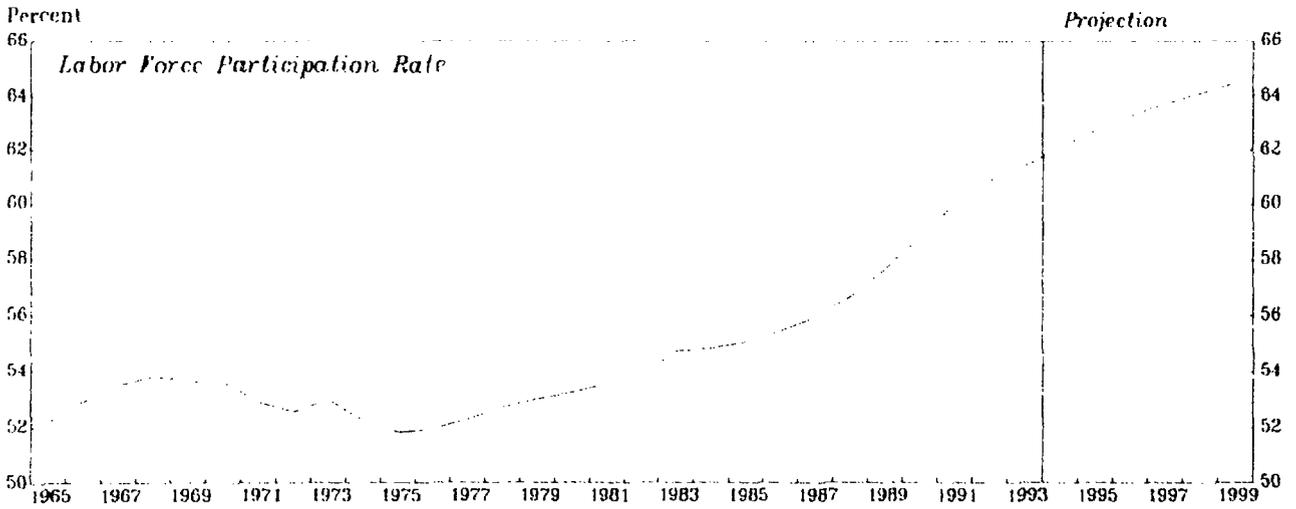
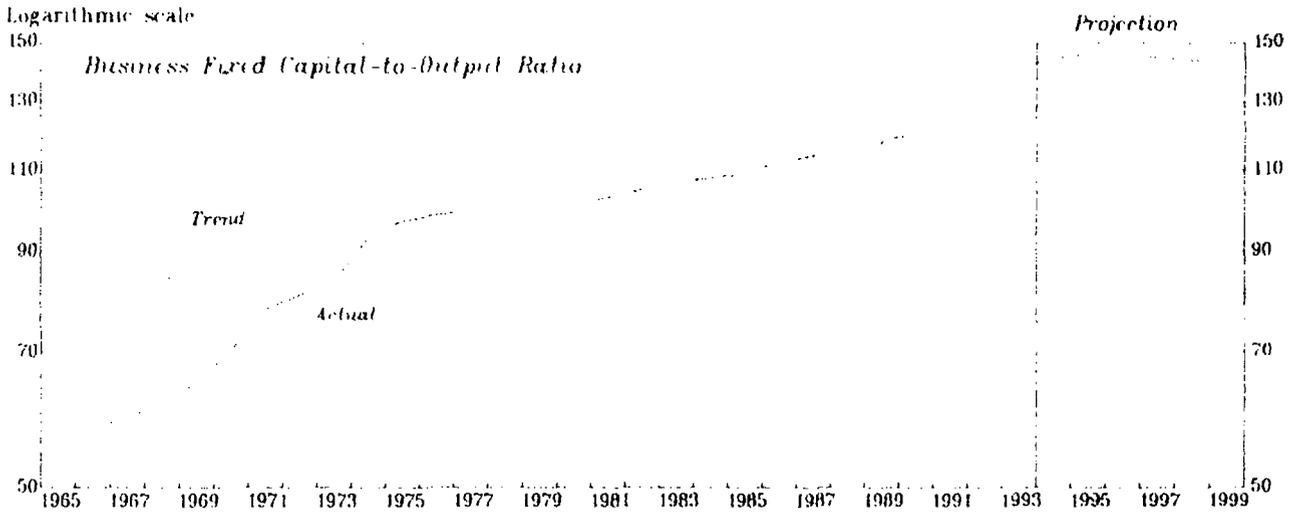
<sup>2/</sup> Demographic developments are discussed in Chapter I of this supplement.

### Chart 7 Japan Determinants of Potential Output, 1971-93



Sources: Economic Planning Agency; and staff estimates.

Chart 8  
Japan  
Factors Determining Medium-Term Potential Output Growth, 1965-99



Sources: Economic Planning Agency; and staff estimates.

"catch-up" phase of Japan's development (Chart 8, bottom panel). Looking at the overall swing in potential growth from 4 1/4 percent during 1987-91 to 2 1/2 percent in 1995-99, slightly less than one half is explained by the bubble-period surge in the capital-to-output ratio and its subsequent reversal. The remainder is due to more fundamental factors--specifically, slower growth in productivity and the trend labor force.

Compared with the projection for medium-term potential growth of 3 1/4 percent in last year's staff report, the current estimates incorporate downward revisions to the contributions of all three determinants of potential output. The capital contribution is 0.3 percentage points lower, in part due to a revised estimate of the "underlying" capital-to-output ratio. Growth in this ratio now reflects only projected future movements in the relative price of capital goods: no shift to explain developments in the late 1980s is incorporated. The absence of a shift in the underlying relationship is consistent with the continuing weak performance of business investment and indications that the capital stock adjustment process will continue for some time. The capital contribution is also lower because of reductions in growth in productivity and the labor input, which reduced the growth in the capital stock needed to maintain a given capital-to-output ratio. The revisions to productivity and labor reflect, respectively, a slightly lower estimate of long-term productivity growth, and a moderation of the projected rise in the labor force participation rate. 1/

The downward revision to productivity growth raises the issue of whether the decline in trend growth since the mid-1980s reflects a decline in "underlying" growth, or the (transitory) impact of the cyclical downturn in 1992-93 on the estimated trend. Truncating the period used to filter productivity in 1986--prior to both the economic boom and the recession--gives a productivity growth rate of 1 1/4 percent, 1/4 percentage point above the assumed medium-term growth rate. Alternatively, as discussed below, incorporating future data based on either WEO projections or time-series models to construct trend productivity would yield lower growth rates ranging from 1/2-3/4 percent--although this approach is subject to circularity problems. Similarly, if the participation rate were to rise in the future at the rate observed during the bubble period, growth in the labor input would be higher than assumed here; if it stabilizes near its current level, growth would be correspondingly lower.

These considerations underscore the point that projections of long-term productivity growth are subject to many uncertainties, and undue confidence should not be attached to any precise estimate. 2/ With these considerations in mind, the next two sections take alternative approaches to

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1/ Nevertheless, the staff's estimate remains above that of several private research institutes in Japan, which are predicting declines in potential growth to around 2 percent in the late 1990s.

2/ For instance, no attempt has been made to estimate the possible impact of deregulation and market-opening measures on future productivity growth.

examining the degree of uncertainty around the "baseline" estimates of the trends in both productivity and employment.

3. Historical performance of the methodology; 1982-93

As noted in the introduction, the approach used to construct potential is likely to be least robust toward the end of the historical period, when the relative importance of demand versus supply shocks is least certain. One way of assessing this uncertainty is to truncate the data used to construct the trend series at various points in the past; the estimate of potential output based on the historical sample periods can then be compared with the "final" estimate obtained using all data up to the end of 1993. 1/

This exercise was performed quarterly from 1982 to 1993, assuming sequentially that each quarter was the last data point available. Employment and productivity were smoothed using the historical data up to that quarter, yielding an estimate of potential reflecting past information only. In addition, the level of potential output was extrapolated six quarters beyond the end of the sample period using the average potential growth rate over the last year of the sample.

Two statistics were calculated to indicate the extent to which the original calculations of potential were revised once information on future movements in output became available. The first is the square root of the mean squared revision (RMSR), which is a relatively straight-forward measure of the typical size of revisions. 2/ In addition, to indicate whether there was a systematic tendency to over or underestimate the initial *absolute* size of output gaps, the average revision to the absolute size of the output gap was calculated. The results are as follows:

Average Revisions to Initial Estimates of Output Gaps, 1982-93

(In percent of potential GDP)

	<u>Contemporaneous Estimate</u>	<u>6-Quarter Ahead Estimate</u>
Square root of the mean squared revision (RMSR)	1.1	1.9
Average revision to the absolute output gap	0.1	-0.9

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1/ It should be noted that this exercise is illustrative only: the estimates of potential used in the staff's past analysis were not necessarily consistent with the approach described here.

2/ The mean absolute revision was also calculated, with results that were very similar to the RMSR.

For the contemporaneous estimate of potential output, the RMSR indicates a typical revision of about 1 percent of GDP; for the six-quarter ahead estimate, it points to a revision of almost 2 percent of GDP. The average revision to the absolute output gap shows that the contemporaneous estimate slightly *understated* the final size of the output gap, suggesting that the estimated trend is dragged "too close" to actual GDP at the end of the sample. In contrast, the 6-quarter ahead extrapolation *overestimated* the future size of the gap by almost 1 percent of GDP. The latter results suggest that the estimated *growth rate* of potential is more distorted than is the absolute size of the initial gap--extrapolating the "wrong" growth rate then leads to systematic overestimates of future gaps. One of the messages implicit in this result is that estimates of future output gaps should be regarded with particular caution.

These characteristics of how estimates of potential evolved in response to developments in actual GDP are illustrated for 1986-93 in Chart 9, which compares the contemporaneous and 6-quarter ahead estimates with the staff's current estimate. Of particular interest is the impact of the "bubble" period of rapid output growth. In the early stages of the bubble (mid-1987 to mid-1988), estimates using only past data placed excessive weight on the preceding period of weak growth, and thus fell below the "final" potential series. This is particularly evident in the 6-quarter ahead extrapolations, reflecting both the low starting point and an excessively pessimistic growth rate. By early 1989, the contemporaneous and 6-quarter ahead estimates of potential had adjusted upward to roughly the current values. From mid-1989 on, the estimates based on past data started to "overshoot," placing excessive weight on the abnormally high levels of output during the bubble period. The largest error would have occurred in late 1991, when the contemporaneous estimate stood over 2 percent above the final estimate of potential, while the 6-quarter ahead forecast was almost 4 percent higher.

#### 4. Alternative estimates of current and projected output gaps

The above exercise illustrates the magnitude of the revisions that can occur to initial estimates of potential toward the end of the observed data series. Two approaches could be taken to reducing the dependence on recent data. One is to look farther back in time to determine underlying trends, in effect weighting more distant historical information more heavily; the other is to look farther into the future, incorporating forward-looking information. Both approaches have drawbacks. With the "backward-looking" approach, when trend growth rates are changing over time, the estimate of the current trend will depend excessively on growth in the distant past. With the "forward-looking" approach there is an element of circularity, since the observer's view of future developments depends in turn on an assessment of the current level and growth rate of potential output.

Nevertheless, it is of interest to examine the implications of both alternatives. The approach of weighting past information more heavily has been implemented by constructing a segmented linear trend line for

productivity growth for the 1962-92 period, with a break in trend in 1972. 1/ The "forward-looking" approach is implemented in two ways. One is to ignore the circularity problem, and simply extend the smoothing period to 1999 using the staff's WEO projections for productivity and employment growth. The other is to use historical data to estimate the speed at which productivity has typically returned to its trend level; productivity is then forecast from 1994 on using this auto-regressive equation, and its trend recalculated using both historical and extrapolated data. 2/

The results using these approaches are shown in Chart 10 for both the levels of potential output and the implied output gaps. The linear productivity trend yields a higher estimate of potential growth than the baseline toward the end of the historical period and over the projection horizon. This is not surprising, as the linear trend is less affected by the slowdown in productivity growth since the late 1980s: it implies trend growth of slightly below 1 1/4 percent per year, similar to the estimate implied by truncating the filter of actual productivity in 1986, prior to both the bubble and the recession. The implied output gap at end-1993 is 6 percent; the gap widens further over the near term, before narrowing only gradually by 1997.

At the opposite end of the spectrum is the approach using both historical and WEO projection data, which begins to drop below baseline in 1990. By end-1993, the output gap implied by this series is only 3 percent as opposed to the baseline estimate of 5 1/2 percent. This difference widens over the projection period: the output gap constructed using the WEO projection data is fully closed by 1997, while the baseline estimate of potential implies a remaining gap of almost 3 percent. Lying between these two estimates is the potential series based on the auto-regressive projection of productivity, which implies an output gap of 4 1/2 percent in end-1993 that is fully closed by 1998.

## 5. Conclusions

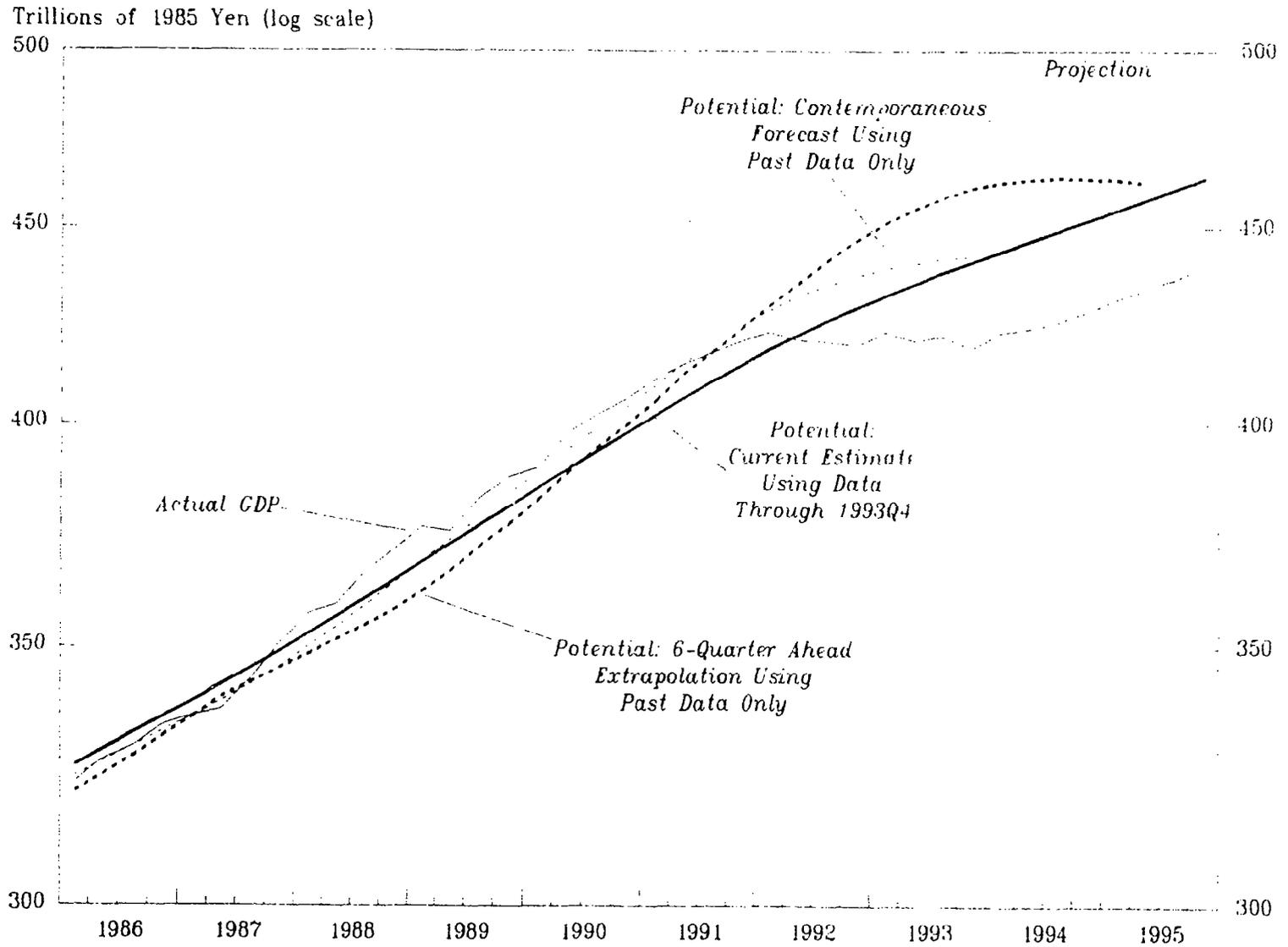
As noted earlier, each of the above approaches has certain drawbacks. Nevertheless, some tentative conclusions can be drawn from the range of estimates they provide. All of the alternatives suggest that there exists a substantial output gap in Japan that might range from 3-6 percent of GDP. On the basis of the staff's current GDP growth projection, these output gaps are projected to remain large through end-1995. Over the medium term, however, the pace at which the gaps close differs significantly. At one extreme, output might reach potential by 1997, while at the other, the gap

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1/ Such a break in the early 1970s is consistent with the evidence for several other industrial countries.

2/ Circularity was also an issue with this procedure, as the projected productivity data depend on the estimated trend and vice versa. To resolve this, the procedure was iterated several times until the two series were mutually consistent.

Chart 9  
 Japan  
 Historical Forecasts of Potential GDP Versus Current Estimate, 1986-95

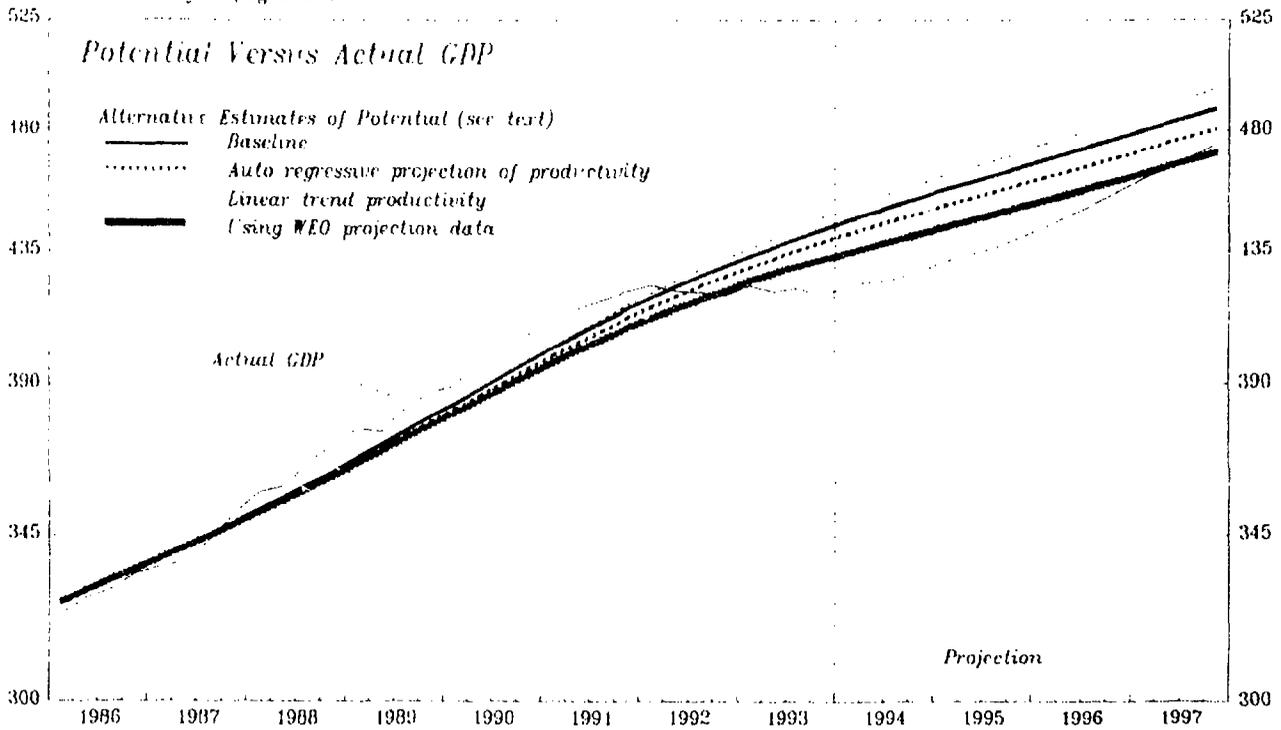


Sources: Economic Planning Agency; and staff estimates.

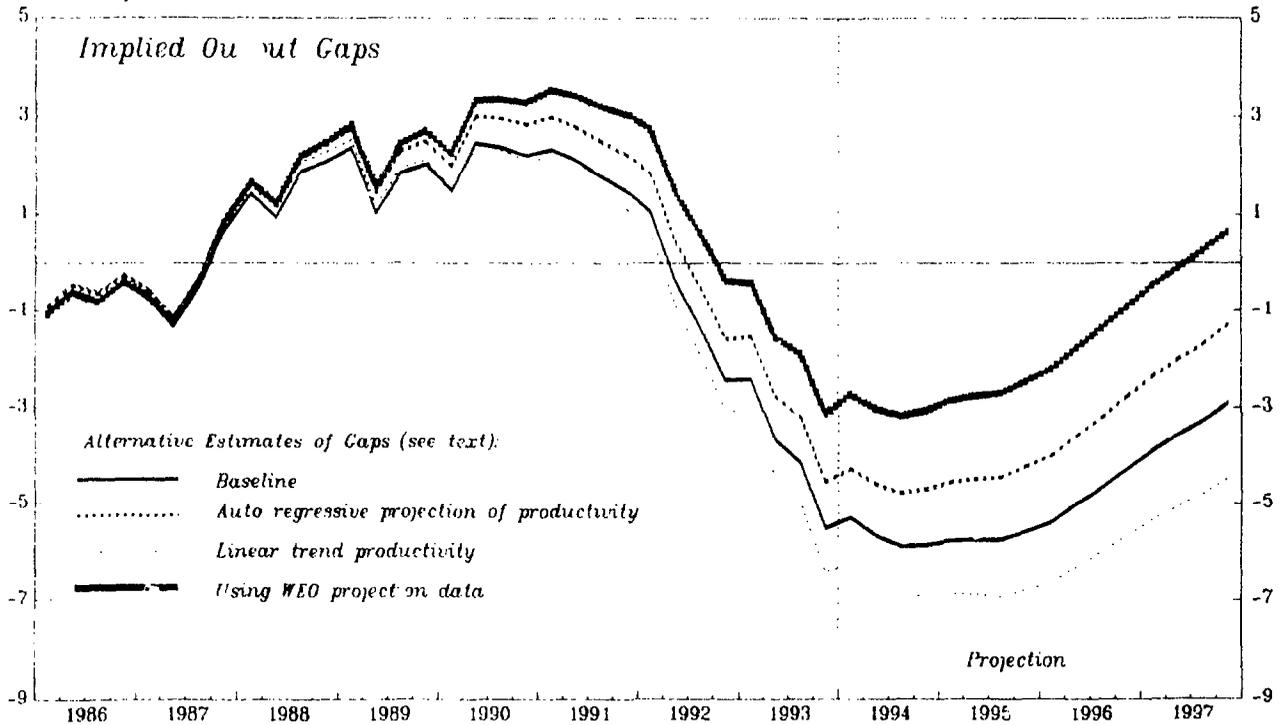
Chart 10  
Japan

# Alternative Estimates of Potential GDP, 1986-97

Trillions of 1985 yen (log scale)



Percent of potential GDP



Sources: Economic Planning Agency; and staff estimates.

would still not be full closed by 1999. A strong element of uncertainty about the future is also conveyed by the retrospective analysis, which indicates that estimates of potential are subject to wide margins of revision, especially when extrapolated into the future. There is also a tendency to systematically overestimate the size of future output gaps based on past information only.

From a policy perspective, the analysis supports the view that the risk of economic overheating in the near term is remote. Indeed, even rather conservative estimates of potential suggest the persistence of significant output gaps in 1994-95. Over the medium term, greater caution is indicated. Uncertainty about demand conditions is reinforced by the imprecision of estimates of the sustainable level of output, pointing to the risk that pre-committing to counter-cyclical policies beyond the near term may lead to unintended consequences.

### III. Review of Recent GDP Forecasts

#### 1. Introduction

Throughout the recent economic downturn, Fund staff forecasts substantially overestimated GDP growth in Japan. Moreover, the staff projections generally implied an imminent turnaround in activity, although, in the event, the recession deepened and lengthened. This chapter reviews the Fund's GDP forecasts for Japan prepared for the World Economic Outlook (WEO) and for the Article IV consultations in 1992-94.

The main errors in Fund projections were made in private investment and, to a lesser extent, in private consumption; deviations of actual exchange rate developments from the initial assumptions underlying the forecasts were also a contributing factor. The forecast errors in private investment, which accounted for the bulk of the total discrepancy, were mainly attributable to a misjudgment of the causes of the investment boom during the "bubble" years, and an underestimation of stock disequilibrium. By contrast, the forecast errors in private consumption reflected mainly a misjudgment of the growth in disposable income, rather than of the underlying behavioral relationships. While the WEO projections (by construction) assume a constant effective exchange rate, the yen appreciated significantly in 1992-93. The stronger-than-projected yen not only reduced net external demand, but also weakened domestic demand through its effect on consumer and investor confidence.

The forecast errors were also affected by the authorities' policy response to the recession. Since staff projections are based on "current policies," the forecasts could not incorporate the effects of future stimulative measures. As a result, staff forecasts underestimated, in particular, public expenditure, which was boosted by a series of fiscal stimulus packages starting in August 1992. This underestimation partly

offset the errors emanating from overly optimistic forecasts for private demand.

## 2. Growth projections, 1992-94

Staff forecasts of GDP growth in 1992 and 1993 overshot the outturns by a large margin (Table 1). The six staff projections for 1992 <sup>1/</sup> ranged from a high of 3.9 percent to a low of 2.0 percent (average of 2.9 percent), while actual GDP growth turned out to be 1.1 percent. Similarly, the six staff forecasts for 1993 (prepared in 1992 and 1993) ranged from 3.9 percent to -0.1 percent and averaged 2.3 percent, compared with the realized growth of 0.1 percent. Not surprisingly, for both 1992 and 1993, the GDP growth projections became more accurate with each successive forecast. A common characteristic of the projections was also that, while the immediate growth prospects were seen as weak, a relatively sharp upturn was envisaged for the following year (Chart 11).

It is useful to compare the staff forecasts in 1992-94 with those made by other institutions. A convenient reference point is provided by the "consensus" forecast--the mean of projections made by about 20 private sector institutions in Japan (Table 1 and Chart 12). For both 1992 and 1993, the consensus forecast drifted downward over time, and a similar tendency can be observed for the 1994 growth forecasts. Throughout the period, the staff forecasts, as well as those of the OECD, were relatively close to the mean of the consensus forecasts.

A major difficulty that all forecasters faced was that the latest cycle was atypical--both during the upturn when the relatively small (negative) output gap was not a good indicator of the underlying imbalances, and during the recession, which turned out to be unusually long and deep. Chart 13 shows that forecasts based on past cyclical patterns (as summarized by a simple autoregressive GDP equation) would have been misleading. Through early 1993, forecasts based solely on information contained in past GDP data would have predicted a much milder recession than actually occurred.

## 3. Sources of forecast errors

Before discussing possible explanations for the large and systematic forecast errors since 1991, it may be useful to see which components of GDP were the principal sources of errors in the staff projections (Table 1 and Chart 14). A decomposition of the total error reveals that the main sources of the upside errors were private investment (especially business fixed investment) and private consumption. Overly optimistic forecasts of private investment were on average responsible for 1.8 percentage points of the total forecast error (of 1.8 percentage points) in 1992 and for

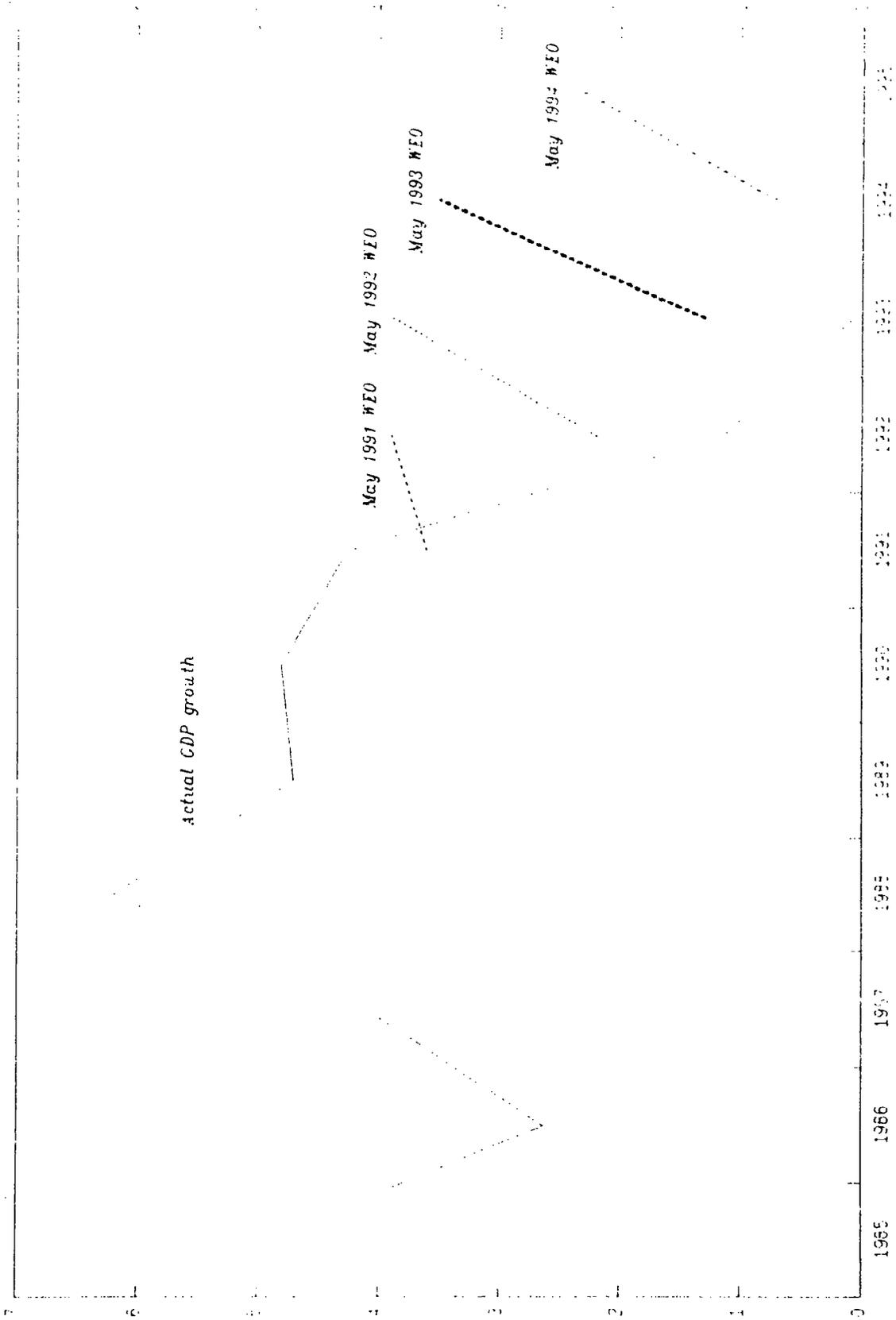
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<sup>1/</sup> WEO forecasts published in the spring and fall of 1991 and 1992, and the forecasts prepared for the Article IV consultations in June 1991 and June 1992.

CHART 11

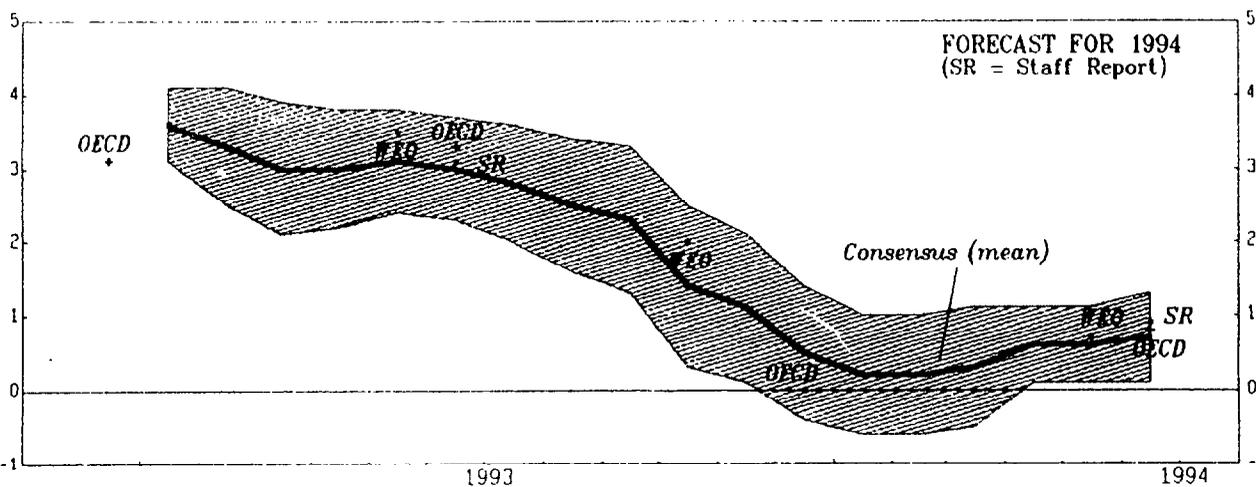
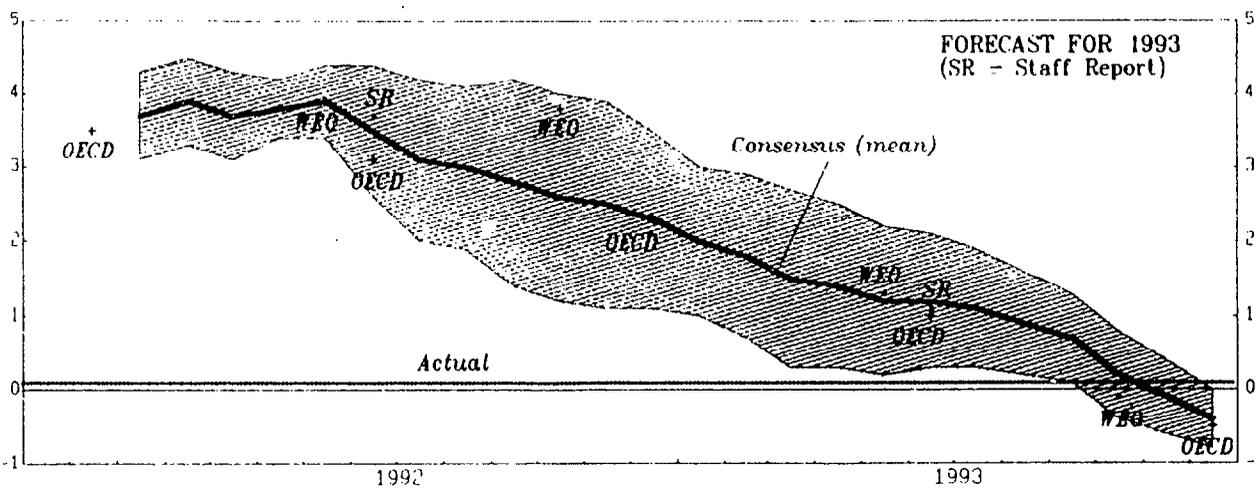
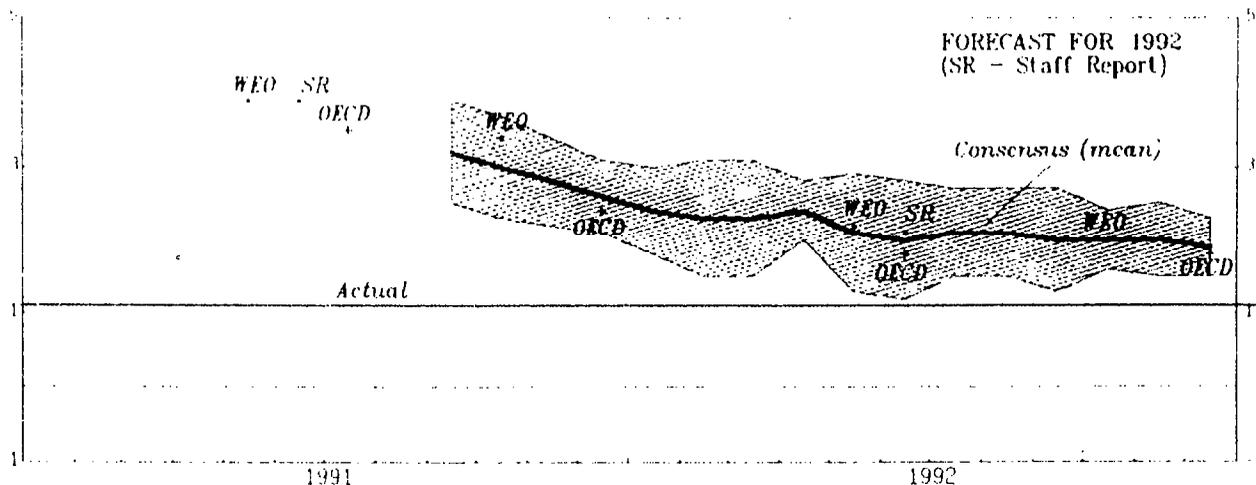
JAPAN

Actual GDP Growth and WEO Projections, 1985-95 1/  
(In percent)



Sources: Nikkei Telecom; and staff estimates and projections.  
1/ For simplicity, this chart focuses on the May WEO forecasts, leaving out the October WEO forecasts and the staff report projections.

### Comparison of GDP Growth Forecasts for 1992-94 1/ (In percent)

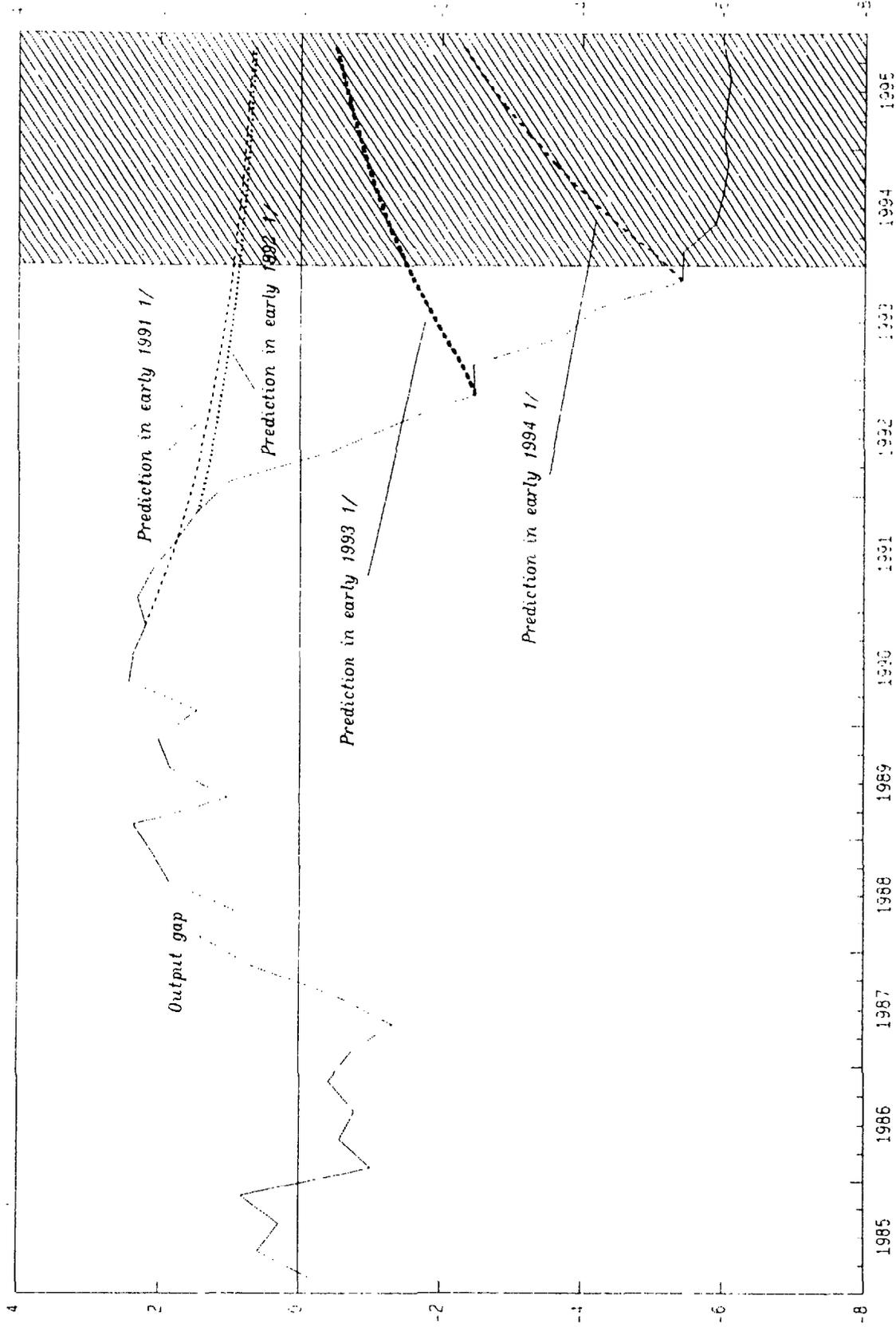


Sources: Consensus Forecasts; OECD Economic Outlook; and staff estimates and projections.  
1/ The shaded area represents the consensus mean plus/minus one standard deviation.

CHART 13

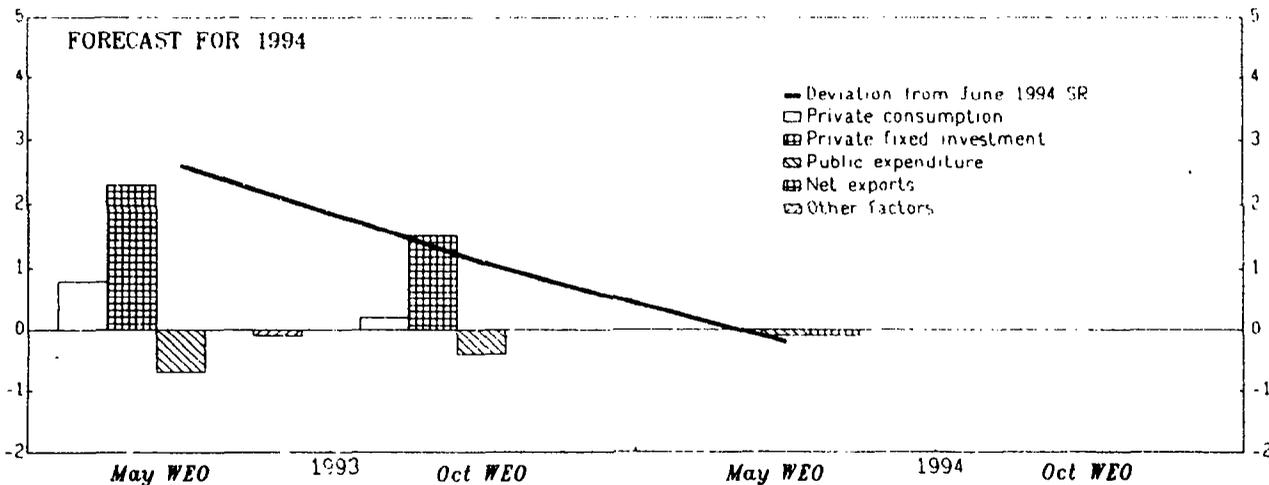
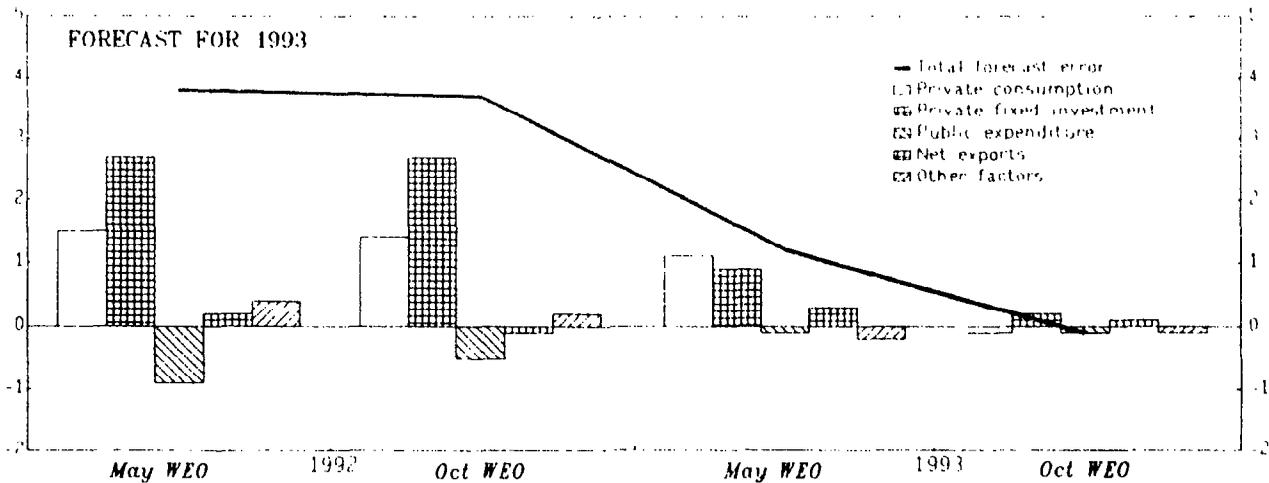
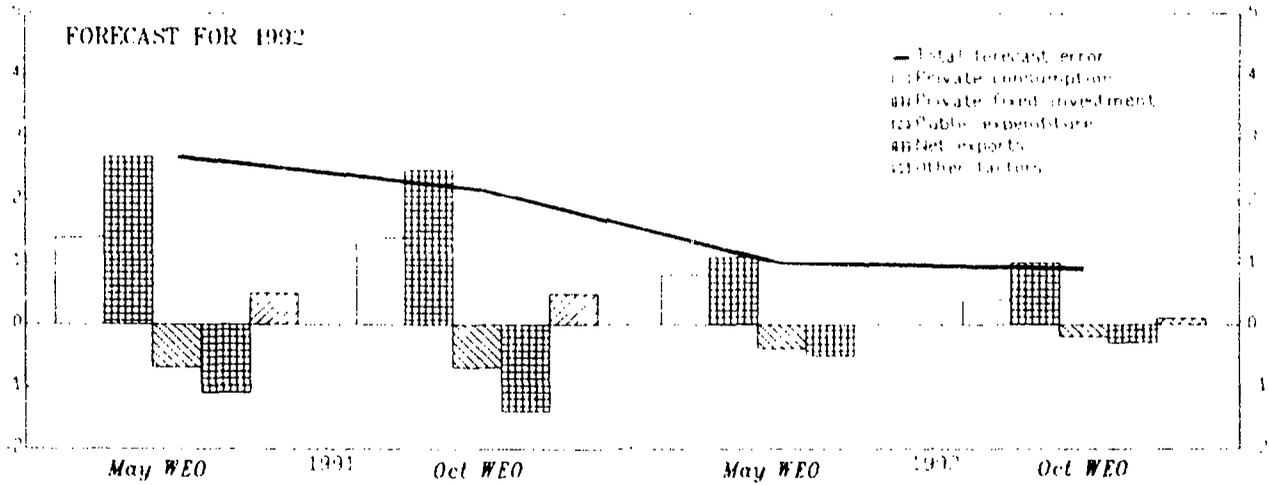
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### Actual and Predicted Output Gap, 1985-95 (In percent of potential)



Source: Staff estimates and projections.  
1/ Predictions based on autoregression with two lags using quarterly data from 1960 up to the end of the preceding year.

Sources of Errors in Forecasting GDP Growth, 1992-94 1/  
(In percent)



Sources: Staff estimates and projections.

1/ For simplicity, this chart focuses on the WEO forecasts and excludes projections prepared for the staff reports



1.6 percentage points of the total forecast error (of 2.2 percentage points) in 1993. Similarly, overestimates of private consumption accounted for 1.0 percentage points of the average forecast error in GDP growth in 1992 and 0.8 percentage points in 1993. These upside errors in forecasting private spending were in part offset by public expenditure, which was consistently higher than projected. Net exports were significantly underestimated for 1992 but slightly overestimated for 1993.

#### 4. Possible explanations

While providing some insight, the above mechanical decomposition sheds little light on the underlying reasons for the forecast errors. Why did the staff fail to project a continuation of the recession? At a general level, there are two possibilities: either there were unforeseen events (such as new policy measures or changes in the external environment) that took place after the forecasts were completed, or the behavioral relationships of the economy, which may have undergone a structural change, were not fully understood at the time when the projections were made. The following discussion suggests that both types of factors played a role, although the latter were more important.

The main exogenous event, from the point of view of the forecast, was the yen appreciation in 1992-93. By construction, WEO forecasts (and projections for staff reports) assume a constant real effective exchange rate. For example, a WEO forecast published in May typically uses the exchange rates prevailing in the first half of March as the base. For 1992, when the actual annual average exchange rate was ¥ 126 per U.S. dollar, the four WEO forecasts published in 1991-92 had used assumptions ranging from ¥ 138 per dollar (October 1991) to ¥ 126 per dollar (October 1992), with an average of ¥ 133 per dollar. Staff estimates (explained in detail below), which incorporate both the direct effect of an appreciation on net external demand and the partly offsetting influence of an improvement in the terms of trade, suggest that this unexpected appreciation was responsible for about a 1/4 percentage point of the forecast error in GDP growth for 1992. Similarly, for 1993, the actual exchange rate was ¥ 111 per dollar, while the WEO forecasts had assumed an average rate of ¥ 120 per dollar. This unanticipated appreciation is estimated to have accounted for close to 1/2 percentage point of the error in the GDP forecast. In addition, the strength of the yen is likely to have lowered consumer and investor confidence, contributing to the negative "surprises" in private consumption and investment.

The above-mentioned staff estimates take into account the following effects of a yen appreciation. First, net external demand falls as trade and service volumes respond to the stronger yen. The staff's current account model suggests that a sustained 10 percent appreciation of the yen will result in a withdrawal of external stimulus of 0.7 percent of GDP during the first year and of 1 1/2 percent in the long run. Second, the resulting improvement in the terms of trade raises real income and offsets some of the impact of the withdrawal of external stimulus. In the long run,

this terms-of-trade effect of an appreciation on GDP is estimated to be roughly one half of the size of, and of opposite sign to, the direct effect of external demand. In the short run, however, the terms-of-trade effect offsets somewhat less than one half of the direct withdrawal of external stimulus, reflecting lags not only in the adjustment of trade prices to an appreciation, but also in the adjustment of real spending to a change in the terms of trade. Third, there is a foreign repercussions effect, which is likely to be small. With Japan's share of world GDP being about 10 percent, a withdrawal of external demand in Japan of, say, 0.7 percent of GDP would provide a direct stimulus of 0.07 percent of GDP to the rest of the world. This stimulus would tend to cause a slight increase in the rest of the world's GDP; the deterioration in the terms of trade abroad would have an adverse effect on domestic demand in the rest of the world, making the magnitude of the foreign repercussions effect on Japan's GDP insignificant.

If the unexpected strength of the yen is responsible for part of the (positive) GDP forecast error, why did the staff underestimate net external demand for 1992? The explanation is that the negative impact of a yen appreciation on net external demand was more than offset by the impact of significantly weaker-than-projected domestic demand on imports. By contrast, the net external demand forecasts for 1993 turned out to be too high on average. In that case, the error in the exchange rate assumption (which was larger than in 1992) dominated over the error in the domestic demand projection (which was smaller than in 1992).

The outcome for macroeconomic policies, especially fiscal policy, was also different than that assumed in the staff forecasts. As private demand weakened, the authorities introduced a series of fiscal stimulus packages between August 1992 and February 1994. <sup>1/</sup> While each staff forecast incorporated the estimated effects of already announced packages, the impact of possible future stimulus measures was, of course, excluded. Hence, fiscal policy had a stronger-than-projected effect on GDP, partly offsetting the errors in overly optimistic forecasts of private demand. As an indication of the magnitude of this error, the decomposition discussed in Section 3 shows that higher-than-expected public expenditure made an average contribution of -0.5 percentage points to the GDP forecast error in 1992 and -0.4 percentage points in 1993.

Turning to the underlying behavioral relationships, the relatively large errors in forecasting private consumption appear to be explained primarily by overly optimistic assumptions about income growth. The optimistic assumptions about income growth were based on projections of a constant yen, unchanged consumer confidence (which in the event suffered from the appreciation), and a better-than-realized performance of private investment (which is discussed in detail below). That the underlying

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<sup>1/</sup> While monetary policy was also more expansionary than assumed in the forecasts, it is difficult to measure its contribution to the forecast error.

consumption function did not change significantly is suggested by the fact that the projected propensity to consume was close to the actual one (see the tabulation below). Moreover, simulations using a standard consumption function (including disposable income, financial wealth, and demographic factors as explanatory variables) show no apparent break in the behavioral relationships (Chart 15).

	WEO Forecasts (M - May, O - Oct.)						1/	Actual
	M1991	O1991	M1992	O1992	M1993	O1993		
Private consumption/GDP (in percent)								
1992	58.1	57.1	57.1	57.2	...	...	57.2	
1993	...	...	57.0	57.1	57.6	57.8	57.8	

The above discussion suggests that private investment was the main factor behind the forecast errors. There is evidence that the prolonged slump in business investment could have been anticipated more accurately. As shown in Chart 16, simple indicators like equity prices (which play a prominent role in Tobin's Q theory) or corporate profits gave clear signals about the weak prospects for investment and could have been used to generate less optimistic forecasts. Moreover, the ratio of wages to the user cost of capital (which is the key variable in Jorgensonian theories of investment) continued to move in line with investment during the recession, suggesting no change in the underlying relationships. <sup>2/</sup>

Why were the signals provided by the above-mentioned investment indicators not fully incorporated into the forecasts? Two explanations are relevant. First, during the period following the rapid appreciation of the yen since 1985, the Japanese economy appeared to undergo a structural change toward labor-saving technologies: the cost of capital came down markedly, and Japanese companies moved their more labor intensive production facilities abroad. Under these circumstances, it was plausible to assume that the capital-output ratio would remain well above the long-term trend. Second, in the early 1990s, there was considerable uncertainty as to what extent the sharp asset price increases in the second half of the 1980s had represented rational behavior and to what extent they were a "bubble." It was only when land and stock prices continued to decline that investors (and

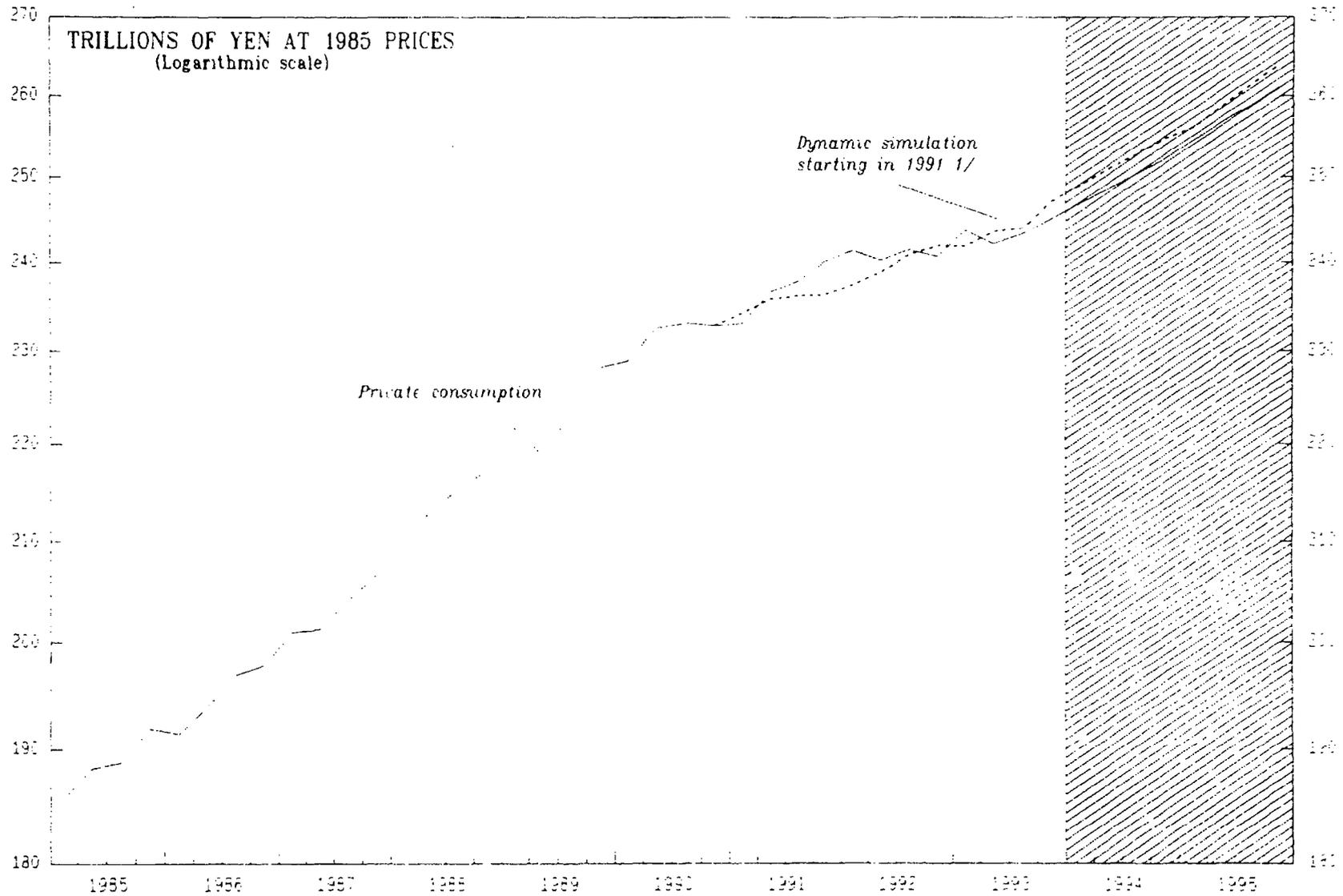
<sup>1/</sup> The staff report forecasts in 1991-93 were very close to the respective May WEO projections.

<sup>2/</sup> The user cost of capital was calculated as  $PK \cdot (R - \Delta PK / PK + D) / (1 - T)$  where PK is the price of investment goods, R is the 10-year government bond rate,  $\Delta PK / PK$  is the rate of change in the price of investment goods, D is the depreciation rate, and T is the ratio of corporate taxes to the operating surplus.

CHART 15

JAPAN

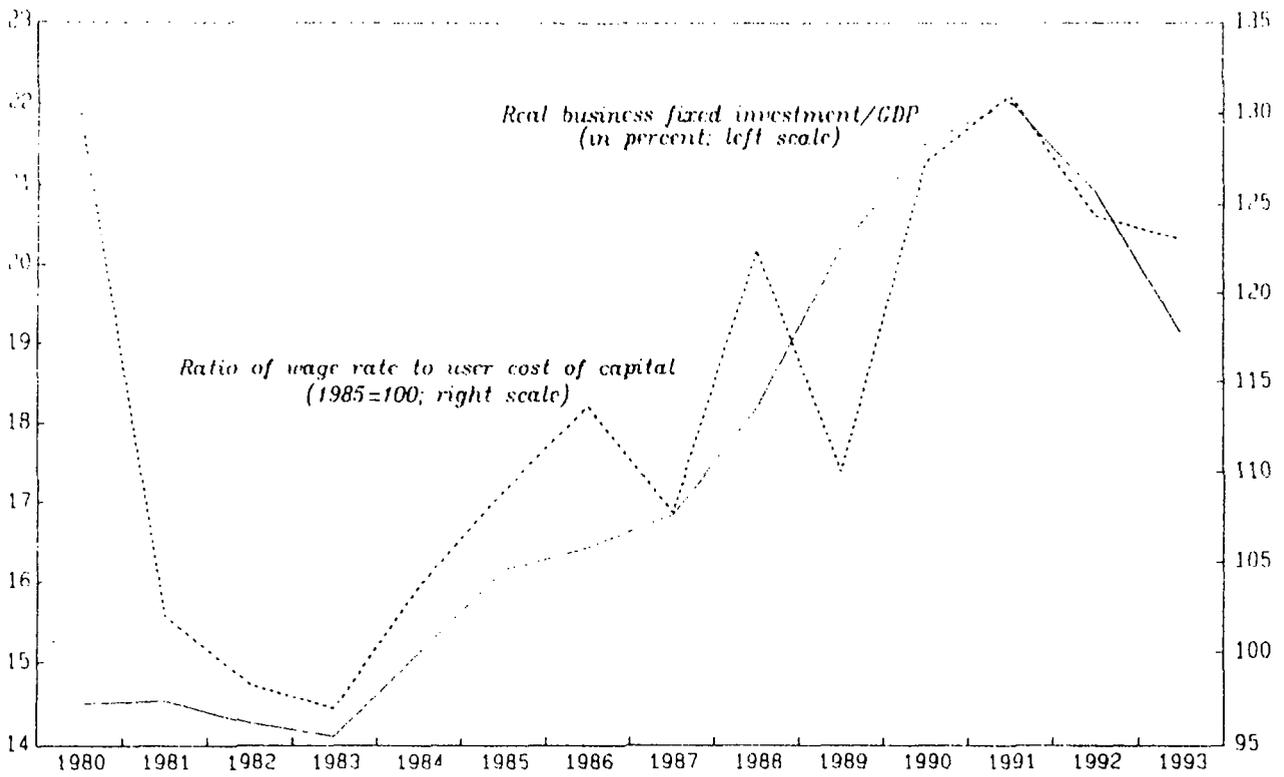
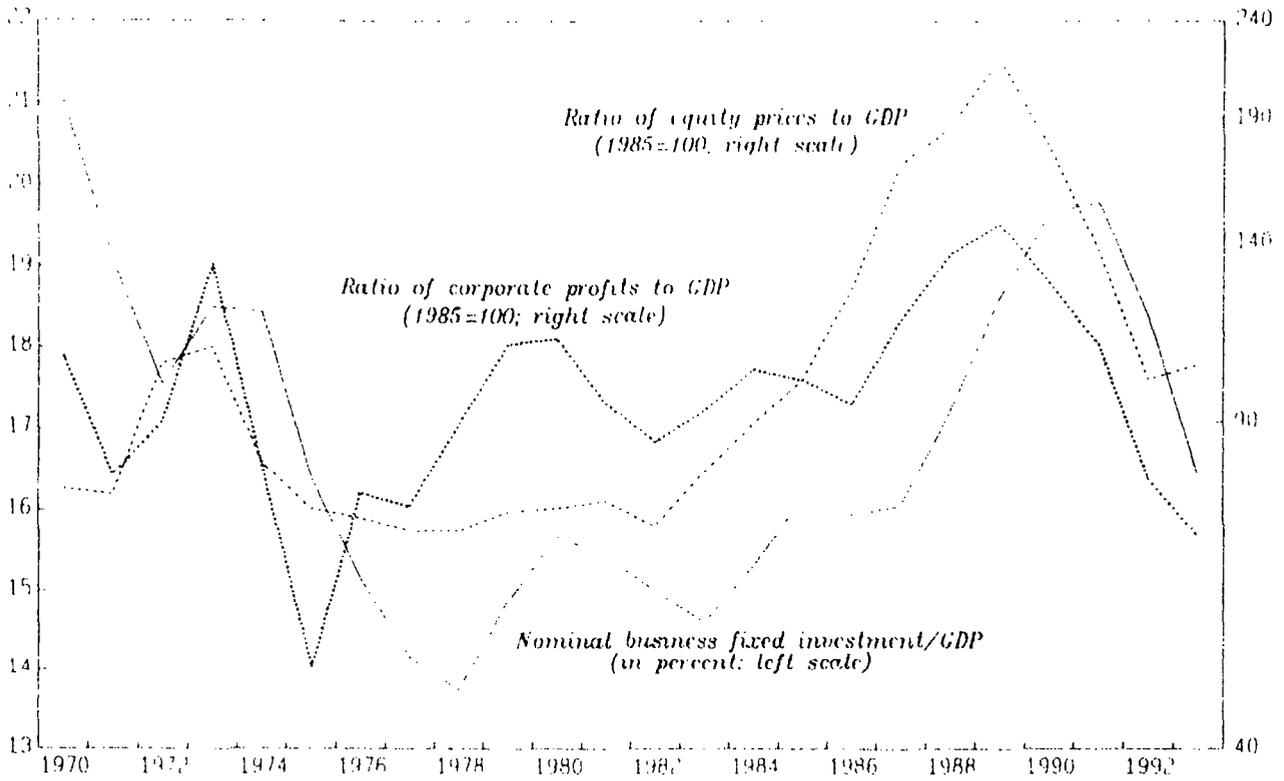
Actual and Predicted Private Consumption, 1985-95



Source: Staff estimates and projections.

1/ Based on a consumption function with households' disposable income, net financial wealth, and demographic factors as explanatory variables.

Indicators of Investment, 1970-93



Sources: Nikkei Telecom; and staff estimates.

forecasters) realized that the asset price increases (and the easy monetary conditions that had been a major factor behind them) had been for the main part temporary. Thus, the extraordinary magnitude of movements in asset prices and the associated balance sheet adjustments made forecasting investment activity unusually difficult.

The difficulty of predicting investment during the last recession is also evident in the poor forecast record of investment surveys. For fiscal years 1992 and 1993, results from the Tankan (a survey of the business outlook carried out by the Bank of Japan) show that as late as February of each year, the investing firms themselves expected investment to be substantially higher (by 3-6 percentage points) than it actually turned out to be in the fiscal year beginning in March.

## 5. Conclusions

As documented above, the Fund staff's projections of activity in Japan were significantly off the mark during the current downturn. Most of the error was concentrated in business investment, although errors in private consumption and in the exchange rate assumption also played contributing roles. These were offset, in part, by the countercyclical response of fiscal policy, which cushioned the weakness of private demand.

The main error in the projections of business investment stemmed from an overestimation of the role of "fundamental" factors in explaining the bubble-period surge in investment that preceded the current recession; correspondingly, the role of easy financial conditions was underestimated. Much of the easing of financial conditions in the late 1980s had occurred through "nontraditional" channels: while real interest rates were not particularly low, rising equity prices allowed firms to raise funds on unusually attractive terms and distorted balance sheet positions by exaggerating the hidden profits of the financial and nonfinancial sectors. The bubble in land prices reinforced these effects by encouraging banks to aggressively expand lending on the basis of higher collateral values, independent of the adequacy of firms' income flows to support this lending. By the time asset prices turned down, firms had accumulated a large excess stock of fixed capital. Thus, the ensuing adjustment reflected, not only the "flow" response of spending to tighter financial conditions, but also the need for firms to work off excess stocks of fixed assets.

What lessons does this experience hold for forecasting cyclical movements in output? The main lesson is that projections should systematically incorporate the impact of a broad range of financial variables on domestic demand. Predicting the impact of sharp movements in asset prices on the economy, however, is not an easy task: witness the initial overestimation of the adverse consequences of the global stock market decline in 1987. A second, related lesson is that stock imbalances can have powerful and long-lasting effects on flows: investment remains depressed in Japan despite the easing of monetary policy and the firming of equity prices. In this context, flow measures of imbalances--such as the

gap between actual and potential output--can give an incomplete picture of the state of economic disequilibrium (even at the peak of the bubble, the output gap in Japan did not exceed 2 1/2 percent of GDP). Of course, these projection errors ultimately reflect the reality that short-term forecasting is subject to large uncertainties and risks, particularly at turning points.