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# Japan: Selected Issues

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JAPAN

**Selected Issues**

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Approved by the Asia and Pacific Department

October 13, 2000

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# I. Population Aging and Its Macroeconomic Implications

by Hamid Faruqee

## A. Introduction

1. Population aging will figure as a prominent feature of the Japanese economic landscape over the next century. According to demographic projections, Japan will have one of the the highest ratios of elderly dependents among the major industrial countries by the end of this year, despite having the lowest share just a decade ago. This dramatic shift is expected to continue well into the new century and will likely have profound social and economic implications.

2. At the policy level, the implications of an aging population have several dimensions in Japan. The social security system—consisting mainly of health care and pension benefits—will inevitably face rising costs associated with the increasing share of elderly dependents.[1] In the absence of further policy reforms, the central government could be saddled with growing unfunded liabilities associated with these entitlement programs. In particular, the pension system, which is partially funded, will face a severe shortfall in meeting future pension obligations at prevailing contribution rates.

3. This chapter develops a general equilibrium framework to examine the economic implications of population aging in Japan as well as the policies designed to address it.[2] The macroeconomic effects of demographic changes in the model are manifested through two main channels: (1) on the supply side, changes in the age structure have implications for labor supply, and (2) on the demand side, population aging has implications for aggregate consumption, saving, and investment. Introducing these features into a multi-country framework based on MULTIMOD, the model is calibrated based on age-earnings and demographic data for Japan as well as for other industrial countries (OI) as a group. To introduce a policy dimension, the model is further extended to incorporate a social security transfer scheme. This allows policy parameters affecting net taxes—i.e., taxes less transfers—to be directly incorporated into private sector behavior.

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[1] The government provides several types of social security benefits through the following agencies: Employee Pension Insurance (EPI) for private sector employees, Mutual Aid Associations (MAAs) for public sector employees, and National Pension (NP) and National Health (NH) systems for self-employed and agricultural workers. Universal national health coverage in Japan was instituted in 1961.

[2] A more thorough examination of alternative fiscal policies and social security reforms is discussed in Chapter II by M. Mühleisen.

4. The consumption and saving behavior in the model flows from a modern life-cycle paradigm.[3] Within this multi-cohort framework, younger agents tend to be net borrowers, reflecting the fact that permanent income exceeds current income; mature agents tend to be large net savers at the peak of their earnings potential; finally, the elderly also tend to save (albeit to a lesser degree), reflecting precautionary saving in the face of lifetime uncertainty and retirement.

5. Compared to many previous studies, the present analysis suggests somewhat smaller effects on saving rates from changing demographics. Much of the previous work is based on macroeconomic time series evidence and reduced-form coefficients from saving regressions on dependency ratios.[4] These older studies tend to find very large negative effects on saving rates from increasing dependency rates.[5] This paper takes a more structural approach, based on a model of overlapping agents whose behavior is more closely tied to the microeconomic evidence on household saving. In the case of Japan, as with many other countries, a stylized fact at the household level is that the elderly generally do not dissave.[6] Consequently, population aging does not guarantee a large decline in aggregate saving, particularly when factors such as increasing longevity are also taken into account.

6. The results can be summarized as follows. In Japan, demographics are defined by a sustained decline in birth rates and an increase in longevity, leading to an aging of the population. The sharp decline in fertility rates is also responsible for a significant decline of Japan's population. As a result of a contracting workforce, the level of real GDP is projected to fall (from a baseline with a constant workforce) by about 20 percent cumulatively over the next half-century or so. In terms of growth, annual GDP growth in Japan may be lower by about 0.5 percent for sometime as the economy settles to a long-run equilibrium with a permanently higher elderly dependency ratio and smaller supply of labor.

7. In per capita terms, GDP per person declines slightly in the long run (relative to baseline). Output falls in proportion to the contraction of labor—measured in efficiency units. However, the percent decline in effective labor supply is larger than the fall in the (adult) population, as the share of elderly increase. Investment and saving levels also decline

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[3] See Blanchard (1985) and Faruqee and Laxton (2000).

[4] Cutler *et al.* (1990) take a third approach to population aging using the Ramsey optimal growth model, augmented for a changing support ratio—i.e., the share of effective workers to consumers. They find that saving (and investment) rates generally decline with population aging, but that short-run saving and saving net of investment tend to *rise* in the country aging more rapidly.

[5] See, for example, Meredith (1995) for a summary of the macroeconomic evidence on demographics and saving with an analytical application to Japan; see Yashiro and Oishi (1997) for a review of studies on the implications for the saving-investment balance in Japan.

[6] See Hayashi (1986). See Weil (1989) for a general discussion of the tension between the saving implications of demographics from the macroeconomic and microeconomic evidence.

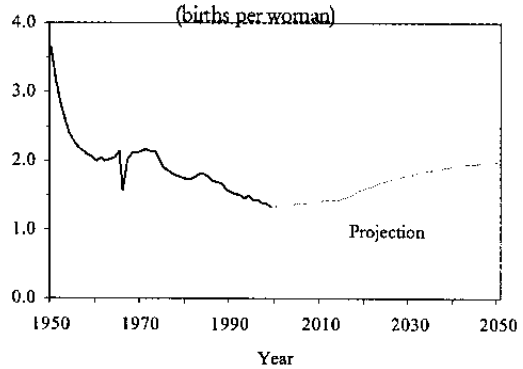
with GDP through the adjustment process. The decline in investment reflects the desire to shed capital in the wake of the contraction in labor and output, though investment rates (as a share of GDP) remain unchanged. However, saving rates and, hence, the current account ratio *increase* slightly as the population ages. Despite a higher proportion of elderly who tend to save less, the increase in longevity and the decline in the inflow of young agents (who tend to have high consumption propensities) act to raise saving rates in Japan.

8. In terms of policy implications, the analysis highlights the importance of taking into account prospective changes in the macroeconomic environment when evaluating policies that address the challenges posed by population aging. An assessment of fiscal sustainability, for example, which focused only on the social security dimensions would miss an important component of the analysis if it ignored the macroeconomic implications of demographic changes for the fiscal accounts. Similarly, the endogenous response in private behavior to various policy changes should also be taken into account when examining policy reforms. On this last point, the simulation analysis suggests that changes in social security benefits can have a notable impact on private sector saving. In particular, a balanced decline in benefit and contribution rates is shown to boost private saving rates by nearly half of the reduction in benefit rates, as agents anticipate having to self-finance more of their consumption in retirement.

## B. Demographic Trends

9. A central feature of Japan's demographics is a long-run decline in fertility. In the postwar era, the total fertility rate–defined as the number of births per woman–experienced a sharp decline in a single ten-year span, falling from over 3½ births in 1950 to just 2 births in 1960 (Figure I.1). Since that time, the fertility rate has continued to decline generally, and now remains well below the replacement rate.[7] The implications for the overall population of this dramatic fall in fertility is that the number of young adults or workers expected to arrive in the future (ignoring immigration) will decline significantly for some time to come.[8]

Figure I.1
Japan--Total Fertility Rate, 1950-2050
(births per woman)

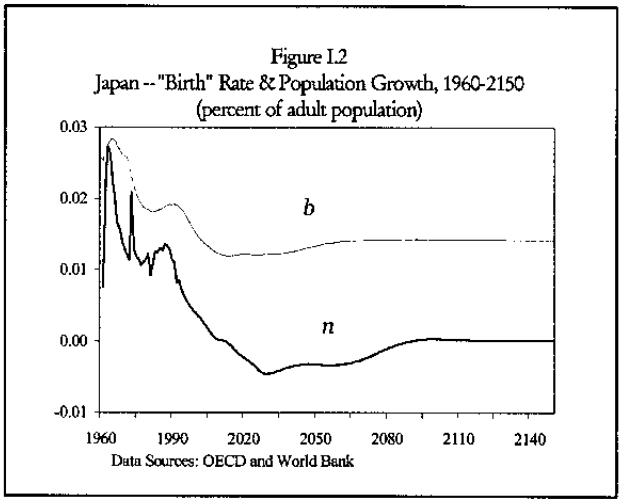



Source: Takayama (1998) and World Bank

[7] Takayama (1998) cites three factors behind the decline in fertility rates in Japan: first, a decrease in the salary gap between men and women; second, difficulties reconciling work with child rearing; and third, a generous social security system to provide adequate living standards for the elderly.

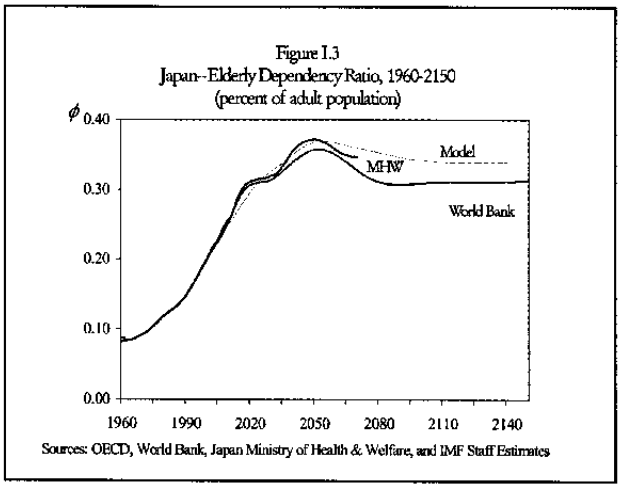
[8] The World Bank projections call for Japan's fertility rate to stabilize and recover to the replacement rate by the middle of the century. This recovery is needed to (eventually) obtain a stationary population.

10. Redefining "births" as the inflow of new adults into the economy, Figure I.2 shows the historical and projected evolution of Japan's "birth rate" $b$ since 1960. As evident in the graph, the inflow of young adults as a share of the adult population has declined significantly over the past 40 years; moreover, even assuming a modest recovery in fertility rate over the next fifty years, the "birth rate" is projected to remain far below its historical levels well into the next century.[9]




11. The long-run decline in Japan's birth rate has *two* important demographic implications: a declining population and an aging population. As seen in Figure I.2, the decline in the "birth rate" $b$ is associated with a decline in the population growth rate $n$. In fact, given that fertility rates have already fallen to such an extent, a declining adult population ($n<0$) can be expected for much of the 21st century.

12. With smaller cohorts of new adults arriving in the future, the relative share of working age people will diminish over time and the population's average age will increase. The result is a sharp increase in the share of elderly in the population. Figure I.3. shows the dramatic rise in the ratio $\phi$ of Japan's elderly dependents (age 65+) as a share of the adult population projected from the analytical model described in Annex I, as well as projections from Japan's Ministry of Health and Welfare and the World Bank.




13. It should be noted that, while a decline in fertility is generally associated with an aging population, a contraction of the population need not occur, especially when mortality

[9] To be consistent with the model described later, the focus here is on the *adult* population (i.e., age 15+), and the birth rate is defined as the arrival rate of new adults or workers. Correspondingly, growth rates refer to the percent change of the adult population. In Figure I.2, historical data and projections for the "birth" rate are constructed from data from the OECD and World Bank on the youngest adult cohort group—i.e., 15–24 year olds—to yield the share of new adults arriving each period; this series resembles movements in the more conventional fertility rate shown in Figure I.1 with a 20-year lag.

rates are also falling (i.e., longevity is increasing).[10] Among other industrial countries as a group, for example, while population aging and a slowdown in population growth is expected, the population is not expected to shrink to any large extent. However, the more precipitous decline in fertility rates in Japan implies that a declining population will also figure as a prominent feature of its demographics.

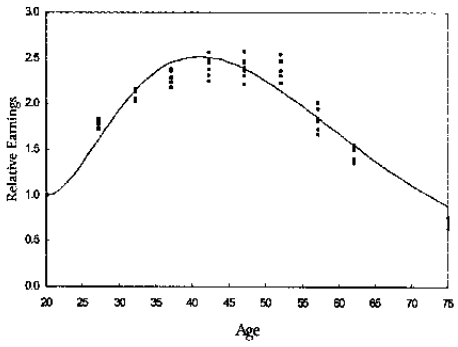
## C. Age-Earnings Profiles in Japan

14. A key component to the analysis of demographic effects is the nature of the age-earnings profile. Over the life cycle, individuals can expect a *hump-shaped* pattern to labor earnings. Initially, as agents join the workforce, they can expect a rising path of earnings, reflecting productivity gains that come from work experience and seniority wages that reward work service. Eventually, labor earnings level off and decline as agents move into retirement.

15. The profile that summarizes the life-cycle earnings path is important in determining both supply-side and demand-side implications of population aging. On the supply side, age-earnings profiles provide an indicator of the changes in relative productivity and (inelastic) labor supply that occur over an individual's working life. On the demand side, the anticipated path of labor income influences the saving plans of consumers over their lifetimes. Changes in the demographic structure of the population can thus have important macroeconomic implications for aggregate saving and labor, stemming from these life-cycle effects.

16. To calibrate the model according to the life-cycle pattern of earnings, empirical age-earnings profiles for Japan are estimated using cross-sectional data on wage-based salaries by age group for the period 1970 to 1997. The earnings data are adjusted by labor force participation rates, reflecting the fact that the share of persons with zero earnings (i.e., those who are retired) varies across age groups. The age-earnings data thus represent the average earnings per person (not per worker) within each age category. The data points are shown in Figure I.4, normalized relative to per capita labor earnings of the youngest cohort.[11]

Figure I.4
Japan--Age-Earnings Distributions, 1970-1997
(relative to youngest cohort)




Sources: *Japan Statistical Yearbook* and IMF Staff Estimates

[10] World Bank demographic statistics for Japan project an increase in life expectancy (at birth) from 81 years presently to 84 years by 2050.

[11] Data are based on contract wages by age, adjusted for labor force participation rates, as reported in the *Statistical Yearbook*; the earnings data are combined for both male and female workers for the following age categories: 15–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65+. Midpoints of each age group were used in estimating the structural time-

(continued...)

17. As shown by the data, relative earnings profiles have been stable over the sample period. This suggests that the underlying institutional and structural features that implicitly underpin the variation in relative labor earnings across age groups—such as seniority wages and retirement age—have also been fairly stable historically.[12]

18. In the analysis, the *cross-sectional* pattern between age and earnings that emerges from the data is taken as representative of the *time-series* pattern of an individual's wage earnings over the course of his or her lifetime. Moreover, this relation between age and relative earnings is assumed to reflect the changes in relative productivity and labor supply that occurs over an agent's life cycle.[13] The profile essentially summarizes the nature and timing of the rise and fall in relative earnings that agents can expect as they become mature workers and then move (gradually) into retirement.

19. To characterize an agent's life-cycle income profile, non-linear least squares (NLLS) estimation is used on the following equation:

$$ry(s,t) = a_1 e^{-\alpha_1(t-s)} + a_2 e^{-\alpha_2(t-s)} + (1 - a_1 - a_2) e^{-\alpha_3(t-s)}; \qquad (1)$$

where *ry* denotes relative labor income, $s$ and $t$ represent cohort and time indices, respectively, and their difference determines the age of a particular cohort group. The restriction on the $a_i$ terms reflects the normalization that the youngest cohort (i.e., when $s = t$) has relative income equal to unity. The fitted values of the estimated equation (1) are shown by the line in Figure I.4.[14]

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series equation relating earning to age. Ministry of Labor data on earnings—which include contract wages *and* bonus wages—would slightly raise relative earnings for the middle-age groups (age 35–54), but otherwise yields a very similar profile.

[12] Whether the historical age-earning profiles will be a reliable guide to the future, particularly in the face of dramatic demographic changes, is an open question. We return to this issue when discussing the sensitivity issues later.

[13] An issue is whether the empirical relation between age and relative earnings fully reflect differences in productivity and labor supply. The presence of seniority wages, for example, may be more a matter of prestige than productivity and may overstate the gains in productivity that accompany the rise in earnings of mature workers. On this score, however, it should be noted that the estimated earnings profile (solid line) in Figure I.4 tends to place the peak of relative earnings at an earlier age, when the productivity peak is perhaps more likely to occur.

[14] NLLS estimates yield the following results (corrected standard errors appear in parentheses): $\alpha_1 = 0.073^{**}$ (0.001); $\alpha_2 = 0.096^{**}$ (0.002) $\alpha_3 = 0.085^{**}$ (0.001)

$\overline{R}^2 = 0.92$, *D.W.* = 1.31, *S.E.E.* = 0.18;

where *(**) indicates significance at the 5 (1) percent level. The $a_i$ coefficients were obtained through grid search ($a_1 = a_2 = 200$).

20. The income-profile parameters in equation (1) enter the model in two distinct ways. On the supply side, the parameters directly affect the dynamics of aggregate labor supply—measured in efficiency units—since they reflect the relative productivity and labor supply of workers at different ages. On the demand side, since consumption is (partly) based on permanent income, these income-profile parameters also affect consumption-saving plans through their impact on human wealth—i.e., the present value of future labor income streams.[15]

21. Consumption/saving propensities do vary by age as consumers choose to smooth lifetime consumption in the face of life-cycle income. Younger agents tend to dissave or borrow if possible—i.e., if not liquidity constrained—to consume at levels commensurate with permanent income which exceeds current income.[16] Older agents tend to save for retirement when labor earnings are relatively high. Meanwhile, the elderly tend to save at lower rates (falling to zero) in retirement as they largely consume out of asset (including annuity) income and transfers.

22. On this last point, unlike traditional life-cycle models—e.g., Diamond (1965)—the elderly do *not* dissave or run down financial assets in this model due to life-time uncertainty. Instead, with retirement, agents build up wealth to some target level as a precaution against the possibility of remaining alive without labor income.[17] This behavioral feature allows the multi-cohort framework to avoid a common criticism of standard life-cycle models that posit large negative saving rates among retirees.[18] In terms of empirical evidence, the model's

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[15] The paper describing the complete theoretical model is available from the author upon request.

[16] See Jappelli (1990) for evidence suggesting that younger agents—who tend to be relatively asset and income poor—are the segment of the population most likely to face borrowing constraints. Liquidity constraints are included in the model to also reflect the fact that consumption tends to be somewhat hump-shaped over the life cycle; see Attanasio *et al.* (1995). This assumption also allows consumption to display some "excess sensitivity" to disposable income, reflecting the fact that some agents are unable to borrow and must consume out of current income; see for example Flavin (1981).

[17] See Davies (1981) and Abel (1985). Kotlikoff and Summers (1981) argue that retirement saving in traditional life-cycle models appears insufficient to explain the amount of wealth accumulation and the fact that 80 percent of wealth is inherited in the United States. But as Abel (1985) shows, a life-cycle model with precautionary saving and accidental bequests can largely address these issues. Liquidity constraints can also be shown to further augment the amount of capital accumulation in the model.

[18] Hayashi (1986) argues that positive saving among the elderly in Japan favors models with bequest motives over the life-cycle approach. Yoshiro *et al.* (1997) argues, however, that in the case of Japan the micro data tend to overstate the positive saving rates of the elderly by under-representing poorer agents who reside with younger family members.

behavioral implications appear consistent with numerous studies at the household level that find scant evidence of dissaving among the elderly.[19]

**Pension System**

23. To complete the analytical framework, social security needs to be modeled. An advantage of the multi-cohort approach is that social security transfers can be straightforwardly included. In particular, a pension system can be introduced into the framework as follows. Consider the simple case of a lump-sum transfer scheme:

$$tr(s,t) = \begin{cases} -\alpha(t); s > j(t) \\ +\beta(t); s \leq j(t) \end{cases} \tag{2}$$

where $tr(s,t)$ represent the transfers paid or received by individuals, depending on their age. Younger generations $s > j(t)$ pay into the system, while older agents or pensioners $s \leq j(t)$ receive a benefit. For any transfer scheme, a full-financing condition can be written as follows:

$$\int_{-\infty}^{t} tr(s,t)N(s,t)ds = 0\,. \tag{3}$$

This general condition must hold for the transfer scheme to be deemed fully funded (i.e., no unfunded liabilities). Otherwise, there would exist a financing gap that would need to be covered through other revenues or government borrowing. The amount of the financing gap is determined by the following relation:

$$gap\ (t) = \beta(t)\phi(t) - \big(1 - \phi(t)\big)\alpha(t)\,. \tag{4}$$

A positive gap would indicate a shortfall of financing relative to benefits. Full-financing—i.e., a zero gap—would require the well-know condition that the benefit-to-contribution must equal the support ratio, defined as the number of working-age persons relative to elderly dependents.

24. The case of payroll tax financing is straightforwardly extended. In that case, individual contributions $\alpha(s,t)$ would be age-dependent, determined by social security taxes paid on individual labor income—$\tau y(s,t)$. In what follows, a social security transfer scheme along these lines is introduced into MULTIMOD, so that *net* taxes—i.e., taxes less transfers—replace the previous treatment of government revenues; social security benefits and contributions (as ratios to GDP) are taken as exogenous policy parameters. In terms of behavior, these benefit and contribution rates mainly affect private behavior through their implications for permanent income (i.e., the present value of future income less net taxes).

[19] For a recent review of household saving, see Browning and Lusardi (1996) and the references cited therein.

### D. MULTIMOD Simulations

25. Incorporating demographic dynamics and social security into MULTIMOD, this section conducts various simulations to assess the economic impact of a rising dependency ratio and to examine certain policies intended to address the challenges of population aging.[20] To quantify the economic impact of demographic changes in Japan, a reference scenario is constructed where the population is assumed to be stationary in an initial steady state.[21] Then treating Japan's demographic projections as a shock and assuming unchanged policies, the economic effects of population decline and aging are simulated.[22]

26. Table I.1 and Figure I.5 summarize the economic effects of demographic changes in Japan.[23] With a declining and aging population, the level of real GDP is projected to fall by about 20 percent cumulatively (from baseline) in the long run.[24] The decline in GDP largely occurs between 2025 and 2075, when the demographic changes are most pronounced. In growth terms, annual GDP growth is lower by about 0.5 percent per year over this time

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[20] See Laxton *et al.* (1998) for a description of the Mark III vintage of MULTIMOD.

[21] The annex describes in detail the reference scenario as well as an alternative counterfactual scenario and its comparative implications for the results.

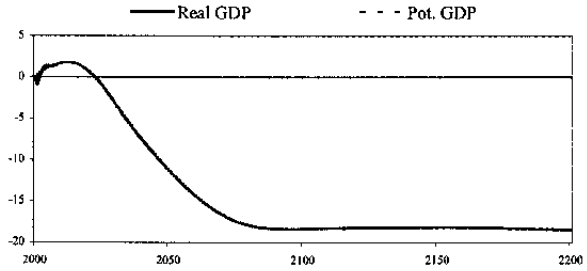
[22] The public debt path is taken as given and social security benefit and contribution ratios (to GDP) are fixed. This is done to isolate the impact of population aging on the macroeconomy through its direct implications for saving, investment and labor supply. The additional implications through the fiscal accounts and social security are taken up in Chapter II.

[23] The table shows the impact of the shock on the Japan block of the model in isolation—i.e., treating world variables as exogenous and without further feedback. Examining the effects of demographic changes on Japan's variables in a multi-country setting (with feedback effects) would yield very similar results. Adding demographic dynamics simultaneously for the other industrial countries, however, will change some of the implications of the model, particularly for external variables. These difference are noted later.

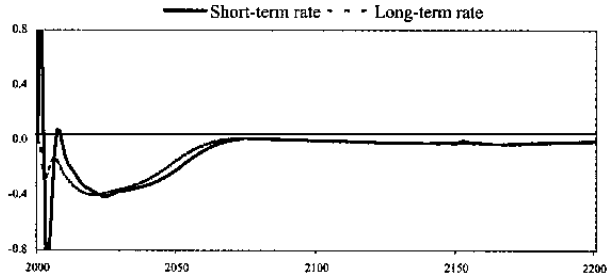
[24] Initially, output and investment rise owing to the fact that effective labor supply is growing at the outset relative to the stationary population assumed in the baseline. Significant aging (relative to baseline) also does not occur till after 2015. An increase in effective labor supply—somewhat akin to a positive shock to labor productivity—tends to reduce the interest rate and boost saving and investment. But, eventually, the decline in effective labor with population aging and contraction (similar to a negative productivity shock) lead to a rise in interest rates as saving and investment levels decline with output.

# Figure 1.5
## Japan--MULTIMOD Simulation
## Effects of Population Aging and Decline

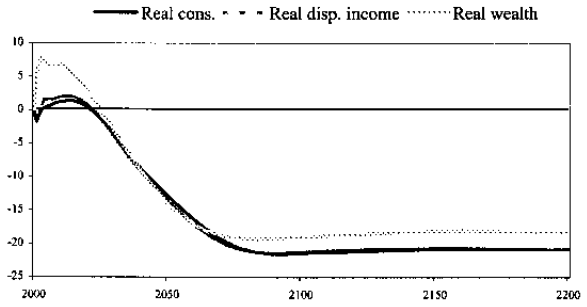
Real and Potential GDP
(deviation from baseline; percentage change)



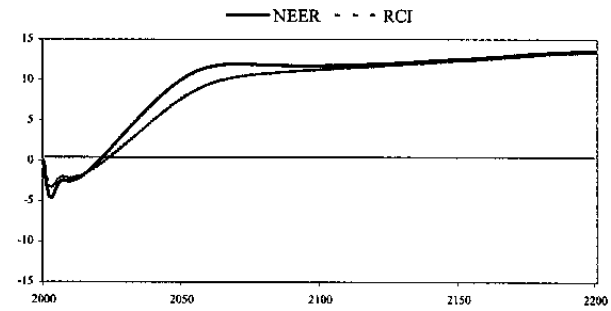

Interest Rates
(deviation from baseline; percentage points)



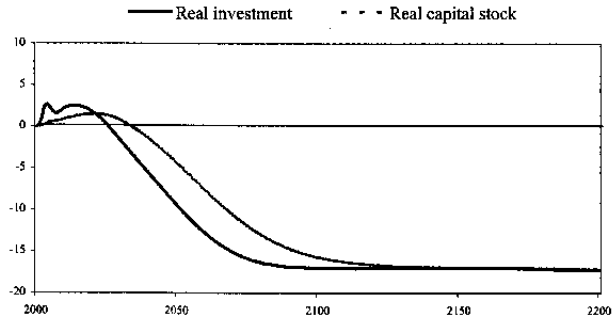

Consumption, Disposable Income and Wealth
(deviation from baseline; percentage change)



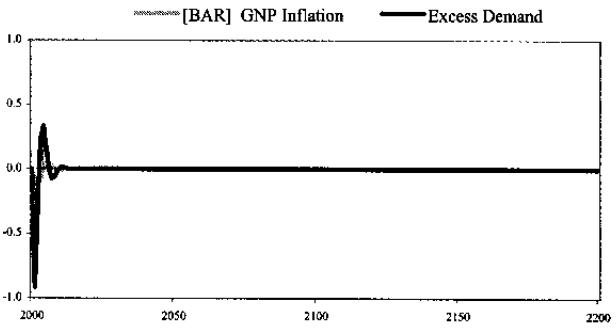

Nominal Eff. Exchange Rate and Real Comp. Index
(deviation from baseline; percentage change)



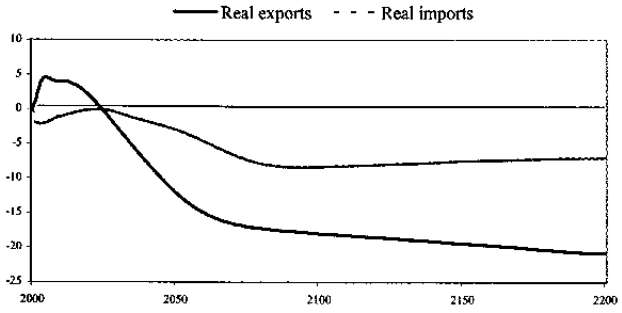

Investment and Capital Stock
(deviation from baseline; percentage change)



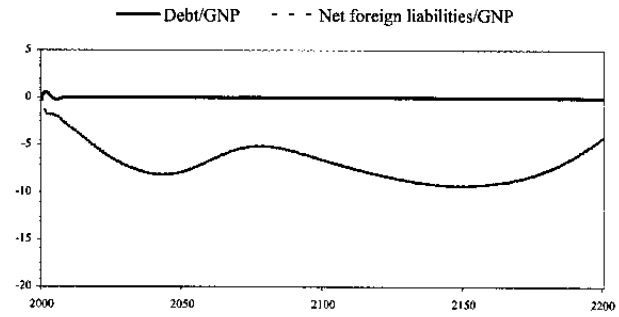

Inflation and Excess Demand
(deviation from baseline; percentage points)




Exports and Imports
(deviation from baseline; percentage change)




Debt and Foreign Liabilities
(deviation from baseline; percentage points)




Source: Staff Estimates.

period, before the economy settles to a longer-run equilibrium with a permanently higher elderly dependency ratio.[25]

Table I.1. Simulated Effects of Population Aging in Japan
(Percent deviation from baseline; unless noted otherwise)

| *Variable* | 2001 | 2005 | 2010 | 2015 | 2025 | 2050 | 2075 | 2100 |
|---|---|---|---|---|---|---|---|---|
| Real GDP | -0.7 | 1.4 | 1.6 | 1.7 | -0.9 | -11.2 | -17.4 | -18.4 |
| Interest Rates[1] | -0.2 | -0.2 | -0.3 | -0.5 | -0.4 | -0.2 | 0.0 | 0.0 |
| Contribution to GDP: | | | | | | | | |
| Consumption[2] | -1.0 | 0.3 | 0.8 | 0.9 | -0.9 | -8.8 | -13.9 | -14.7 |
| Investment[2] | 0.0 | 0.4 | 0.3 | 0.4 | 0.1 | -1.4 | -2.4 | -2.6 |
| Net Exports[2] | 0.3 | 0.7 | 0.5 | 0.4 | 0.0 | -1.0 | -1.1 | -1.1 |
| CPI Inflation[1] | 0.2 | -0.1 | -0.0 | -0.1 | -0.1 | -0.0 | 0.0 | 0.0 |
| GDP per adult | -1.0 | 0.0 | 0.0 | 0.2 | 0.0 | -1.4 | -1.2 | -1.5 |
| Real Exchange Rate | -2.4 | -2.6 | -2.0 | -1.6 | 0.8 | 7.7 | 10.5 | 11.2 |
| C/A Balance[1] | 0.2 | 0.4 | 0.4 | 0.5 | 0.5 | 0.3 | 0.2 | 0.4 |
| Private Saving Rate[1] | 0.5 | 0.6 | 0.5 | 0.6 | 0.6 | 0.5 | 0.4 | 0.5 |
| Dependency Ratio[1] | 0.0 | 0.0 | 0.1 | 0.7 | 2.0 | 5.1 | 4.0 | 2.5 |
| Population Growth[1] | 0.3 | 0.2 | 0.0 | -0.1 | -0.4 | -0.3 | -0.2 | 0.0 |

[1] Percentage point deviation from baseline; interest rates are long-term nominal rates.
[2] Deviation from baseline value in percent of baseline GDP

27. In per capita terms, GDP per adult declines slightly in the long run (relative to baseline) for the following reason. The percent decline in output is in line with the contraction of labor, measured in efficiency units. However, the percent decline in effective labor is *larger* than the fall in the number of workers, given the aging of the workforce and the differences in labor productivity and supply across age groups implicit in the age-earnings profile. Extending the simulation further out (i.e., closer to steady state) would show the decline in per capita GDP to be about 5 percent relative to baseline, as the output-labor ratio returns to its baseline level.[26]

28. Investment and saving levels (relative to baseline) also decline in the long run with GDP. The fall in investment reflects the desire to shed capital in the face of declining labor and output in the economy; the rate of investment (as a share of GDP) though is more or less

[25] With inflation targeting, the impact of aging on inflation is negligible. Under a money targeting policy rule, inflation and nominal interest rates tend to rise by about 0.5 percent during the period of slower growth. In this latter case, though, the path of nominal interest rates and nominal exchange rates would look somewhat different.

[26] With the initial decline in interest rates, the economy experiences some capital deepening (i.e., rise in the capital-labor ratio), and thus, a rise in GDP per effective unit of labor. But because aggregate productivity is exogenous and the interest rate is fixed (equal to the world rate) in the long run, the capital-labor ratio is predetermined in the long-run by the production function.

unchanged. Saving rates, however, *increase* slightly as the population ages. Despite a higher proportion of elderly who tend to save less, the decline in the inflow of young agents (who tend to have high consumption propensities) and the increase in longevity act to raise saving rates.[27] Consequently, the current account surplus increases, mainly reflecting the rise in private saving. Correspondingly, the real exchange rate would depreciate initially before appreciating in the long run with the accumulation of net foreign assets.[28]

**Policy Simulation**

29. The framework can also be used to examine the impact of various policies. In Japan, the debate over social security reforms has largely centered around the extent of benefit cuts and the methods for achieving sustainable financing. On the latter, concerns have arisen that the prospective increases in the payroll tax burden to finance future pension benefits could act as a disincentive to work.[29]

30. To examine some of the implications of pension reform, a dynamic simulation of changes in social security is considered. In particular, the effects of a permanent reduction in social security premiums and benefits are simulated. Contribution and benefits are both permanently reduced by 2 percent of GDP; the adjustment paths to this long-run reduction is kept the same for both the expenditure- and revenue-side of social security so that the direct effect on the overall fiscal balance is always zero.

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[27] An increase in longevity—i.e., a decline in the mortality rates in the model—increases agents' planning horizons and lowers their effective discount rate. Longer horizons and more patience tend to raise saving rates. See Annex II for a further discussion. Other parameters affecting consumption (e.g., liquidity constraints) could also have some bearing on the saving implications of demographics. For example, fewer liquidity constraints—i.e., more dissaving/borrowing by younger agents—would tend to magnify the increase in aggregate saving rates from population aging.

[28] In multi-country simulations, the results for Japan are broadly similar to those shown in Table I.1. With the single country simulation (i.e., small open economy assumption), the world interest rate is fixed; hence, the domestic interest rate in the long run is also fixed (equal to the world rate) by interest rate parity. In the multi-country case, however, the world interest rate is endogenous and tends to decline permanently with the world demographic shock. The reason is that world population growth is positive (for some time) with the shock; the increase in labor supply spurs saving and investment abroad and leads to a decline in the world interest rate relative to the baseline. For Japan, domestic rates still tend to rise during the adjustment phase with aging, but then converge to the lower long-run level of interest rates internationally which mitigates somewhat the fall in output in Japan.

[29] See Chapter II for a fuller discussion of social security and the menu of alternative reform options. Note also that labor supply is assumed to be inelastic (though age-varying) here and hence unresponsive to policy changes. In Chapter II, labor supply effects are also considered.

31. Table I.2 and Figure I.6 show the simulated effects of a balanced reduction in social security contribution and benefit rates in Japan. A cut in these rates initially reduces consumption and output. Consumption remains below baseline for some period as agents increase their saving rates in response to the cuts. The initial slowdown in consumption underpins a decline in interest rates and some boost to investment. The saving effect is larger,

Table I.2. Simulated Effects of Pension Reform in Japan
(Percent deviation from baseline; unless noted otherwise)

| *Variable* | 2001 | 2005 | 2010 | 2015 | 2025 | 2050 | 2075 | 2100 |
|---|---|---|---|---|---|---|---|---|
| Real GDP | -0.8 | 0.4 | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 |
| Interest Rates[1] | -0.2 | -0.3 | -0.2 | -0.1 | -0.1 | -0.1 | -0.1 | -0.0 |
| Contribution to GDP: | | | | | | | | |
| Consumption[2] | -1.1 | -0.6 | -0.5 | -0.2 | 0.3 | 1.0 | 1.5 | 1.8 |
| Investment[2] | 0.0 | 0.3 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 |
| Net Exports[2] | 0.3 | 0.7 | 0.5 | 0.3 | -0.0 | -0.7 | -1.1 | -1.4 |
| Social Security | | | | | | | | |
| Benefits/GDP[1] | -0.0 | -0.2 | -0.6 | -1.5 | -2.0 | -2.0 | -2.0 | -2.0 |
| Contributions/GDP[1] | -0.0 | -0.2 | -0.6 | -1.5 | -2.0 | -2.0 | -2.0 | -2.0 |
| C/A Balance[1] | 0.2 | 0.5 | 0.5 | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 |
| Private Saving Rate[1] | 0.4 | 0.8 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 |

[1] Percentage point deviation from baseline; interest rates are long-term nominal rates.
[2] Deviation from baseline value in percent of baseline GDP

however, and the current account ratio rises. Over the longer run, higher output and consumption levels are attained with the build-up of capital and net foreign assets.[30]

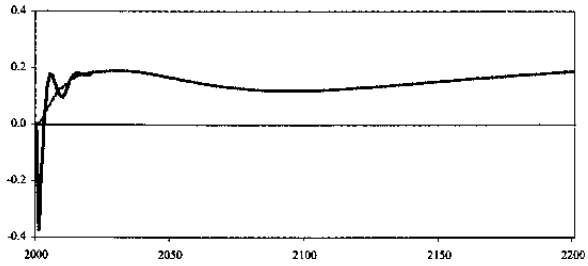
32. The increase in saving rates can be understood as follows. The reform redistributes disposable income from pensioners who receive less transfer income to workers who face lower payroll taxes. This latter group generally have higher marginal saving propensities. In addition to this distributional aspect, saving across all age groups would generally rise as individuals, faced with less generous pension benefits now or in the future, need to save more for their own retirement and future consumption. Quantitatively, the simulations suggest that private saving increases by 0.8 percent of GDP, or nearly half the amount of the reduction in benefits (2 percent of GDP).[31]

[30] Multi-country simulations of this shock yield very similar findings. Note that the simulation in Table I.2 ignores possible labor supply gains surrounding a cut in payroll taxes. This case is taken up in Chapter II.

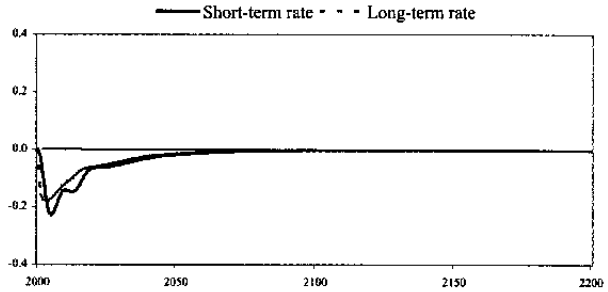
[31] The saving effects shown are close to those implied by cross-country estimates reported in Feldstein (1980).

# Figure I.6
## Japan--MULTIMOD Simulation
## Effects of Pension Reform

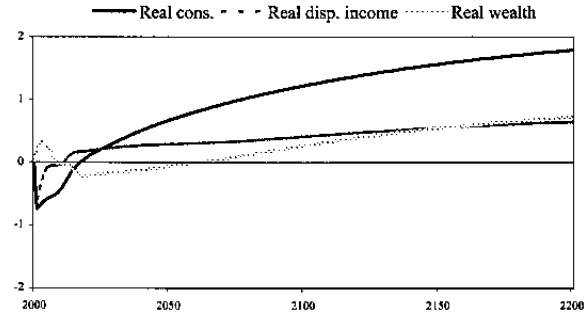
Real and Potential GDP
(deviation from baseline; percentage change)



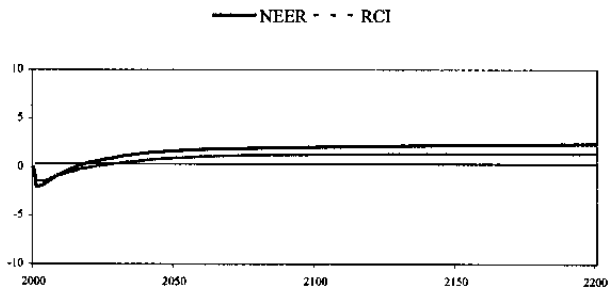

Interest Rates
(deviation from baseline; percentage points)



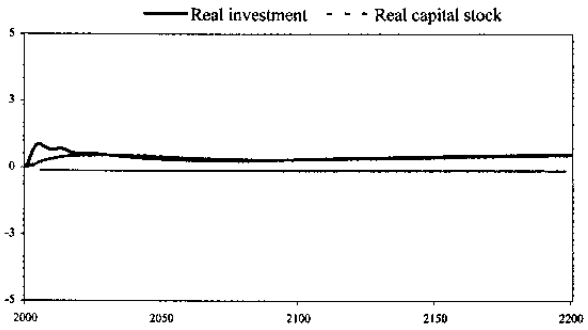

Consumption, Disposable Income and Wealth
(deviation from baseline; percentage change)



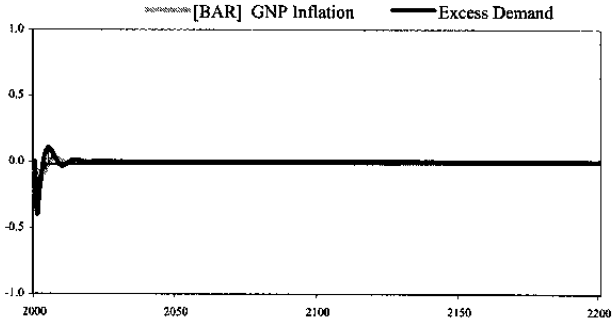

Nominal Eff. Exchange Rate and Real Comp. Index
(deviation from baseline; percentage change)



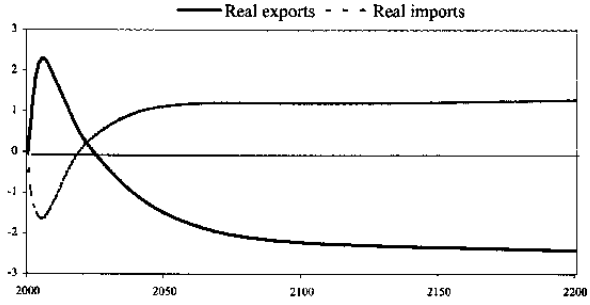

Investment and Capital Stock
(deviation from baseline; percentage change)



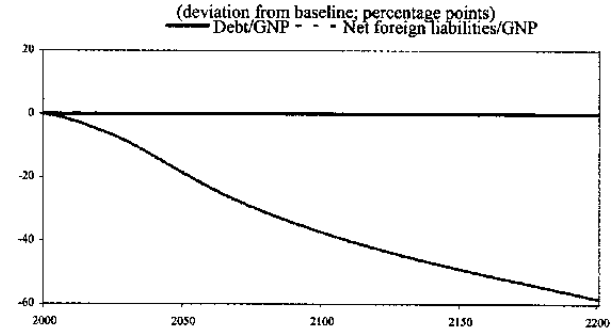

Inflation and Excess Demand
(deviation from baseline; percentage points)




Exports and Imports
(deviation from baseline; percentage change)




Debt and Foreign Liabilities
(deviation from baseline; percentage points)




Source: Staff Estimates

**Sensitivity Issues**

33. Throughout the analysis, it has been assumed that the age-earnings profile remains stable in the face of demographic changes. Whether the stable historical relationship between age and relative earnings will prevail in the future, however, is an open question. With healthier seniors living longer and pension benefits possibly declining, older workers may decide to postpone retirement. A higher retirement age and similar considerations would tend to "flatten" the age-earnings profile and, hence, mitigate that economic impact of population aging.[32] Intuitively, since the income profile largely determines age-specific characteristics in the analysis, a flatter profile suggests smaller differences across age groups and, thus, smaller economic implications from a changing age distribution.

34. A countervailing effect, however, is the possibility that the extent of population aging and contraction may be understated. The demographic projections—taken as exogenous—are largely based on World Bank projections; these projections impose a stationary population by construction by 2150. However, in the case of Japan, the downward momentum in birth rates and population growth rates would require a significant stabilization and recovery for a stationary population to obtain within this time frame (see Figure I.1).

35. Another issue is total factor productivity growth (TFP) which is taken as exogenous. Some have argued that the transition to a smaller, older workforce in Japan will require adoption of labor-saving technologies and human capital-intensive production.[33] These production technologies may stand to benefit more from dynamic efficiency gains associated with technological change and improvement. Thus, the possible structural shift in the economy may entail a rise in the overall rate of technological progress in the economy, allowing output and living standards to rise at higher rates than otherwise.

## E. Conclusions

36. Demographic changes will be a defining feature in Japan for the foreseeable future. A sustained decline in fertility rates underlies a rapid aging and decline of Japan's population that can be expected to continue well into the new century. This dramatic demographic shift will likely have profound social and economic implications. Using a multi-cohort modeling approach and the information in empirical age-earnings profiles, this analysis has sought to

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[32] With a rapidly aging workforce, firms may find it more difficult to reward workers with seniority wages which could affect the relative earnings profile. But in a sense, this is consistent with the notion that seniority wages may not necessarily reflect higher productivity of older workers. Hence, the empirical age-earnings profile may already *understate* the decline in relative productivity of workers at advanced stages of their earnings cycle, and thus, may understate the labor supply effects of an aging workforce.

[33] See Kosai *et al.* (1998).

quantify some of the macroeconomic implications of demographic changes in Japan. The results of the dynamic simulations can be summarized as follows.

- Population aging and decline in Japan will likely result in slower growth in output for some time. Absent any significant acceleration in total factor productivity, annual output growth in Japan would be lower by about one-half percent over the next half century or so as the workforce contracts. In per capita terms, GDP per person could also decline (relative to the case of no demographic changes) since the significant contraction of the population and workforce suggests an even larger decline in effective labor supply, given the rising share of elderly.

- Saving rates and the current account ratio need not decline significantly with an aging population. Though a higher share of elderly would tend to reduce saving rates, other aspects of demographic changes in Japan, such as fewer young adults (and youth dependents) and increased longevity, would tend to counterbalance the negative effects of population aging on saving rates.

- In terms of policy implications, the analysis highlights the importance of taking into account prospective changes in the macroeconomic environment when evaluating policies that address the challenges posed by population aging. Moreover, the potential impact of social security reforms on private sector behavior should also be incorporated. On this last point, the simulations show that reforms to social security benefits could have large effects on private saving. In particular, the model suggests that a balanced decline in benefit and contribution rates would boost private saving rates by nearly half of the reduction in benefit rates, as agents anticipate having to finance more of their own consumption in retirement.

## ANALYTICAL FRAMEWORK

1. In this section, some key components of the analytical framework are described, beginning with population dynamics.[1] For the overall (adult) population, the basic law of motion is given by:

$$\frac{\dot{N}(t)}{N(t)} = n(t) = b(t) - p(t), \tag{A1}$$

where $N$ is the population level and $n$ is the growth rate, $b$ the "birth" rate—defined as the arrival rate of new adults—and $p$ is the mortality or death rate; [2] a dot over a variable denotes the derivative with respect to time. Integrating equation (A1) over time yields an expression (up to a constant of integration) for the size of the total population at any moment in time:

$$N(t) = e^{\int_{-\infty}^{t} n(v)dv} = e^{\int_{-\infty}^{t} [b(v) - p(v)]dv}. \tag{A2}$$

Equation (A2) shows that population size evolves according to the accumulation of past changes to its growth rate (i.e., the difference between past birth and death rates), which determines the size of the current population as a growth factor times the size of the initial population.[3]

### Dependency Ratio

2. To examine various demographic issues—e.g., population aging—it is useful to define a measure that characterizes the age distribution of the population. By summing up all cohorts above a certain age, an elderly *dependency ratio* can be defined as a proportion of the total population as follows:

$$\phi(t) = \int_{-\infty}^{j(t)} \frac{N(s,t)}{N(t)} ds \;;\; 0 < \phi < 1, \tag{A3}$$

---

[1] The paper describing the complete theoretical model is available from the author upon request.

[2] See Buiter (1988) for the case of constant population growth with fixed birth and death rates. In that case, the number of agents belonging to a generation $s$ at time $s$ (i.e., at the time they are born), as a proportion of the contemporaneous population, is given by $N(s,s) = bN(s)$; the number of survivors from that cohort at time $t \geq s$ is then given by $N(s,t) = bN(s)e^{-p(t-s)}$, where $p$ is the common death rate facing all agents.

[3] Note that the size of the population, which until now has been defined in *relative* terms—vis-à-vis a reference population, can also be defined in *aggregative* terms—as the sum of all existing individuals across all generations (indexed by $s$): $N(t) = \int_{-\infty}^{t} N(s,t)ds$.

where $\phi$ measures the proportion of all individuals older than some threshold age—indexed by $j(t)$. Assuming that this age definition does not change, the index $j(t)$ moves with time to include new dependents, who have just reached the threshold age at each moment in time (i.e., $j'(t) = 1$). In the case where birth rates are constant, it can be shown that the dependency ratio $\phi$ would also be constant.[4] Otherwise, the dependency ratio evolves over time according to the time derivative of equation (A3):

$$\dot{\phi}(t) = \frac{N(j(t),t)}{N(t)} - [p(t) + n(t)]\phi(t). \qquad \text{(A4)}$$

3. At each moment in time, the change in the dependency ratio is determined by the relative size of new dependents, less the proportion of the elderly $p\phi$ who die each period and accounting for growth in the population base $n\phi$—i.e., the scaling variable. Using equation (A4) and the paths for Japan's birth rate and population growth rate shown in Figure I.2, the model can be used to project the evolution of the dependency ratio as shown in Figure I.3 in the text.[5]

[4] With steady population growth, the dependency ratio would settle down to its long-run value: $\bar{\phi} = e^{-\bar{b}\Delta}$, where $\Delta \equiv t - j(t)$ and $\bar{b}$ are constants.

[5] Note that the empirical death rate $p$ is determined implicitly by the difference between $b$ and $n$. Because the model assumes a common death rate independent of age, the model tends to *overpredict* the share of elderly in the population. To compensate, a uniform adjustment factor of +0.5% was added to the birth rate series shown in Figure I.1; this size of this increase in the inflow of young adults broadly offsets the distributional implications of a common death rate across cohorts. To match the population growth rate, $p$ also reflects this uniform adjustment.

## REFERENCE SCENARIOS

1. To calibrate the magnitude of demographic changes and their effects, one can construct for comparison purposes counterfactual scenarios wherein certain demographic variables remain unchanged. Using this reference scenario as an artificial baseline, one could then simulate the economic impact of Japan's demographic projections, as determined by the behavioral features of the model and given *unchanged* policies.[1] These simulation results are helpful in projecting—in model-consistent fashion—the future paths of key macroeconomic variables (e.g., interest and growth rates) under population aging when considering issues such as pension reforms.[2]

2. The counterfactual exercise is described here in the appendix and is done in two different ways. In the first simulation, a stationary population is used as the reference scenario to help identify the effects of both population contraction and aging; in the second simulation, the effects of population aging alone are isolated. Japan's demographic dynamics contain components of both phenomena.

### Population Contraction and Aging

3. To examine the effects of a declining and aging population and work force implied by Japan's demographic projections, a counterfactual scenario is constructed where the birth and death rates are chosen so that the rise in the dependency ratio is curtailed somewhat and the population does not contract. Specifically, in the initial steady state, it is assumed the population is *stationary* with the birth rate constant at its 2000 level onward; the death rate is also set equal to this value (i.e., $b - p = n = 0$).

4. Figure I.A1 shows the evolution for the Japan's birth rate and population growth rate under the counterfactual baseline scenario as well as under the alternative scenario of population aging. Figure I.A2 shows the evolution of the elderly

Figure I.A1
Japan--Birth Rate and Population Growth Rate, 1990-2150
(percent of adult population)

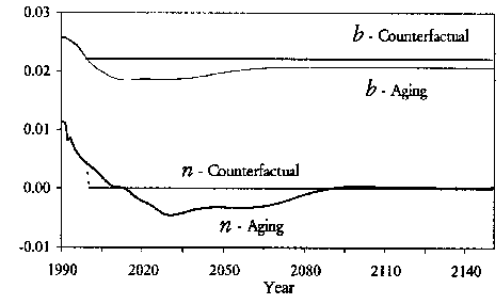
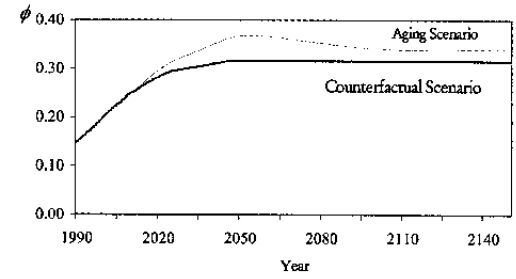



Figure I.A2
Japan--Elderly Dependency Ratio, 1990-2150
(percent of adult population)




[1] The basic simulations are conducted in a model *without* pensions to isolate the economic effects of population aging alone. A pension transfer scheme is later introduced when examining policy shocks.

[2] See Chapter II by M. Mühleisen.

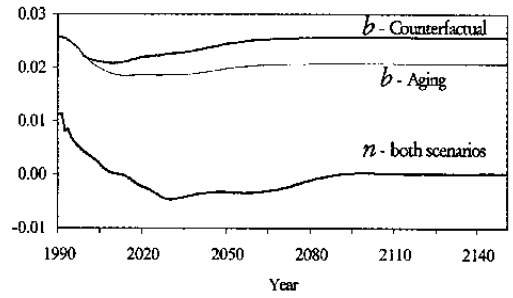
dependency ratio under both scenarios. Note that since the fertility rate has already declined (as part of history), some aging will also occur under the baseline scenario since the full effects on the dependency rate come only with a lag—i.e., the present dependency ratio is still below its long-run level even if the population is stationary from this point forward.

5. Comparing the two scenarios, one sees that the demographic shock underlying the aging scenario involves a continued decline in the birth rate. Population growth is initially positive and higher under the aging scenario before declining and turning negative below the zero growth rate maintained throughout the baseline scenario. This suggests that the mortality rate is also lower initially (i.e., greater longevity) under the population aging scenario than in the case of a stationary population. The fact that population growth eventually goes to zero in the aging scenario at a lower long-run birth rate further requires that the long-run death rate also remain lower than in the baseline.

**Population Aging**

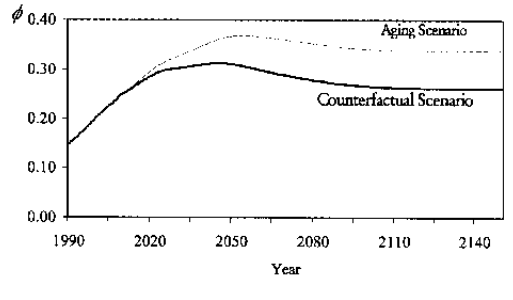
6. To better isolate the impact of a changing age distribution, a second counterfactual or baseline scenario can be constructed where the population growth rate is *identical* to the aging scenario, but where the rise in the dependency ratio is muted. This is done by assuming a higher birth rate in the second reference scenario than in the aging case; correspondingly, the death rate is sufficiently raised so that the same population growth rate obtains. The paths for the $b$ and $n$ in these two scenarios are shown in Figures I.A3 and I.A4.

Figure I.A3
Japan--Birth Rate and Population Growth Rate, 1990-2150
(percent of adult population)




7. Comparing these figures to those associated with the previous counterfactual scenario, one sees that the *aggregative* implications of a decline in the birth rate are removed in the second experiment, but the *distributional* implications are accentuated. In other words, the rise in the dependency ratio in the aging scenario is relatively much larger against the second counterfactual scenario than the first (Figure I.A4 vs. Figure I.A2), but the growth differences are completely negated (Figure I.A3).

Figure I.A4
Japan--Elderly Dependency Ratio, 1990-2150
(percent of adult population)




8. The comparative effects of both counterfactual scenarios versus the aging scenario is summarized below in Table I.A1. The top half of the table shows the effects attributable to both population aging and decline relative to baseline; the bottom half of the table shows the

effects due solely to aging. The results indicate that almost half of the long-run fall in GDP is due to an aging workforce and not just a shrinking workforce.

9. In terms of saving behavior, because mortality falls (i.e., longevity rises) to a greater extent (see Figure I.A3) in the second simulation—i.e., the second reference scenario versus the aging scenario—private saving will rise more in this case. As the death rate $p$ falls, the planning horizon lengthens and the effective discount rate declines. Longer horizons and more patience on the part of agents tend to raise their saving propensities. In the simulations, this can be seen by the larger initial fall in consumption and improvement in net exports in the bottom half of the table. In the long-run, though, consumption falls by less because national income (and output) are higher as net foreign assets are accumulated.

Table I.A1. Comparative Effects of Demographic Changes in Japan
(percentage point deviation from baseline; unless noted otherwise)

| *Variable* | 2005 | 2010 | 2015 | 2025 | 2050 | 2075 | 2100 |
|---|---|---|---|---|---|---|---|
| | | | **Population Aging and Contraction** | | | | |
| Real GDP | 1.4 | 1.6 | 1.7 | -0.9 | -11.2 | -17.4 | -18.4 |
| Contribution to GDP: | | | | | | | |
| Consumption[2] | 0.3 | 0.8 | 0.9 | -0.9 | -8.8 | -13.9 | -14.7 |
| Investment[2] | 0.4 | 0.3 | 0.4 | 0.1 | -1.4 | -2.4 | -2.6 |
| Net Exports[2] | 0.7 | 0.5 | 0.4 | 0.0 | -1.0 | -1.1 | -1.1 |
| Dependency Ratio[1] | 0.0 | 0.1 | 0.7 | 2.0 | 5.1 | 4.0 | 2.5 |
| Population Growth[1] | 0.2 | 0.0 | -0.1 | -0.4 | -0.3 | -0.2 | 0.0 |
| | | | **Population Aging** | | | | |
| Real GDP | 2.7 | 1.4 | 1.5 | -0.6 | -6.0 | -7.9 | -8.1 |
| Contribution to GDP: | | | | | | | |
| Consumption[2] | -4.2 | -4.2 | -3.7 | -3.7 | -4.2 | -3.3 | -2.0 |
| Investment[2] | 1.2 | 0.6 | 0.8 | 0.5 | -0.3 | -0.6 | -0.6 |
| Net Exports[2] | 5.6 | 5.0 | 4.4 | 2.6 | -1.6 | -4.0 | -5.5 |
| Dependency Ratio[1] | 0.0 | 0.1 | 0.5 | 1.5 | 5.6 | 7.3 | 7.6 |
| Population Growth[1] | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

[1] Percentage point deviation from baseline.
[2] Deviation from baseline level in percent of baseline GDP.

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# II. Sustainable Fiscal Policies for an Aging Population

by Martin Mühleisen

## A. Introduction

1. Population aging is a common phenomenon in the industrialized world. Birth rates have been declining as prosperity has increased, and with the baby boom generation about to enter retirement, public pension schemes have come under pressure to raise contribution levels or cut the size of benefits. Japan will be particularly affected by this process. Its population is enjoying the highest longevity worldwide, and the share of elderly people relative to the working population is already among the highest. By contrast, fertility rates are among the lowest in the world, implying that the age distribution of the population will shift rapidly in the coming decades.[1] By 2025, one elderly person will fall on roughly two persons of working age, which will leave Japan with a significantly higher old-age dependency ratio than any other country in the industrialized world (Table II.1).

2. As this demographic shock unfolds, Japan is facing substantially greater fiscal challenges than other countries. While most industrialized nations have been successful in reducing government deficits during the past decade, Japan's fiscal situation has deteriorated dramatically following the government's efforts to resuscitate the economy. The immediate task will be to return the government deficit to a sustainable level, which will be complicated by rising social security benefit payments and by the need to avoid an abrupt shift in the fiscal stance that could jeopardize the recovery. Even after the overall fiscal situation has stabilized, however, the government still faces the long-term task of preserving the solvency of the social security system.

3. This chapter deals with fiscal policy measures that could be taken to restore fiscal sustainability and help achieve a smooth demographic transition. Based on the general equilibrium approach of MULTIMOD, the Fund's global economic model used in Chapter I, a detailed simulation of the Japanese fiscal accounts is used to address two key issues:

- First, the degree of fiscal adjustment needed to stabilize public debt over the medium term, and the output costs of alternative fiscal strategies to achieve that target.

- Second, the long-term implications of demographic developments on public finances under the present policy framework, and responses that would safeguard the viability of the social security system while mitigating the impact on economic growth.

4. In the remainder of the introduction, a brief review of the literature motivates the approach chosen for this study. The second section goes over the salient features of the Japanese social security system. The third presents a long-term baseline simulation for Japan's fiscal accounts, and the fourth analyzes welfare gains that could be realized by strengthening fiscal policies relative to the baseline scenario. The last section concludes.

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[1] See Takayama (1998) for an overview of demographic trends in Japan.

| Table II.1. Old-Age Dependency Ratios[1] | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Canada | France | Germany | Italy | U.K. | U.S. | Japan |
| 2000 | 20 | 28 | 25 | 28 | 27 | 21 | 27 |
| 2025 | 36 | 41 | 36 | 43 | 36 | 33 | 47 |

Source: United Nations, *World Population Prospects 1950–2050*, 1996 revision.

[1] Number of elderly (65 years and older) as percent of working age population (20–64 years of age).

## The Literature

5. There is a broad consensus in the literature that population aging in industrialized countries will reduce output growth and limit increases in economic welfare (see Kohl and O'Brien 1998, OECD 1998a for a survey). A shrinking population will be associated with lower levels of employment and thus output, although the impact on per-capita incomes could be mitigated by rising capital-labor ratios, productivity increases, and higher labor participation rates. However, to the extent that savings behavior is governed by life-cycle motives—that is, individuals save for retirement during their working life and dissave during retirement—most models predict saving rates would decline as the share of the elderly population increases (e.g., Meredith 1995). The ability of the government to stem this decline through higher public saving will be limited, owing to the increasing demand for higher spending on social services on the elderly.

6. The conclusion reached by most papers is that, in order to maintain fiscal sustainability and preserve intergenerational equity, net public pension benefits would need to be substantially cut (Chand and Jaeger 1996, OECD 1998a,b). Yashiro *et al.* (1997) also point out the need for substantial labor market reforms in order to achieve higher participation rates among married women, and reduce seniority wages that tend to act as a disincentive to hiring middle-aged and elderly workers.

7. However, in focussing largely on the broad macroeconomic picture, this strand of the literature has generally provided scant help in choosing between different reform options. In general equilibrium models, the fiscal sector is usually treated on a fairly aggregated basis, and demographic effects have largely been captured through a simple dependency ratio (e.g., Masson and Tryon 1990, Yashiro and Oishi 1997). As a result, these models tend to lack the level of detail needed to analyze the pros and cons of structural pension reform measures.[2]

8. By contrast, a more pragmatic strand of the literature has focussed on the implications of demographics for fiscal and pension policies, while largely neglecting the feedback between tax and spending policies and macroeconomic variables. A number of papers have projected government accounts on the basis of fixed assumptions for future output growth and interest rates. This has proved useful in illustrating the dimension of fiscal adjustments

[2] Exceptions are macroeconomic models used by Aaron *et al.* (1989) for the United States, and Yashiro *et al.* (1997) for Japan—based on the 1994 pension reform—which have embedded in them explicit models for the finances of the social security system.

needed, but the results have suffered from the drawback that different policy measures may affect saving and investment incentives, labor supply decisions, and relative prices in quite different ways. For example, the question of whether to finance social security transfers through direct or indirect taxes could hardly be answered in such a framework. With that caveat, the results of a number of studies are summarized below. Although not necessarily comparable, they shed light on Japan's fiscal challenge from different angles:

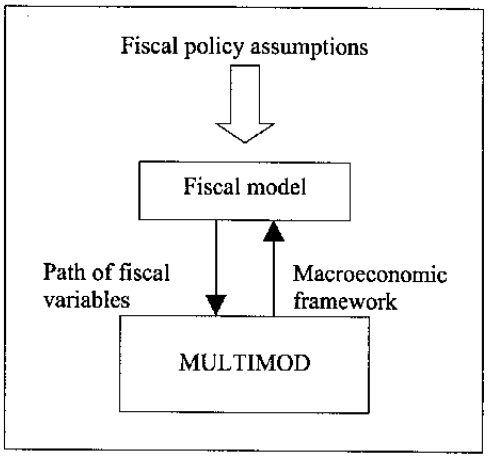
- The Ministry of Health and Welfare (MHW) regularly updates actuarial calculations to estimate the degree to which **pension contributions** would need to be raised to maintain solvency of the main components of the public pension scheme (see Takayama 1998). The latest results—taking account of the recent pension reform—indicate that contribution rates to the main public pension system will still need to increase by about 50 percent to maintain financial viability (see below).

- Chand and Jaeger (1996) estimated the size of **pension liabilities** for major industrial countries through 2050, based on World Bank demographic projections (Bos *et al.* 1994), albeit with a somewhat simplified social security model. As of 1995, the present value of Japan's net pension liabilities (through 2050) was estimated around 110 percent of GDP, roughly at par with Germany and France. This result is within the range of Leibfritz *et al.* (1995) and Roseveare *et al.* (1996), who estimated the value of net pension liabilities for Japan between 50-200 percent of GDP, depending on different productivity and interest rate assumptions.

- A number of papers have followed in the tradition of Auerbach and Kotlikoff (1987) by applying generational accounting models to analyze the distributional consequences of fiscal policies. Takayama *et al.* (1998) and Takayama and Kitamura (1999) have identified **large generational imbalances** in Japan, with future generations expected to pay about 3-4 times more net taxes and social security contributions than the generation currently in retirement. Similar conclusions have been drawn by Hviding and Mérette (1998).

**Approach of this Paper**

9. In this paper, both strands of the existing literature are effectively combined. Policy assumptions affecting general government and social security finances are first fed into a small fiscal model which—under given macroeconomic assumptions—provides a long-term projection of fiscal accounts.[3] The results of the fiscal model are then fed into MULTIMOD, which produces revised macroeconomic assumptions, and the process is repeated until a reasonable degree of convergence is achieved. This approach is used to generate a




[3] The fiscal model improves upon an earlier long-term simulation by Fund staff (Okamura 1998), e.g., by using a more disaggregated model for the social security finances (see below).

*baseline* model, which illustrates the likely fiscal and macroeconomic consequences of current government policies. Once a baseline scenario has been established, MULTIMOD is used to analyze the effects of *alternative fiscal policies* relative to those assumed in the baseline simulation.

10. For the purpose of this paper, the standard MULTIMOD framework was modified in two key points (see Chapter I by H. Faruqee for a fuller explanation).[4] First, the saving and consumption equations of the Japan model were disaggregated for different age cohorts, using age-earnings profiles from official survey data. This prepared the ground for a more realistic simulation of the saving behavior of an aging population, compared to earlier studies that worked largely through the age-dependency ratio. Second, with retirement income a key factor in life-cycle models, behavioral equations for private agents have been updated to include social security parameters, which permits modeling the effects of social security policies on the real economy. For computational purposes, the MULTIMOD framework also needed to be reduced to four major country blocks—Japan, the U.S., other industrial countries, and emerging and developing countries—which nevertheless still allowed for the simulation of capital flows generated by a shift in the distribution of saving and investment as a result of global aging.

11. There are however two kinds of limitations to the approach of this paper:

- From a conceptual point of view, the analysis focuses largely on the public finance sustainability angle of the aging problem, and does not explicitly search for an optimal intertemporal solution that distributes the financial burden in an equitable way across generations. Moreover, the role of private pension arrangements (e.g., corporate pension schemes and 401(k)-type pension plans) is not explicitly covered by this paper.

- On a technical note, the link between MULTIMOD and the fiscal model is not seamless. MULTIMOD has been developed primarily for analyzing the effects of macroeconomic shocks in a forward-looking/rational expectations framework, and does not lend itself easily to simulating actual levels of economic variables. Moreover, it is already a rather complex framework and adding a fully specified fiscal sector would have made the simulation unwieldy. Therefore, some macro parameters in the fiscal model were simulated independently, although projections for key variables, such as growth and saving, were obtained directly from MULTIMOD.

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[4] MULTIMOD is a macroeconomic general-equilibrium model that can be used to simulate economic developments in a global setting, including issues related to exchange rates, fiscal and monetary policies, and demographic developments. Given a set of policy assumptions, the model is constructed to search first for a long-term steady-state solution, and then produce a dynamic adjustment process that leads into the steady state. To arrive at a time consistent solution, the model includes forward-looking agents, whose consumption and investment decisions depend on the steady-state outcome (see Laxton *et al.* (1998) for a description and, e.g., Faruqee *et al.* (1997) for an application of the model).

## B. Social Security and Government Finances

### The Social Security System

12. Japan's social security system is a multi-tier system that covers public pensions, health insurance, and unemployment insurance (Figure II.1).[5] First-tier schemes (the National Pension and National Health schemes) provide pension and health coverage on an equal basis for all residents. The second tier consists of occupational schemes—separate for private employees and public servants—that provide earnings-related pensions and expand somewhat on basic health benefits. There are also possibilities to take out higher insurance through supplementary (third-tier) schemes that are privately financed and managed (but benefit from a number of tax exemptions), and are typically offered by larger employers.

#### *Pensions*

13. The National Pension scheme provides a flat-rate "basic" pension for all residents of age 65 and older, independent of past labor force status.[6] Additional earnings-related pensions are provided from age 60 by the Employees' Pension Insurance (EPI) for the bulk of private-sector employees, and by Mutual Aid Associations (MAAs) for public-sector workers. Benefits drawn under these schemes depend primarily on past monthly wages and the duration over which contributions were paid. Benefit increases are presently linked to the disposable income of active workers, with adjustments in the pension formula taking place every five years. During interim years, pensioners only receive cost-of-living adjustments. Contrary to most other industrial countries, pension benefits are virtually untaxed. The maximum replacement ratio for workers covered by earnings-related schemes is around 80 percent of net wages (Takayama 1998), which is high by international standards, although the average net replacement ratio for the elderly population as a whole is only around 53 percent (Yashiro *et al.* 1997). Compared to some of the larger European welfare states, pension expenditure in Japan is indeed still fairly low, reflecting limited coverage of the earnings-related pension scheme and the comparatively low level of basic pension benefits (Table II.2).

Table II.2. Public Pension Expenditure, 1995
(In percent of GDP)

| Canada | France | Germany | Italy | U.K. | U.S. | Japan[1] |
|---|---|---|---|---|---|---|
| 5.2 | 10.6 | 11.1 | 13.3 | 4.5 | 4.1 | 7.3 |

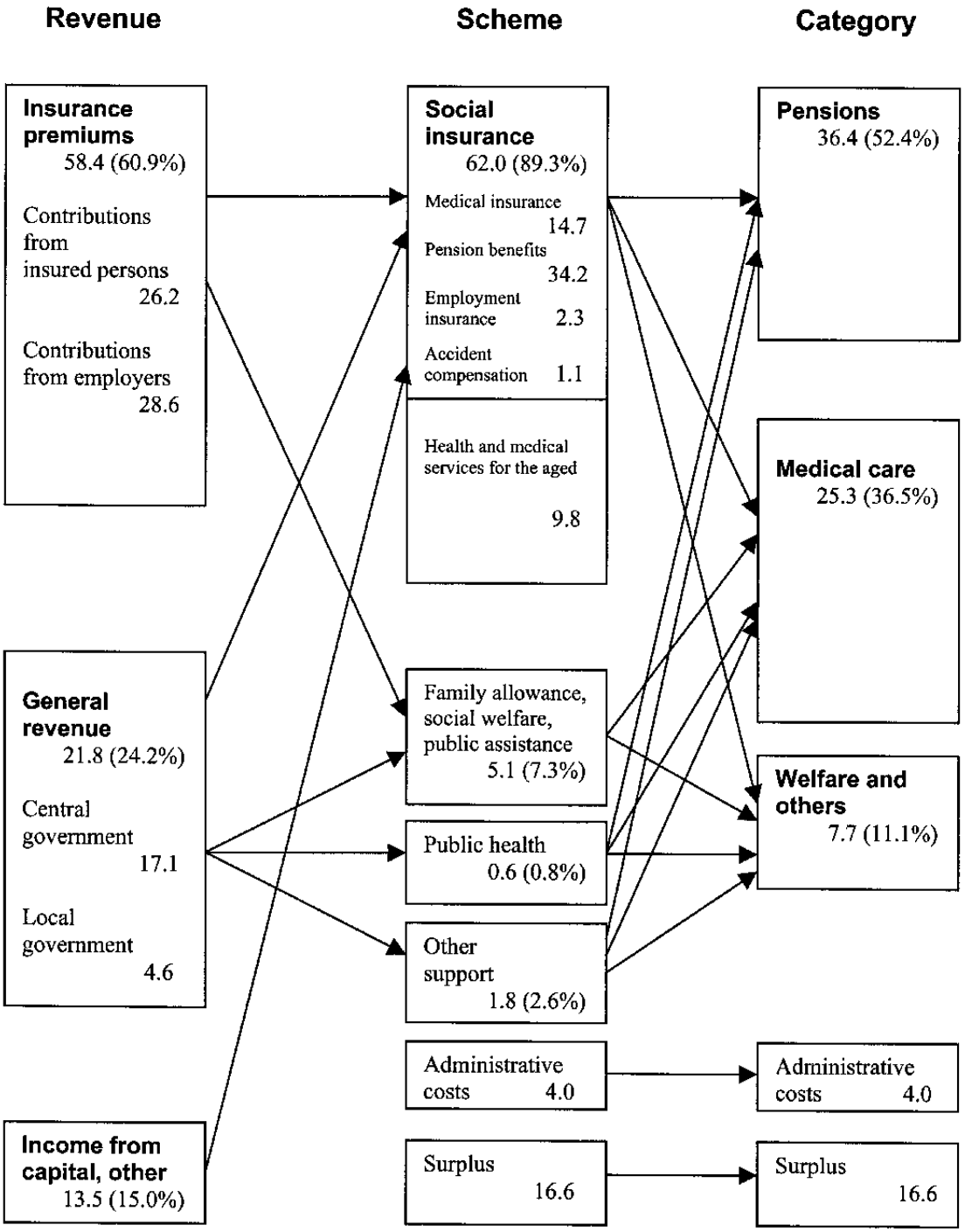
Source: OECD (1997).
[1] FY 1998.

[5] A small public welfare system is considered part of the general government sector, and thus not included in the social security accounts.

[6] The full monthly pension was ¥67,017 (US$ 600) in 1999. A reduced pension can be drawn starting from age 60.

Figure II.1. Japan: Social Security and Welfare Expenditure by Revenue, Scheme and Category, FY1997

(In trillions of yen)




Source: Ministry of Health and Welfare.

14. Pensions are financed from three sources, the largest of which are pension contributions. Persons not covered by any occupational schemes (the jobless, self-employed, farmers, students, and their spouses) are required to pay a flat-rate contribution of ¥13,300 per month to the National Pension scheme. Participants in earnings-related schemes pay a fixed share of monthly basic wages in contributions, which is matched by employer contributions.[7] To finance basic pension benefits for members of occupational pension systems, the National Pension Insurance receives financial transfers from the EPI and MAAs in proportion to the number of beneficiaries that are covered by these schemes.

15. The other two financial sources consist of government transfers, which are currently set at one third of basic pension payments, and returns on public pension assets. Owing to large surpluses in the past, assets held by pension schemes have accumulated to about 50 percent of GDP—about 6 years worth of pension benefit payments, which is unparalleled among industrial countries (for comparison, public pension assets of the U.S. account for about 10 percent of GDP). These assets are largely invested through the Fiscal Investment and Loan Program (FILP), which provides loans to central and local governments, government financial institutions and public agencies (largely for the purpose of infrastructure investment), and holds large amounts of government securities. Owing to the nature of such investments, returns on pension assets have been comparatively low, dropping to below 4 percent in FY1998 from around 6–7 percent in the 1980s.

16. The authorities have taken steps to improve the solvency of the social security system. The recent pension reform bill (approved by the Diet in March 2000) contained provisions to cut lifetime pension benefits by around 20 percent for future retirees, particularly through a reduction in benefit levels by five percent for future retirees, a gradual increase in the age of eligibility for earnings-related pension payments to 65, beginning in 2013, and fully indexing EPI pension increases to the consumer price index instead of disposable income. At the same time, government transfers to the basic pension scheme are to be raised from one third to one half of basic pension benefits from 2004. Nevertheless, according to MHW calculations, the EPI contribution rate would still have to rise to 25 percent of monthly basic wages by 2025 (from the current level of 17¼ percent) to maintain solvency.[8] Even with such an increase, EPI reserves would shrink to around 3½ years worth of benefit payments.

***Health insurance***

17. Health insurance coverage in Japan is universal, based on an organizational structure that is similar to the pension system. The National Health Insurance (NHI) scheme provides basic benefits for all residents, and there are numerous occupational schemes (including the

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[7] The EPI contribution rate is currently 17.35 percent of monthly basic wages, shared equally by employer and employee.

[8] Under the pension reform, the wage base for pension contributions is to be broadened to include bonus payments (which account for an average 20 percent of total worker compensation), but the contribution rate will be reduced to keep the change revenue-neutral.

Employee's Health Insurance, health insurance schemes run by the MAAs for public employees, and company-managed schemes mainly for employees of larger companies). Elderly persons (from the age of 70) are covered separately by an old-age insurance system.

18. Unlike the pension insurance, first- and second-tier health benefits are very similar. Japan has adopted a fee-for-service system, with most of the medical services provided by private hospitals and clinics. Access to providers does not depend on the type of insurance coverage, and insurance schemes differ only slightly with respect to required co-payments. Members of occupational schemes are typically reimbursed for 80 percent of medical expenses, while NHI members receive only 70 percent. Medical care for the elderly is almost fully covered, requiring only very small co-payments. Costs for medical services are regulated by a medical fee schedule (which is revised every two years), and drug prices are also standardized, with drug expenses being reimbursed in line with other medical expenses.

19. Compared to other major industrial countries, health expenditure in Japan has been fairly low relative to GDP (Table II.3). Although the system exerts only limited control on demand, and private suppliers have incentives to provide excessive quantities of service, health spending is on a level comparable to countries with nationalized health services, such as the U.K. While underlying health factors that have contributed to Japanese longevity probably also imply less need for medical services, strict price controls and increases in co-payments in recent years have also been effective in keeping overall expenditure low (Oxley *et al.* 1995). This is likely to change, however, as the Japanese population grows older. With persons over 65 consuming roughly four to five times as much in health services as younger persons, a strong rise in health expenditures can be anticipated.

20. Financing of health benefits is provided to a substantial extent by public transfers, which differ across various schemes. On average, subsidies cover about half of total benefits for the National Health Insurance, one third of old-age medical care spending, and 12 percent of expenditure by occupational schemes—which translates into an average of 30 percent for public health expenditure as a whole. Since elderly people are exempt from health insurance contributions and pay only small co-payments, other insurance schemes together provide 70 percent of financing for old-age medical benefits through financial cross-transfers.

Table II.3. Public Health Expenditure, 1995
(In percent of GDP)

| | Canada | France | Germany | Italy | U.K. | U.S. | Japan |
|---|---|---|---|---|---|---|---|
| Total health expenditure | 9.6 | 9.8 | 10.4 | 7.7 | 6.9 | 14.2 | 7.2 |
| *Of which*: | | | | | | | |
| Public expenditure | 6.9 | 7.7 | 8.2 | 5.4 | 5.9 | 6.6 | 5.7 |

Source: *OECD Health Data, 1997.*

**The State of Government Finances**

21. The situation of Japan's public finances has worsened dramatically during the 1990s. Tax revenues receded strongly after the collapse of the asset price bubble in the early 1990s,

and expenditures have been driven upward by economic stimulus measures, above all public works spending, and by the costs of assuming the liabilities of a number of failed financial institutions (Mühleisen 2000). As a result, the general government deficit has reached an estimated 9 percent of GDP in FY1999 (excluding the social security surplus), and even if Japan's cyclical position is taken account of, the structural deficit remains worse than that of other G-7 countries (Table II.4).

Table II.4. General Government Finances, 1999
(In percent of GDP)

| | Canada | France | Germany | Italy | U.K. | U.S. | Japan |
|---|---|---|---|---|---|---|---|
| Actual balance | 2.8 | -1.8 | -0.7[1] | -1.9 | 0.3 | 0.0[1] | -9.2[1] |
| Structural balance | 3.3 | -0.8 | -0.7[1] | -0.5 | 0.1 | 0.2[1] | -8.1[1] |
| Gross debt | 88.1 | 58.6 | 61.1 | 114.9 | 44.8 | 62.4 | 125.4 |
| Net debt | 56.7 | 49.0 | 52.4 | 108.8 | 39.0 | 50.6 | 38.1 |
| Net debt, excluding social security | ... | ... | 53.1 | ... | ... | 59.1 | 87.9 |

Source: IMF World Economic Outlook; April 2000; staff estimates.
[1] Excluding social security.

22. Although Japan's net general government debt still appears relatively small (at 40 percent of GDP in 1999), this figure includes assets owned by the social security system—accounting for 50 percent of GDP—which are more than offset by future pension claims. If social security assets are excluded, Japan's debt situation is considerably worse than that of other industrialized countries. General government debt (excluding social security) has roughly doubled over the past decade, and markets have been concerned that the true level of public debt could be even higher, given the possibility that the government might have to cover contingent liabilities from loan guarantees and losses by public sector enterprises.

23. The current fiscal situation is clearly unsustainable and calls for strong adjustment measures in coming years. However, the problem for the authorities lies in reducing the fiscal deficit in a way that will not jeopardize the nascent economic recovery. In 1997, the last attempt at fiscal consolidation had to be abandoned as a rise in the consumption tax rate and a cut in public works spending were among the factors contributing to the renewed economic downturn. Although factors other than fiscal policy were at work on that occasion, the principle that fiscal consolidation needs to take account of evolving economic and financial conditions—including the robustness of the recovery—remains a valid one.

### C. A Long-Term Baseline Simulation for Government Finances

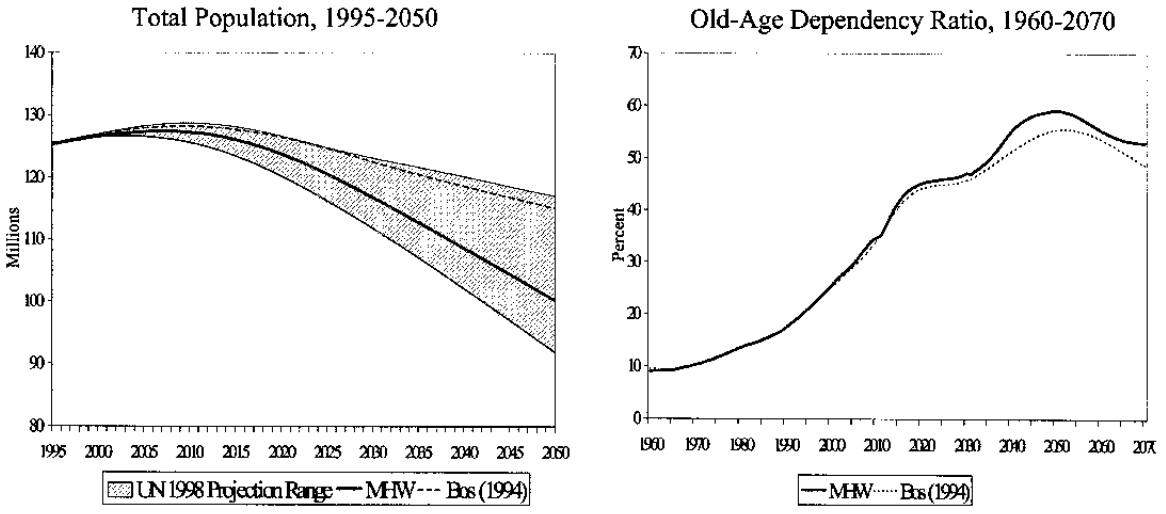
24. This section describes the outcome of a baseline simulation that takes stock of Japan's long-term fiscal problem. The simulation is modeled as closely as possible on the authorities' current policy intentions, e.g., by incorporating reforms in the recent pension legislation, but the simulation does not assume major additional reforms in as yet unspecified areas (for example, reforms going beyond the proposed health insurance bill). The need for further measures is mainly captured through changes in a residual fiscal variable necessary to

maintain fiscal stability. In what follows, this variable is assumed to be the consumption tax rate—which is still relatively low by international standards and carries less economic disincentives than, e.g., the income tax rate.[9]

**Demographic and Macroeconomic Background**

25. The following simulations use demographic projections prepared by a World Bank team (Bos *et al.* 1994) that also have been widely used in earlier studies. The projections imply that Japan's population will reach its maximum of 128 million people in 2010. The old-age dependency ratio would plateau at around 45 percent between 2020 and 2030, before rising again to peak at 55 percent by 2050.[10] More recent population projections, including by the Japanese authorities and the U.N., have assumed an even faster decline in fertility rates, which leaves the Bank's projections at the optimistic end of the current forecast spectrum (Figure II.2). The projections have been retained, however, in part because they are based on the assumption that the population will converge toward a steady state, which is a necessary condition for undertaking the MULTIMOD simulations. However, to avoid painting a too optimistic picture in the simulations, the age distribution has been slightly shifted towards the elderly (by assuming extended longevity), approximating the MHW's old-age dependency ratio while maintaining population levels projected by the World Bank team.

Figure II.2. Demographic Projections




[9] Under unchanged fiscal policy settings—a frequently used reference scenario—Japan's debt levels would obviously explode, since the primary deficit would remain far too high to offset rising interest payments. However, the notion that policies would remain unchanged under such circumstances would not be realistic, making that scenario an unsuitable baseline for policy analysis.

[10] The simulations extend through 2070, i.e., beyond the peak of the age dependency ratio.

26. The overall macroeconomic outcome of the simulation is described in Chapter I. The results—which also incorporate the fiscal baseline assumptions explained below—show that, although Japan's long-term saving rate would remain broadly unchanged compared to a stable demographic scenario, the output loss resulting from a shrinking labor force could still reach 15-20 percent in the steady state. The finding of a broadly unchanged saving rate is related to rising longevity, which causes individuals to save more in their productive phase, and a reduction in younger workers, which reduces the share of the population that dissaves. Finally, owing to rising demand for funds for capital investment, real interest rates would gradually rise toward a long-term level of around 3 percent.

27. While significant, the output loss projected by this simulation would only be a *relative* loss (compared to a scenario without a demographic shock), which would not necessarily imply *absolute* negative output growth in the future. Although the labor force would shrink significantly and higher labor force participation would be discouraged by rising wage deductions from taxes and social security contributions, this would be mitigated by an increase in the capital intensity of the production process (the baseline model predicts that the capital-labor ratio would roughly triple by 2050), and positive total factor productivity growth (the baseline scenario assumes TFP growth of about ¾ percent per year). However, even under relatively strong investment growth, potential output growth would peak at around 2 percent over the next decade and then decline over time towards its steady-state rate of ¾ percent over the next 50 years. Owing to a shrinking population, per-capita growth would average about 1 percent over that period.

**Baseline Projection: Social Security Finances**

28. The model for projecting the finances of social security is complicated by the large number of different schemes and the complex system of financial transfers (see Annex for details), but the simulation is based on a few main assumptions:

- *Pension payments* are modeled to increase largely in line with consumer prices and the number of retirees. EPI pension cuts would be implemented as foreseen by the recent pension reform bill, and other earnings-related pension benefits would follow a similar pattern.

- *Pension contributions*. As envisaged by the government, flat rate contributions to the National Pension scheme would increase by ¥800 in real terms every year between 2005 and 2020. Similarly, EPI pension contribution rates would initially rise in 5-year steps, reaching 27½ percent of monthly wages in 2025, although two further rounds of increases are assumed to bring the rate to 28½ percent by 2050, and 30 percent thereafter, to limit the drawdown of pension assets.[11] Contribution rates to other pension schemes would rise in line with the EPI.

[11] The difference with official calculations—which project a rise in the EPI contribution rate to only 25 percent—appears mainly related to the higher growth path assumed by the MHW.

- *Health spending*. Rising longevity, more intensive treatment options, and a possibly growing demand-supply gap are estimated to push up real per-patient medical expenditure almost twofold over the next decades, absent a determined effort to contain health care costs. The introduction of nursing care insurance and an increase in co-payments could somewhat dampen the upward trend in medical expenses per elderly person, but these are nevertheless expected to almost double over the forecasting period. Health care contributions are assumed to rise to the extent necessary to maintain financial balance of the health insurance system, as they have in the past.

29. On the basis of these assumptions, the social security system is expected to remain solvent throughout the projection period (Figure II.3, Table II.5). Overall **pension expenditure** would stabilize at around 12 percent of GDP by 2020 (up from 7¼ percent in 1998), partly owing to a slower increase of real per-retiree benefits as a result of the planned increase in the EPI retirement age. With the planned contribution rate increases, assets held by the pension schemes are projected to remain stable relative to GDP through 2020. Although reserve ratios (assets over annual benefit payments) would temporarily fall during this period, a further increase in contribution rates by 2025 would ensure sufficient asset accumulation to maintain solvency through the peak of the aging process in mid-century.

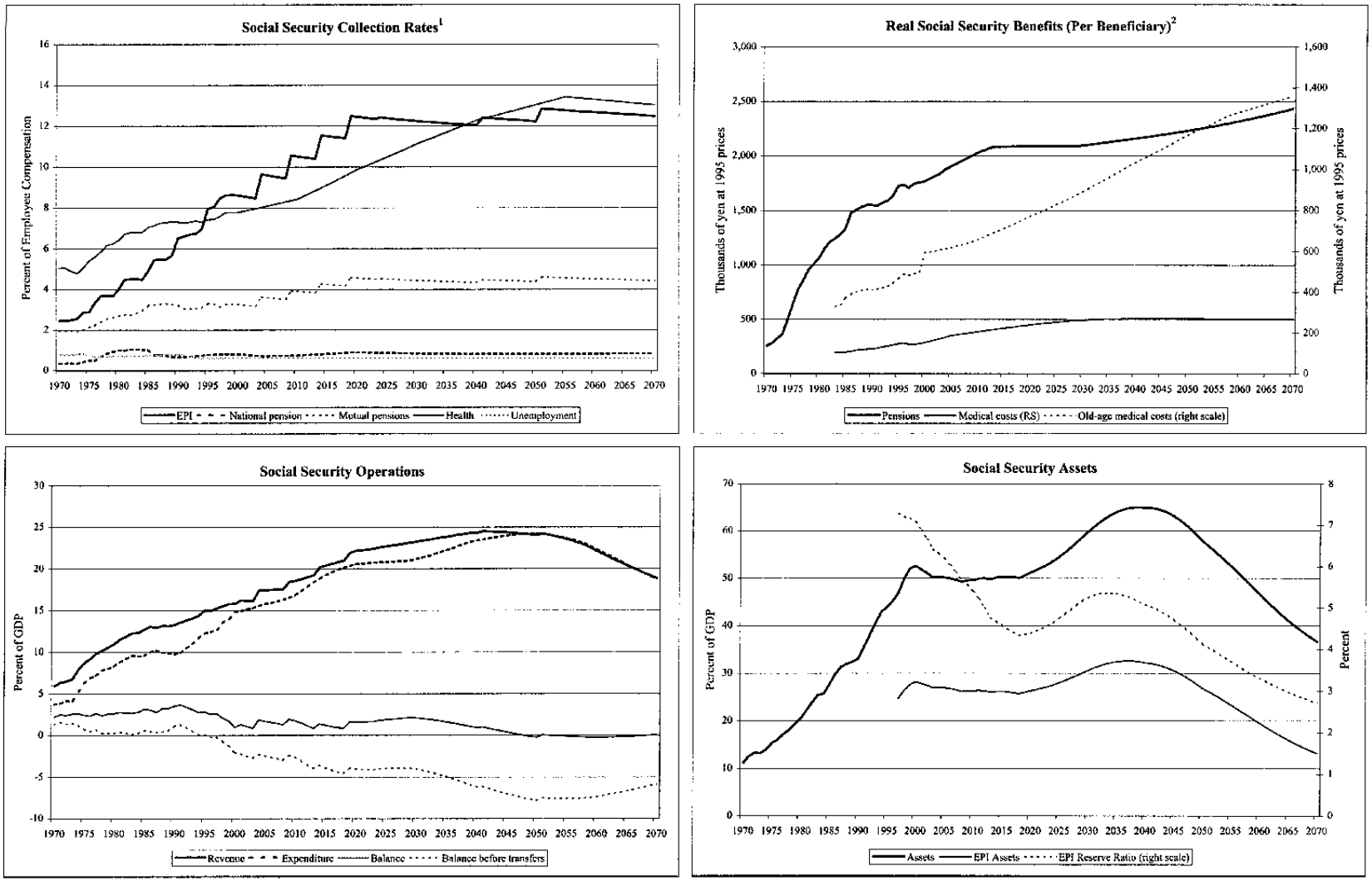
Table II.5. Projected Social Security Operations, 1998-2050
(in percent of GDP)

| | Act. 1998 | Proj. 2010 | Proj. 2020 | Proj. 2030 | Proj. 2040 | Proj. 2050 |
|---|---|---|---|---|---|---|
| Premium revenue | 10.9 | 12.4 | 14.4 | 14.6 | 14.4 | 13.9 |
| o/w: Pensions | 6.9 | 8.0 | 9.2 | 8.9 | 8.3 | 7.9 |
| o/w: Health insurance | 3.7 | 4.2 | 4.9 | 5.4 | 5.8 | 5.7 |
| Government transfers | 2.8 | 4.4 | 5.6 | 6.1 | 7.0 | 7.6 |
| Property income | 1.8 | 1.7 | 2.1 | 2.5 | 2.9 | 2.5 |
| Benefit payments | 12.9 | 16.3 | 20.0 | 20.6 | 22.8 | 23.7 |
| *Of which*: Pensions | 7.3 | 9.4 | 11.6 | 11.5 | 12.6 | 13.0 |
| *Of which*: Health insurance | 5.1 | 6.5 | 8.0 | 8.9 | 10.0 | 10.5 |
| Other expenditure | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Balance | 2.1 | 1.7 | 1.6 | 2.1 | 0.9 | -0.2 |
| **Memorandum item:** | | | | | | |
| Social security assets | 50.0 | 49.6 | 51.2 | 59.8 | 64.9 | 57.8 |

Source: Economic Planning Agency; and staff projections.

30. **Public health spending** would rise from 5 percent in GDP in 1998 to 8 percent of GDP in 2020 and to more than 10 percent of GDP by 2050 (comparable to OECD 1997 projections). Health insurance contributions would have to increase to keep up with rising public expenditures. From the current level of around 8 percent of wages, contributions

Figure II.3. Japan: Social Security Operations, 1970-2070




Source: Economic Planning Agency, National Income Accounts; and staff calculations.

[1] Total revenue divided by aggregate wage payments.

[2] Benefits received by the elderly are divided by the number of persons aged 65 and above.

would be expected to rise to 11 percent over the next 25 years, before peaking at 13 percent by the end of the forecasting period.

31. The impact of population aging on the fiscal accounts is apparent from the fairly drastic increase in **government transfers** implied by these projections. Under present formulas, transfer payments would rise from currently 2¾ percent of GDP to 5½ percent of GDP in 2020 and more than 6 percent of GDP in 2050, by which time the bulk would be spent on health benefits. While these transfers would ensure that the overall balance of social security would remain positive for most of the projection period—preventing a drawdown of assets until the demographic peak around 2050—they would clearly impose a heavy burden on the overall fiscal situation.

**Baseline Projection: General Government Finances**

32. The simulations for general government finances are guided by a gradual approach to fiscal consolidation, represented by two operational policy targets:[12]

- *Stabilize net debt within 10 years*. The simulation assumes that the government would embark on a sustained path of fiscal consolidation to stabilize net debt (excluding social security assets) at around 120 percent of GDP by 2010.

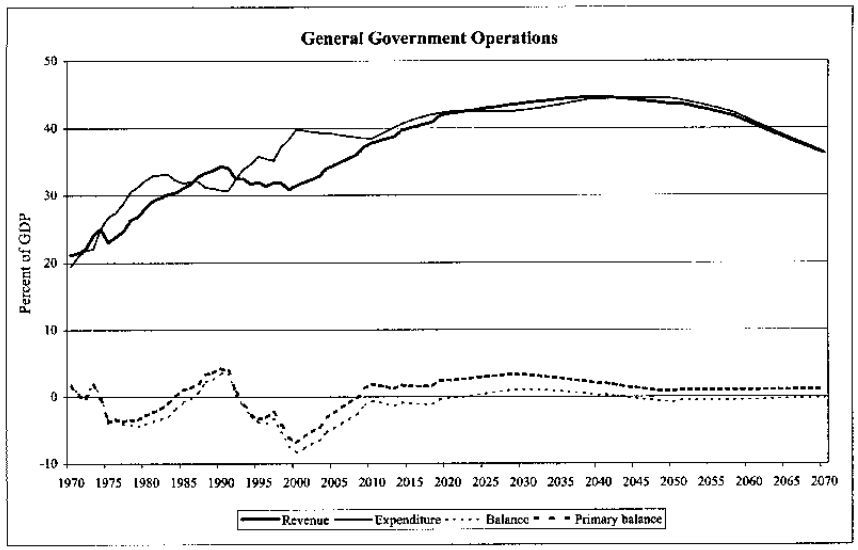
- *Reduce debt levels gradually in subsequent years*. The pace of overall fiscal consolidation is assumed to slow once the demographic transition fully gets underway after 2010. Nevertheless, further measures are assumed to be implemented in order to offset rising social security transfers and avoid substantial crowding-out of private investment over the long-term. It is assumed that general government debt (excluding social security assets) would be reduced to roughly 60 percent of GDP by 2070 compared to 120 percent in 2010 and almost 90 percent of GDP today.

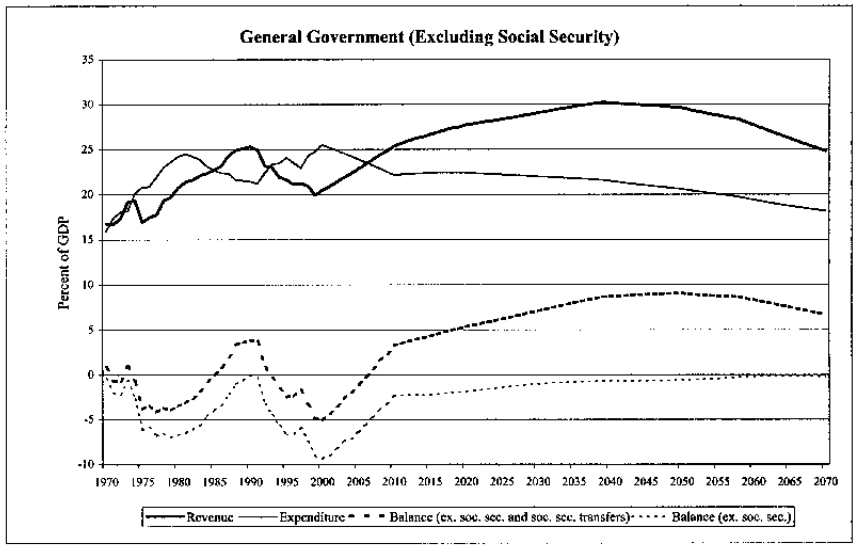
33. The first policy target implies that the general government deficit (excluding social security) would need to be reduced from 9½ percent of GDP in FY2000 to 2½ percent of GDP within 10 years (Figure II.4). To achieve this reduction of *7 percentage points*, it is assumed that the government would pursue the following strategy:

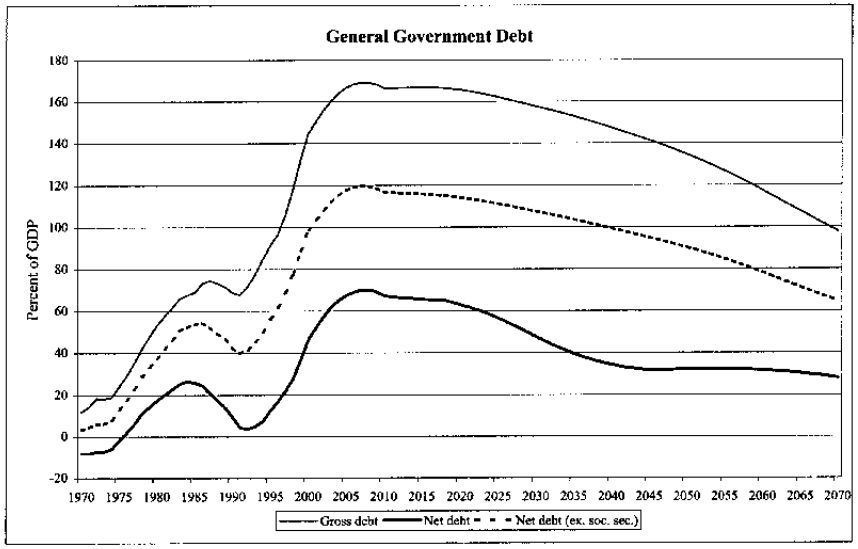
- It is likely that **public works** spending would be substantially cut following the onset of recovery, given the questionable return from such investment in the past. Public investment is assumed to fall by *3½ percent of GDP* to reach the G-7 average of 4 percent of GDP by 2010. The withdrawal of stimulus would be somewhat mitigated by a Ricardian reaction of the private sector (which also appears to have limited the effectiveness of such policies in recent years).

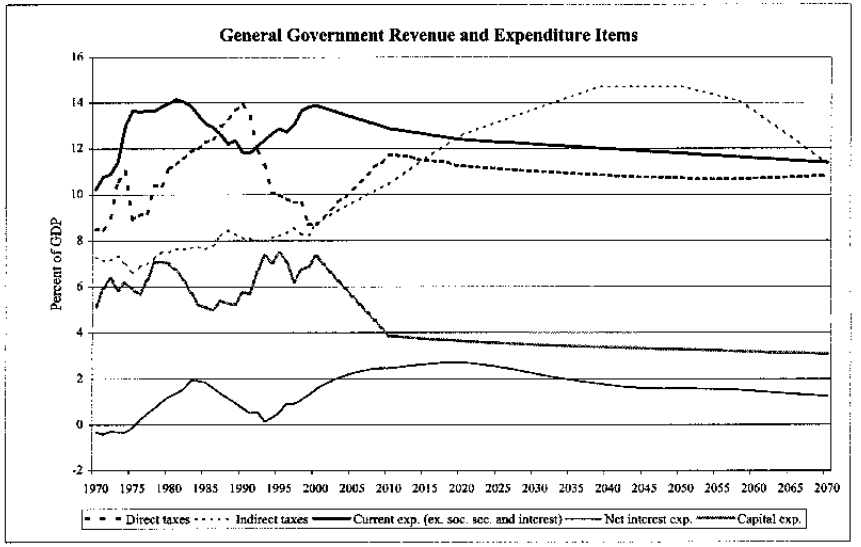
[12] To facilitate the analysis, no distinction was made between central and local government operations, and activities of public agencies outside general government (e.g., the FILP) were not explicitly modeled.

Figure II.4. Japan: General Government Operations, 1970-2070




Source: Economic Planning Agency, National Income Accounts; and staff calculations.

- While interest payments and social security transfers would rise by a combined *2½ percent of GDP*, spending cuts as well as administrative reforms currently underway could affect **other current expenditure** (e.g., payroll spending, employment subsidies), although the room for overall reductions is limited due to rising costs for public servants' pensions which are borne directly by the government. Savings in that area are projected at *1 percent of GDP*, which would leave other current expenditure higher relative to GDP than during most of the 1990s.

- On the revenue side, **direct tax collections** could be boosted by a cyclical recovery in income tax revenues (although a pickup in corporate tax revenue would lag for several years, owing to loss carry-forwards) and by base broadening measures. Although measures to expand the tax base could perhaps yield as much as 10 percent of GDP in revenue collections according to OECD estimates, the baseline only assumes additional revenue of 1-1½ percent as a result of such efforts, owing to potentially large political resistance. Overall, direct tax revenue is assumed to rise by about *3 percent of GDP* through 2010, which would be comparable to revenue levels in the mid-1980s.

34. Under these assumptions, the increase in indirect tax revenue required to achieve the debt target would be around *2 percent of GDP*, which would be equivalent to a hike in the consumption tax rate from 5 percent to 10 percent by 2010. In view of the 1997 experience, this would be a rather significant adjustment, that would need to be phased in carefully over the full 10-year horizon.

35. Achieving the assumed long-term policy target—a reduction in net general government debt (excluding social security) to about 60 percent of GDP by 2070—would require additional adjustment measures of 4 percent of GDP. This is assumed to be achieved largely through further indirect tax increases. First, following the adjustment measures through 2010, there appears to be limited room for further expenditure cuts, especially as welfare obligations are likely to remain high. Second, income tax measures would be made more difficult by the continued rise in social security taxes. Indeed, income tax revenues are likely to decline somewhat relative to GDP, owing to a drop in the overall share of labor income, an increase in the share of older workers in the labor force, and increases in alternative work arrangements (such as part-time work). As a result, indirect tax revenue would need to steadily increase from 10 percent in 2010 to a peak of around 14 percent in 2050, consistent with a rise in the consumption tax rate to 24½ percent, which would be larger than today's VAT levels in other major industrial countries.

**Sensitivity Analysis**

36. For obvious reasons, the results of the baseline scenario are at best indicative. Given the long forecasting period, the simulation outcome is highly sensitive to the underlying assumptions, and the focus should thus be more on broad trends in macroeconomic variables rather than a single scenario itself. To help in assessing such trends, the results of two different simulations are presented in Table II.6, involving one scenario with more pessimistic demographic projections, and a second one with stronger productivity growth:

Table II.6. Sensitivity Analysis: Social Security Indicators, 2050
(In percent)

| | Baseline | Weaker Demographics | Higher TFP Growth |
|---|---|---|---|
| Real benefit levels per beneficiary (2000 = 100) | | | |
| Pension (average) | 126.3 | 108.6 | 130.1 |
| General health insurance | 178.3 | 162.1 | 180.1 |
| Old-age medical care | 196.6 | 168.4 | 196.4 |
| Contribution rates | | | |
| Pensions (EPI) | 28.5 | 35.0 | 28.2 |
| Health (average) | 13.0 | 15.1 | 12.3 |
| Government transfers to social security (percent of GDP) | 7.6 | 8.4 | 6.4 |
| Consumption tax rate | 24.6 | 29.4 | 17.8 |
| **Memorandum item:** | | | |
| Average per-capita growth rate, 2000-50 | 0.9 | 0.8 | 1.1 |

Source: Staff calculations.

- *Weaker demographics*. The population projection by Bos *et al.* (1994) used in the baseline scenario projects a recovery in the fertility rate to 1.6 or more over the next 25 years, compared to its 1999 level of 1.34. However, the birth decline in recent decades appears to have been mostly related to an increase in the marriage age as more women enter into career streams, and there is little evidence so far to suggest that a reversal in this trend is about to occur (Yashiro *et al.* 1997). Therefore, this scenario assumes the fertility rate to stabilize at around 1.3 percent, which would result in a continuous population decline toward the steady-state level of 80 million, and an increase in the age dependency ratio to 80 percent by 2050 (20 percentage points higher than in the baseline model).

- *Technology change*. A second scenario assumes TFP growth at 1 percent, or 20 basis points higher than the historic average used in the baseline scenario. As the Japanese economy is likely to become more capital intensive, particularly through investment in new technologies, and with a gradually advancing structural reform process, it would not be unrealistic to expect TFP growth to accelerate in the future.

37. The results show that the financial consequences of weaker demographics could indeed be severe, and they also highlight the importance of growth for preserving Japan's social security system. Under more **pessimistic population projections**, both benefit cuts and further contribution increases would be necessary (relative to the baseline), especially in the pension system which depends to a lesser degree on government transfers. Even if pension benefits would be kept almost unchanged from their current levels in real terms, the EPI contribution rate would need to be raised to 35 percent. Similarly, despite lower real health care benefits, medical contribution rates would be higher than in the baseline, and the consumption tax rate would also need to be increased to achieve the assumed long-term fiscal

target. However, the high consumption tax rate of 29 percent indicates that absent a more severe effort to curb medical expenditure (which would imply lower government transfers), it would become almost impossible to finance public health insurance in its current form. By contrast, **higher TFP growth** would imply that the benefit levels of the baseline scenario could be maintained at reduced contribution levels as well as lower government transfers, implying that the consumption tax rate could also remain at significantly lower levels than in the baseline model.

## D. Policy Analysis

38. The baseline simulations show that a policy of slow debt consolidation and gradual social security reforms would be a long-term drag on living standards, owing to economic disincentives posed by high social security contribution rates and indirect tax increases necessary to finance rising government transfers and interest payments. What could be gained by pursuing different policies, and at what cost? To respond to these questions, this section presents alternative policy paths—both for stabilizing government debt and for restoring the long-term viability of the social security system—and analyzes their impact on growth and welfare relative to the baseline scenario, using the MULTIMOD framework.

### Speed and Composition of Fiscal Consolidation

39. One option for the government would be to achieve debt stabilization faster than the 10-year period assumed in the baseline scenario. While the benefits of such a policy are obvious in theory—including positive debt dynamics and higher public saving—there could be a drawback if strong fiscal adjustment measures stalled the recovery, making eventual fiscal consolidation all the more difficult to sustain. Moreover, multiplier analysis suggests that cuts in public investment could have particularly strong negative effects on growth, whereas tax measures would tend to affect output on a smaller scale. Thus, there is not only a question regarding the speed of fiscal adjustment, but also the composition of fiscal measures.

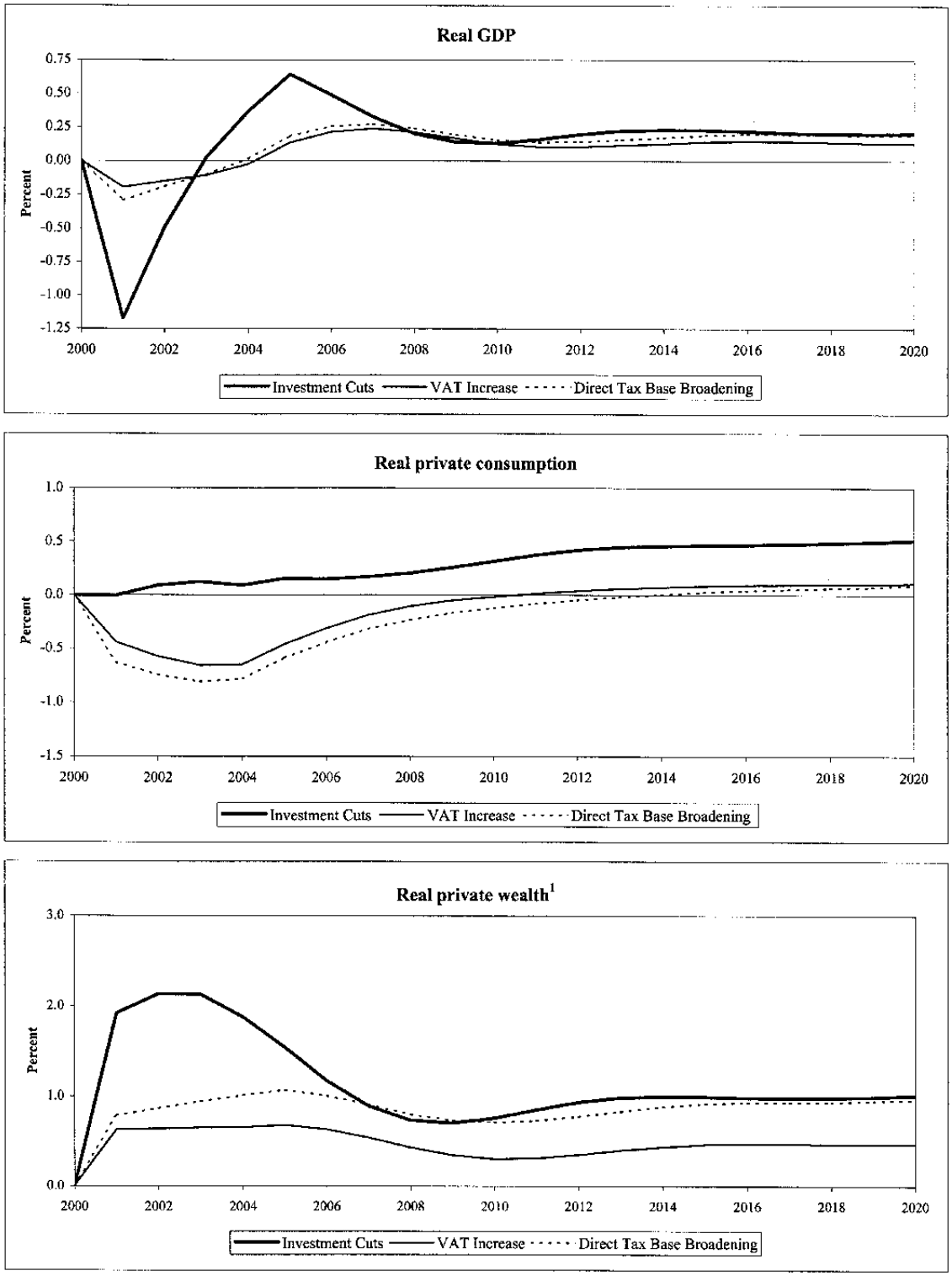
40. To illustrate the macroeconomic trade-offs, three simulations have been run under the assumption that general government debt is stabilized over a period of 5 years. Compared to the baseline scenario, the stronger fiscal path is assumed to result from the following policy measures: (i) **cuts in public investment**; (ii) an **increase in the consumption tax rate**; and (iii) **direct tax base broadening.**[13] Faster consolidation would stabilize debt at a lower level than in the baseline, and it is assumed that this positive debt differential is maintained through the end of the forecasting period. All other assumptions (regarding social security parameters, technology, etc.) remain unchanged from the baseline scenario.

41. As expected, faster consolidation would result in sustained gains to economic output over the medium-term, although at the cost of short-term losses (Figure II.5). Real output would decline relative to the baseline scenario for the first 3-4 years of the adjustment

[13] The case of higher direct tax rates was also considered, but produced an inferior outcome compared to both consumption tax increases and base broadening measures.

Figure II.5. Japan: Macroeconomic Effects of Fiscal Consolidation Strategies

(Difference to baseline scenario, in percent)




Source: Staff calculations.

[1] Real financial assets plus discounted real income over the projection period.

process, but rise above baseline output for the rest of the forecasting period. The largest long-term gains would be achieved in the case of public investment cuts, but these would also entail the largest short-term output losses, with real GDP being 1¼ percentage points below baseline output in the first year of the adjustment process.[14] The cases of tax base broadening and consumption tax increases would imply a much smaller initial output loss as public investment would be kept unchanged, but long-term gains would also be smaller, owing to the distortionary effects of higher taxes.

42. Long-term gains in real private consumption and private wealth (here used as proxy measures for economic welfare), shown in Figure II.5, also highlight the beneficial role of public investment cuts. Both measures increase immediately relative to the baseline scenario, whereas the other two strategies result in lower consumption for most of the time, as well as significantly smaller wealth gains.[15] This reflects the fact that tax increases either directly reduce disposable labor income (in the case of direct taxes), or decrease future real incomes through an increase in consumer prices (in the case of consumption taxes).

43. Three main policy conclusions can be drawn from these findings:

- **A shortening of the fiscal adjustment horizon** *ceteris paribus* implies short-term output costs—suggesting that sharp tightening measures should be held back until private demand has reached sustainable levels.

- The risk to short-term output growth is largest in the case of **investment cuts**, although these would also generate the strongest long-term welfare gains. From an economic perspective, tax increases would provide a less risky instrument to achieve fiscal consolidation in the initial phase of an upswing. Investment cuts could then be phased in more gradually, depending on the progress of the recovery.[16]

- In terms of **taxation measures**, the simulations indicate that a consumption tax increase would have somewhat less beneficial effects than a broadening of the direct tax base. This highlights the fact that the VAT—although generally considered to be close to an optimal tax—does carry distortionary effects as it introduces a wedge between producer and consumer prices that is captured in MULTIMOD. The model suggests that efficiency losses from base broadening (which could result from lower tax exemptions) are smaller, although only by a small margin.

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[14] In MULTIMOD, the public capital stock is not part of the production function, i.e., public investment does not raise economic output over the long term. Economic gains of lower public investment could be somewhat overstated as a result.

[15] Gains in private wealth are positive even in the case of tax increases, because they include discounted future earnings which are higher if GDP increases relative to baseline.

[16] This is consistent with the view that public works have *de facto* substituted for fiscal stabilizers in the recent past, and thus should be reduced only gradually in an economic upswing (Mühleisen 2000).

**How to Address the Aging Problem?**

44. The debate over social security reform in Japan has focussed mainly on two questions. First, to what extent should future benefits be cut, and second, how to finance the rise in social security benefits associated with population aging? These questions, however, are related as it is generally agreed that significantly higher payroll taxes (as in the baseline scenario) would have undesirable effects on work incentives and labor costs, which indicates the need either to reduce future benefit levels or to examine alternative financing means, including higher indirect taxes:

- *Benefit cuts*. There have been various suggestions in the literature and in the public arena to cut net benefits, including through cuts in the gross replacement ratio, higher taxation of pension incomes, and an increase in the retirement age. Potentially large savings could be achieved by shifting all remaining pension components from wage to price indexation (including National Pension benefits and entry levels of earnings-related pensions; Yashiro *et al.* 1997). An increase in the retirement age would also contribute to overall labor supply and output, but this effect is likely to be small as the participation rate of elderly Japanese in the labor force is already quite high.[17]

- *Higher consumption taxes*. Raising indirect taxes would avoid some of the disadvantages associated with higher pension contributions (and health insurance premiums) and spread the burden of financing social security benefits over the general population (including pensioners themselves). Therefore, there have been suggestions to increase transfers from the general government to the pension system, financed through higher consumption tax revenue.

45. This debate is reflected in the following two simulations. First, one scenario assumes a **reduction of social security benefits** by 2 percent of GDP over a period of 20 years relative to the baseline scenario, which would allow a commensurate decline in social security contributions (for simplicity, the cuts could be in either pension or health benefits, or both). The second scenario keeps social security benefits unchanged relative to the baseline, but assumes that **consumption taxes would be raised** to finance a reduction in social security contributions identical to that in the first scenario. In this way, the scenarios analyze the trade-off between the level of social security benefits and consumption tax increases that appears to be at the heart of the pension debate in Japan.[18]

46. The results suggest that benefit reductions, coupled with a decline in social security contributions, would clearly offer the most beneficial reform alternative with regard to both

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[17] There have as yet been no studies to what extent health benefits would need to be reduced to avoid an increase in health insurance contributions.

[18] The assumptions also imply that the social security balance in both scenarios is identical to that in the baseline.

growth and economic welfare measures (Figure II.6).[19] The chart shows that both simulated reforms would result in higher long-term growth relative to the baseline, although the effects would be larger in the case of benefit reductions. While benefit cuts would imply a short-term output decline (owing to a drop in consumption as forward-looking agents would immediately increase saving for retirement age), the positive long-term effects on output would be substantially larger, owing to a fall in interest rates that would provide a boost to investment.[20] In the case of a consumption tax increase, private saving would decline relative to baseline, since the pension financing would be partly shifted from workers to pensioners who generally have a lower marginal propensity to save. Higher growth over the long term would thus mainly be an effect of increased labor supply as a consequence of lower payroll taxes.[21]

47. In contrast to benefit cuts, a reduction in social security contributions financed by a consumption tax increase would have mixed effects on private consumption and wealth. The initial decline in saving implies that interest rates rise and that there is less of a buildup in capital stock compared to the baseline (which translates into a valuation loss of financial assets and thus lower wealth). Moreover, the increase in interest rates leads elderly consumers—who are less liquidity constrained—to increase consumption, thus further reducing aggregate saving.[22] The resulting decline in the current account surplus also depresses financial wealth through a drawdown of foreign assets. Eventually, the fall in wealth would imply that consumption would drop relative to baseline, although this would only occur towards the end of the projection period.

48. Although the results may depend to some extent on the particular specification of the model, the main policy conclusion is that a reduction of social security benefits would generate lasting output and welfare gains, although at the risk of some small short-term

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[19] The two scenarios have been estimated with two different female labor supply reactions. On the basis of time-series regressions, female labor supply elasticity with respect to disposable income was estimated at 0.1. For illustration, the charts also show the simulation results for an elasticity twice that size. Except for the labor supply effects, the first scenario is identical to that in Faruqee (2000).

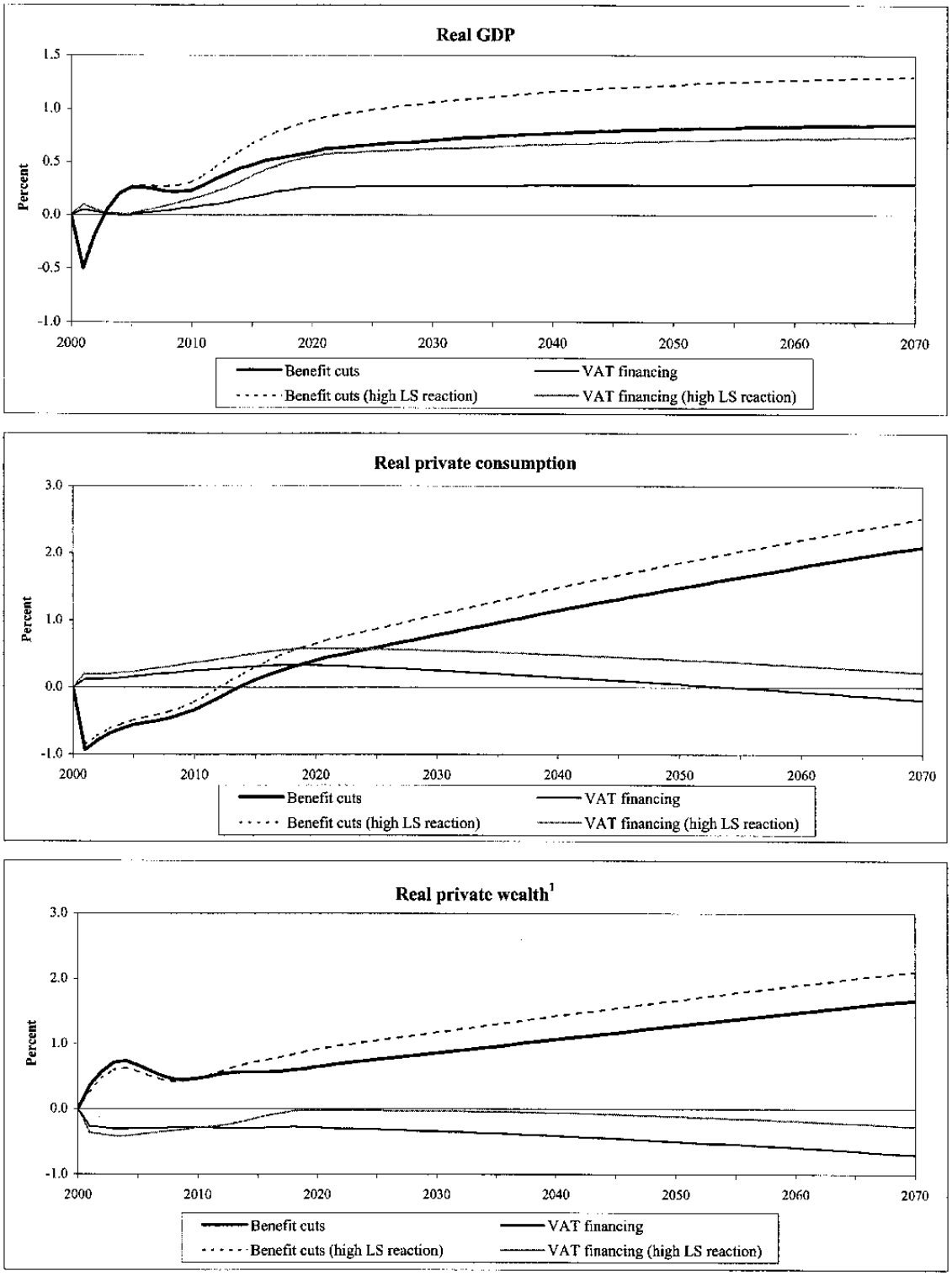
[20] As a result of rational expectations, the intertemporal pattern is likely exaggerated by the model as long-term policy changes are immediately reflected in agents' decision making. Indeed, substantive pension reforms could have beneficial effects on output, owing to improvements in confidence as the social security system would be more plausibly funded, although such an effect is not captured in the MULTIMOD framework.

[21] As pointed out in the literature survey, benefit cuts would also be the most equitable way of distributing the pension burden across generations.

[22] MULTIMOD is set up in a way that the income effect of higher interest rates on saving significantly exceeds the substitution effect. This is consistent with the large reliance of elderly Japanese households on accumulated assets for retirement income.

Figure II.6. Japan: Macroeconomic Effects of Social Security Reform

(Difference to baseline scenario, in percent)




Source: Staff calculations.

[1] Real financial assets plus discounted real income over the projection period.

output losses that would need to be minimized through careful phasing. By contrast, financing social security through an increase in the consumption tax would also result in output gains relative to payroll tax financing, but beneficial welfare effects would not be permanent.

## E. Conclusions

49. This chapter illustrates the difficult situation facing Japanese fiscal policy in the years ahead. On the one hand, high public debt and adverse population dynamics increasingly constrain the government's room for maneuver, suggesting that strong policy adjustments will eventually be required to put public finances back on a sustainable footing. Reforms currently implemented by the government are a step in the right direction, but further measures in both the pension and health systems will be needed to avoid a large increase in payroll taxes and government transfers that would distort incentives and harm economic growth.

50. On the other hand, the model's simulation results suggest that ambitious debt stabilization, particularly through cuts in public investment and other expenditure, and further reductions in social security benefits could result in substantial short-term output costs, posing a risk to the recovery. This is particularly true in the case of public investment cuts, where the multipliers are generally believed to be larger. Therefore, as long as private demand remains fragile, fiscal adjustment policies would have to be implemented cautiously.

51. However, in view of the serious aging problem, once the recovery is on a sound footing, Japan will need to implement a long-term fiscal strategy that will return the public finances to a sustainable position. This chapter suggests that public investment cuts, base broadening measures for income taxes, some increase in the consumption tax, and reductions in social security benefits, are likely to be the key building blocks of the longer-term solution.

## MODELING THE SOCIAL SECURITY ACCOUNTS

1. The finances of the social security system are at the heart of the simulation model used for this paper. The model is built around a set of forecasting equations for revenue and expenditure of the major components of the social security system, and an attempt has also been made to map the complicated system of government transfers and cross-transfers between the various schemes. However, the complexity of the system required a large number of simplifying assumptions, and the simulations are therefore only capable of projecting broad trends in social security finances. While this enables them to be used in macroeconomic models, the degree of accuracy of these simulations can not be compared with, e.g., actuarial calculations made by the government.[1]

2. The simulations are based on data provided by the national accounts, which show premium revenues and benefit payments for the main social security components (Table II.7). These data are grouped into eight categories, which are individually simulated. The breakdown on the pension side is straightforward, following the multi-tiered structure of the Japanese pension system. On the health insurance side, the most important distinction is between medical insurance for the young and the old, given the substantially higher treatment costs for elderly persons. General health insurance has been modeled as a single entity, since different health plans offer very similar types of insurance, and there are separate equations only for old-age medical insurance and nursing care insurance.[2] For completeness, the finances of unemployment insurance are also simulated, although they have no significant effect on social security finances as a whole.

Breakdown of Social Security Components

| **Pensions** | **Health** |
|---|---|
| National pension insurance | General health insurance (below age 70) |
| Employee pension insurance (EPI) | Old-age medical care (from age 70) |
| Pension insurance provided by MAAs | Nursing care insurance |
| Other pension funds | |
| | Unemployment insurance |

3. Financial operations of these components were modeled as follows (Table II.8):

- **Revenue** from contributions was assumed to expand largely in line with contribution rates (the main policy parameter) and employee compensation or employment levels, depending on whether the contributions were collected in the form of a payroll tax or flat-rate contribution.

[1] The simulations were however roughly calibrated against the MHW's simulations results.

[2] The FY1998 national accounts do not yet reflect nursing care insurance, which has been introduced on April 1, 2000.

# Table II.7. Japan: Finances of Social Security, FY1998[1]

(in trillions of yen)

| | Contributions | | | Benefit payments | Balance before asset income and public transfers |
|---|---|---|---|---|---|
| | Employers | Employees | Total | | |
| Special accounts | 15.5 | 15.9 | 31.4 | 35.9 | -4.5 |
| Welfare insurance | 13.4 | 13.3 | 26.7 | 22.6 | 4.1 |
| Health insurance | 3.0 | 3.0 | 6.1 | 4.3 | 1.7 |
| Welfare pension (EPI) | 10.3 | 10.3 | 20.6 | 18.3 | 2.3 |
| National pension | 0.0 | 1.9 | 1.9 | 9.7 | -7.8 |
| Laborers' insurance | 2.0 | 0.6 | 2.7 | 3.5 | -0.8 |
| Workmen's accident compensation | 1.4 | 0.0 | 1.4 | 1.0 | 0.4 |
| Employment insurance | 0.6 | 0.6 | 1.3 | 2.6 | -1.3 |
| Seamen's insurance | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 |
| National health insurance | 0.0 | 3.4 | 3.4 | 5.8 | -2.4 |
| Old-age medical care[2] | ... | ... | ... | 10.1 | -10.1 |
| Mutual aid associations (MAA's) | 6.5 | 3.1 | 9.6 | 7.4 | 2.2 |
| Central government employees | 1.4 | 0.7 | 2.1 | 1.9 | 0.2 |
| Local government employees | 4.0 | 2.1 | 6.0 | 4.8 | 1.2 |
| Public corporation employees | 0.7 | 0.0 | 0.7 | 0.0 | 0.7 |
| Others | 0.4 | 0.4 | 0.8 | 0.7 | 0.1 |
| Health insurance run by private mutual associations | 3.3 | 2.5 | 5.8 | 3.2 | 2.6 |
| Other funds | 2.3 | 1.6 | 3.9 | 1.8 | 2.1 |
| Pension funds | 2.3 | 1.6 | 3.8 | 1.8 | 2.1 |
| Funds for casualty compensation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 27.6 | 26.6 | 54.2 | 64.4 | -10.1 |

Source: Economic Planning Agency.

[1] Data on national accounts basis.

[2] Old-age medical care is financed by financial transfers from government and other health insurance schemes.

Table II.8. Major Factors in Modelling Social Security Finances

| | Premium revenues | Benefit payouts | Government transfers |
|---|---|---|---|
| **National Pension** | - Increase in real monthly contributions (flat amount)<br>- Employment level | - Size of population 65 and older<br>- CPI | One half of pension benefits |
| **Employee Pension Insurance** | - Increases in nominal EPI contribution rates.<br>- Employee compensation | - Size of population 65 and older<br>- CPI | (One half of basic pension benefits) |
| **Mutual Aid Pensions** | - Linked to EPI contribution rates<br>- Employee compensation | - Size of population 65 and older<br>- CPI | (One half of basic pension benefits) |
| **Pension Funds** | - Employee compensation | - Size of population 65 and older<br>- Gross wage | -- |
| **General health insurance** | - Average contribution rates (7½ percent of gross wage in 1997)<br>- Employee compensation | - Per-capita spending (formula driven)<br>- Size of population under 65 | 30 percent of benefits |
| **Old-age medical care** | -- | - Per-capita spending (elasticity of 2.0 w.r.t CPI)<br>- Size of population 65 and older | 30 percent of benefits<br><br>(Rest subsidized through general health insurance) |
| **Nursing care insurance** | - CPI<br>- Employment level | - Size of population 65 and older<br>- CPI | One half of benefits |
| **Unemployment insurance** | - Unchanged contribution rate<br>- Employee compensation | - Number of unemployed<br>- Gross wage | 14 percent of benefits |

On the **expenditure** side, most **pensions** will be indexed to the CPI following the recent pension reform, and pension benefits can thus be modeled mostly in line with the number of pensioners and price inflation. Ad hoc adjustments have been made to allow for benefit cuts of up to 5 percent for new pensioners, as well as an increase in the EPI retirement age to 65.

- **Medical** costs were simulated on a per-patient basis. Econometric analysis identified real income and consumer price inflation as major factors in general per-capita health expenditure, broadly in line with findings in Oxley (1995).[3] In the baseline model, the following formulas were used:

  *log* (per-capita general public health expenditure) =

  $$\underset{(-10.4)}{-5.8} + \underset{(4.4)}{0.39}\ log(\text{real per-capita GDP}) + \underset{(37.7)}{1.74}\ log(\text{CPI})^{4}$$

  *log* (per-capita public old-age medical expenditure) = $-4.8 + 2.0\ log(\text{CPI})^{5}$

  The above-unity coefficient for the CPI is consistent with the assumption that increasing intensity and continued upgrades in the quality of treatment are likely to lead to over-proportional increases in medical costs for the foreseeable future. It is assumed, however, that the coefficient in the general health expenditure equation diminishes over time as a result of cost control measures.

- **Government transfers** were modeled in line with the official formulas for such transfers (e.g., the government would carry one half instead of one third of basic pension benefits from 2004). The system of cross-transfers between social security components (e.g., from the EPI to the national pension system) was too difficult to reproduce explicitly (especially in health insurance). Historical data were therefore employed to approximate past transfers as follows:

| | |
|---|---|
| Change in assets owned by scheme X from previous year | |
| Less: | Revenue from contributions and interest income |
| Plus: | Expenditure on benefits and administration |
| = | Net transfers received by scheme X |

  Transfers were held constant relative to scheme X's benefit payments in future years.

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[3] Oxley *et al.* (1995) analyze overall health care expenditure across industrial countries, using a variety of health-care related variables. They found that per-capita income generally had the largest impact on per-capita spending levels.

[4] The equation was estimated for the period 1970-1997 ($R^2 = 0.99$; t-values in brackets), and included a dummy for the year 1983, when cost increases were low due to reform measures.

[5] The estimated CPI coefficient was 2.37 ($t = 10.5$, $R^2 = 0.90$, 1984–97). The simulation uses a lower coefficient due to expected savings through nursing care insurance.

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## III. The Yen-Dollar Rate: Have Interventions Mattered?

by Ramana Ramaswamy and Hossein Samiei

### A. Introduction

1. The yen-dollar rate has been more than just the exchange value of one currency against another. Fluctuations in the yen-dollar rate in the 1980s, for instance, became enmeshed in an outbreak of trade frictions between Japan and the United States. Swings in the yen-dollar rate have also had systemic effects on the global economy. The sustained depreciation of the yen against the dollar, beginning in mid-1995, eroded the external competitiveness of a number of Asian countries that had pegged their currencies closely to the dollar, and became one of the triggers for the Asian crisis in 1997. More recently, the abrupt appreciation of the yen has threatened to scupper Japan's fragile recovery from its worst post-war crisis, as it did during 1994–95. It is therefore not much of a surprise to find that policy makers in Japan have intervened repeatedly in foreign exchange markets to influence the yen-dollar rate, and that markets have avidly monitored every one of these moves. The critical question, however, is whether these interventions have made a difference to the yen-dollar rate.

2. Perceptions about the effectiveness of foreign exchange interventions have changed over time. The coordinated interventions that followed the Plaza Accord in September 1985 were followed by a sustained decline in the exchange value of the dollar against the yen; econometric studies indicate that these interventions had a statistically significant impact on exchange rates.[1] The weakening dollar was, however, not accompanied initially by a reduction in current account imbalances between Japan and the United States, and accentuated trade frictions. This outcome also had the effect initially of generating skepticism about the effectiveness of interventions, even though the success of interventions ought to be measured strictly by their impact on the exchange rate, and not by how the subsequent adjustment process works. However, as noted by Krugman (1991) in a review of developments during this period, the external imbalances between Japan and the United States did subsequently narrow significantly between 1988–90, with the lag being due to "J-Curve" effects.[2]

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[1] Dominguez and Frankel (1993), for instance, use an augmented portfolio balance model, incorporating exchange rate expectations, to show that interventions had a statistically significant impact on exchange rates in the post-Plaza Accord period; interventions are also shown to have mattered during 1982-84, when skepticism about the effectiveness of interventions was pervasive. See, also in this context, Dominguez (1998).

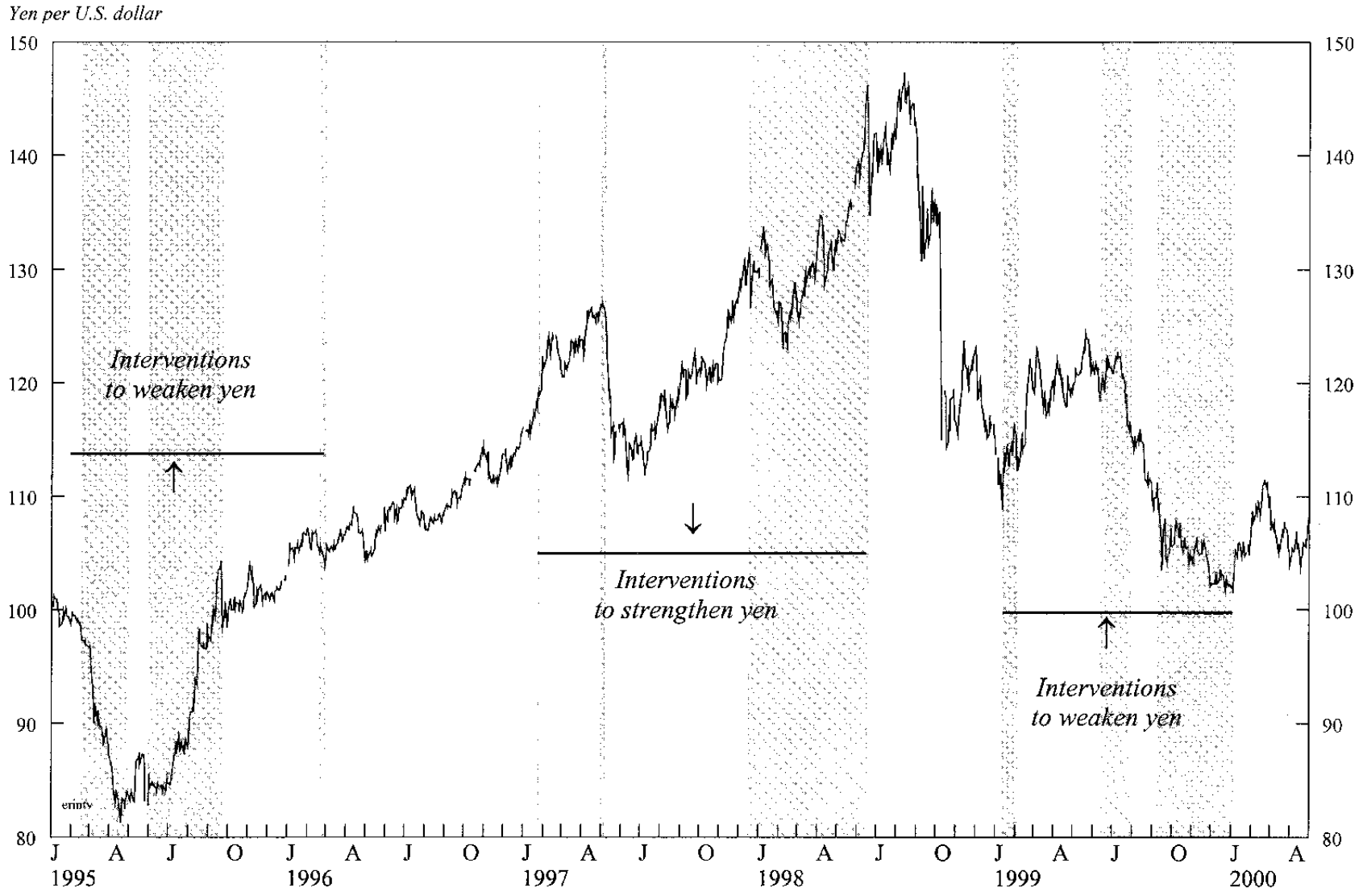
[2] Research at the IMF during this period, for instance, indicated that Japan's external balances throughout 1985-90 responded to exchange rate changes in broadly the same way that they do in other countries, and in a pattern that was broadly consistent with estimated econometric relationships. See, in this context, Corker (1989) and Meredith (1993).

3. Despite the post-Plaza Accord experience, doubts about the effectiveness of foreign exchange interventions have lingered, and have come to the fore again recently as the exchange value of the yen has oscillated during the past five years from a highly appreciated level to a highly depreciated one, and then back again to excessive strength. Despite a series of interventions conducted by the Bank of Japan to weaken the yen during early 1995, it continued to appreciate, reaching a high of about ¥80/$ in April 1995 (Figure III.1). As dollar-buying operations continued throughout that year, including episodes of coordinated interventions and an easing of monetary policy in Japan, the yen depreciated significantly, crossing the ¥125/$ mark in early 1997. The Japanese authorities soon after had to change strategy, and began instead to intervene to prevent the exchange value of the yen from depreciating further. However, with confidence in the yen dented by the advent of the Asian crisis in July 1997 and the financial panic generated by the bank failures in Japan in late 1997, the yen continued to depreciate, reaching ¥145/$ by August 1998. The turbulence in global financial markets intensified at that point, resulting in an abrupt unwinding of the so-called "yen-carry-trades", and the yen began to appreciate dramatically, reaching ¥110/$ by January 1999. Surrealistically, the Japanese authorities were forced within the span of a few months to shift from a strategy of intervening to strengthen the yen to one of intervening once more to weaken the yen, and periodic dollar buying operations have continued in 2000.

4. The foreign exchange interventions carried out in the latter half of the 1990s raise a number of questions. How effective were the foreign exchange interventions? Did they have persistent effects on the yen-dollar rate? Were interventions more effective when coordinated than when conducted unilaterally? Did interventions to strengthen the yen have a greater chance of success than interventions to weaken the yen? Why did the Japanese authorities intervene much more frequently in the yen-dollar market than the U.S. authorities did, and what specifically triggers foreign exchange interventions? The paper attempts to answer these questions, estimating an interest-rate arbitrage rational expectations model of the exchange rate with daily data, and a probit model of the probability of interventions. In contrast to recent studies which have focused on the impact of interventions on exchange rate volatility (Dominguez (1998) and Chang and Taylor (1998)), or have revisited the effectiveness of the Plaza Accord interventions (Humpage (1999)), the focus of this paper is on directly testing the impact of the interventions conducted in recent years on the level of the exchange rate.

5. The main finding of the paper is that the foreign exchange interventions conducted during 1995–99 have on the whole mattered, and did succeed on a number of occasions in changing the path of the yen-dollar rate in the desired direction, even though the interventions in the yen-dollar market were routinely sterilized. Thus, contrary to the conventional wisdom that interventions can be effective only when left unsterilized, an important finding of the paper is that sterilized interventions appear to work—having a probability of success of about 50 percent. The paper argues that sterilized interventions have been effective primarily because they influence market participants' expectations of future economic fundamentals and the stance of monetary policy, and also erode bandwagon effects. Consistent with conventional wisdom, the paper finds that coordinated interventions in the yen-dollar market have been more effective than unilateral interventions, having a probability of success of about 75 percent; when successful, coordinated interventions move

Figure III.1. Japan: Foreign Exchange Interventions in the Yen-Dollar Market 1/




Source: WEFA.

1/ Shaded areas indicate the months in which the interventions occurred.

the exchange rate in the desired direction by about 2–3 percent—about thrice as much as unilateral interventions do. While interventions have, on average, had relatively small effects on the yen-dollar rate, these effects tend to be persistent. However, it needs to be noted in this context that the model used for the estimations succeeds in explaining only a relatively small part of the day to day fluctuations in the yen-dollar rate, which like all asset prices, has a significant unexplained component to its movements.

6. The paper also finds that unilateral interventions by the Bank of Japan to weaken the yen have had a somewhat lower success rate than unilateral actions to strengthen the yen. It is interesting to note in this regard that the Bank of Japan (BoJ) intervenes much more frequently in the yen-dollar market than the Fed does, with much of the interventions aiming to stem yen appreciation. The paper argues that the higher frequency of the BoJ's interventions is related to the fact that Japan's nominal effective exchange rate, unlike that of the United States, moves in close synchronization with the yen-dollar rate; consequently, any strengthening of the yen against the dollar implies a stronger negative shock for the Japanese economy than an appreciation of the dollar against the yen does for the U.S. economy. The probit model used to estimate the triggers for interventions indicates that the Japanese authorities have in practice intervened to stem both an "excessive appreciation" and an "excessive depreciation" of the yen, just as they claim to do in their official pronouncements on exchange rate policy. And, finally, the estimations indicate that interventions in the yen-dollar market tend to occur in clusters, so that if there has been an intervention today, there is then a good chance that there will be another one tomorrow.

### B. Foreign Exchange Interventions in Practice

7. A brief overview of how foreign exchange interventions are conducted in the yen-dollar market provides a useful starting point for analysis. In the case of Japan, the authorization of the foreign exchange operations, as well as the financing of interventions, is the responsibility of the Ministry of Finance.[3] The Bank of Japan (BoJ) implements the actual intervention operations in the foreign exchange market. In the United States, both the Federal Reserve (Fed) and the Treasury have independent legal authority to initiate foreign exchange interventions. Nevertheless, the primary responsibility in practice for initiating interventions has rested with the Treasury. The Fed implements the actual interventions through the operations of the Foreign Exchange Desk of the Federal Reserve Bank of New York. The financing of interventions is shared between the Treasury and the Fed.[4]

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[3] The recent technical changes in the financing of foreign exchange interventions—the sale of Finance Bills issued by the Ministry of Finance to the public rather than to the BoJ directly—has made no effective difference to how interventions are ultimately financed.

[4] See Cross (1998) for a more detailed description of how foreign exchange interventions are carried out in the United States.

8. How can we identify specific interventions in the yen-dollar market? The data on the Fed's intervention operations can be obtained after a lag of about a year, but there are no official data on specific interventions conducted by the BoJ. Indicative information on interventions in the yen-dollar market can, however, be gleaned from the financial press, which provides prominent coverage of these operations soon after they take place. News reports of foreign exchange interventions tend to be highly reliable, particularly in the post-Plaza Accord period. Both the Fed and the BoJ have for some years now conducted their intervention operations openly and directly in the dealer market, typically with the foreign exchange desks of large commercial banks. While central banks have the option of keeping their operations in the dealer market secret, they have typically chosen not to do so, as the primary objective of the interventions has been to show a presence in the foreign exchange market and indicate a view about exchange rate trends. The interventions are usually reported soon after they occur on Reuters and other news agencies, and then receive prominent coverage in the financial press the next day. While some traders do learn of interventions before they appear on Reuters reports, this lag is usually less than 30 minutes in the yen-dollar market, so that for all practical purposes interventions become public knowledge soon after they are conducted. Sometimes official statements confirm interventions, but the Japanese authorities have typically not followed this practice.[5]

9. For this study, information on the occurrence of foreign exchange interventions in the yen-dollar market (by both the BoJ and the Fed) during 1995–99 have been collected from the electronic archives of the Financial Times and the Wall Street Journal. The news reports on interventions in these two newspapers have been cross checked with each other, and also with other news sources. Sometimes there are reports in the financial press about either rumors or threats of interventions in the yen-dollar market. Reports of both rumors and threats of interventions have not been included in compiling the data set on interventions, and only reports that specifically mention that central banks have intervened to either weaken or strengthen the yen have been included. The data on foreign exchange interventions, thus, includes four categories of interventions conducted during 1995–99: (a) unilateral interventions by the BoJ to weaken the yen; (b) coordinated interventions by the BoJ and the Fed to weaken the yen; (c) unilateral interventions by the BoJ to strengthen the yen; and (d) coordinated interventions by the BoJ and the Fed to strengthen the yen. No instances of unilateral interventions by the Fed in the yen-dollar market were identified in news reports during this period.

10. According to reports in the financial press, interventions in the yen-dollar market in the latter half of the 1990s were predominantly aimed at either preventing or reversing yen appreciation. Of these, unilateral interventions by the BoJ to stop the yen from strengthening far outnumbered coordinated interventions. While we identified about 32 unilateral interventions by the BoJ to prevent yen appreciation, there were only 6 such instances of coordinated interventions by the BoJ and the Fed. There were 9 instances of unilateral

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[5] See Cross (1998), Chang and Taylor (1998), and Dominguez (1999) for a more detailed description of central bank intervention operations.

interventions by the BoJ, and 2 instances of coordinated interventions by the BoJ and the Fed to either prevent or reverse yen depreciation. It is, of course, likely that news reports failed to identify some of the interventions that did take place during this period, and also, some of the interventions that were reported to have taken place in the press may well have not have occurred in reality. But such errors of identification are likely to be small, given that central banks, as discussed earlier, have used interventions for explicitly signaling their presence in foreign exchange markets.

### C. Sterilized Versus Unsterilized Interventions

11. The interventions in the yen-dollar market during this period have typically been sterilized—i.e., not allowed to have an impact on the monetary base and interest rates. While there is no explicit information on whether particular interventions were sterilized or not, central banks in industrial countries have in practice routinely offset the impact of foreign exchange interventions on the stance of monetary policy, as monetary policy has typically been used for achieving low rates of inflation rather than for a particular exchange rate objective. In the case of Japan, for instance, the impact of both yen selling and buying operations ordered by the Ministry of Finance on domestic liquidity is offset by the open market operations of the BoJ in order to maintain its desired level of daily excess reserves. In fact, with zero interest rates, sterilizing foreign exchange interventions has become particularly important to the BoJ, as markets have tended to focus on the level of excess reserves as an implicit indicator of the stance of monetary policy. Likewise, directives to the Foreign Exchange Desk of the Fed to sell dollars are simultaneously combined with directives to the Open Market Desk to mop up the resulting excess liquidity. This does not, however, imply that conditions in the foreign exchange market have had no influence on the monetary policy of industrial countries. Rather, the decision to change the stance of monetary policy, which could be influenced in part by exchange rate developments, has been separated in practice from the decision to intervene in the foreign exchange market. So, a test of the effectiveness of interventions in the yen-dollar market, is for all practical purposes, also a test of the effectiveness of sterilized interventions in this market.

12. Why should sterilized interventions, contrary to conventional wisdom, be expected to have an impact on the yen-dollar rate? That sterilized interventions can work should not come as a surprise when viewed from a historical perspective. As noted before, academic studies indicate that sterilized interventions were successful in the post-Plaza Accord period. Nevertheless, the persistent skepticism about the effectiveness of sterilized interventions in popular discourse appears to be based on a casual empiricism focusing on selective episodes of interventions, combined with an interpretation of the interest parity condition that underplays the importance of expectations in exchange rate determination.

13. The interest parity condition is often invoked as the theoretical rationale for the assessment that interventions work only when left unsterilized. Uncovered interest rate parity in its strict form states that, in equilibrium, the currency of the country with a higher interest rate is expected by market participants to depreciate against the currency of the country with the lower interest rate over the relevant time horizon, so that investors are indifferent

between holding the two currencies (see below). Under a simple view, sterilized intervention does not affect the interest rate differential, and therefore does not affect the exchange rate. By contrast, unsterilized interventions are expected to impact on the exchange rate because they change interest rate differentials.

14. However, because future expectations of the exchange rate enter the interest rate parity condition, the exchange rate is influenced not only by actual changes in monetary policy, but also by expectations of future changes in monetary policy. Consequently, even in the context of the interest rate parity condition, actions that provide signals about the future course of monetary policy should also have an impact on the exchange rate. Sterilized interventions can thus make a difference by providing signals to private agents about the future course of monetary policy.[6] Indeed, one of the main aims of central banks in carrying out sterilized interventions is to change the path of exchange rates by altering market participants expectations of the future course of monetary policy and economic fundamentals. It needs to be noted, however, that the signaling channel is less likely to be effective in situations where markets perceive the central bank not to be in full concurrence with the decision of the Ministry of Finance to intervene; sterilized interventions, in such situations, are likely to be less effective.

15. While sterilized interventions can also be expected to have an impact on exchange rates by changing the currency composition of assets held by the private sector—the portfolio balance effect—central bank interventions are too small a fraction of the daily turnover in the foreign exchange markets (typically about 1 percent) for them to make significant changes in the currency composition of assets held by the private sector. This is one of the reasons—besides the limited availability of daily data on the magnitude of the interventions—why the econometric strategy adopted in this paper focuses on the number and types of interventions in the yen-dollar market rather than on the actual quantities of foreign exchange spent on interventions.

16. Sterilized interventions can also be effective in circumstances where currencies stay persistently misaligned because bandwagon effects and collective action problems dominate the influence of fundamentals. Market players' decisions in such situations are conditioned by what other participants are likely to do rather than on what the underlying economic conditions warrant. For example, such a situation could emerge when no private agent is willing to be the first to buy or sell a currency that he judges to be misaligned, because of imperfect information about the beliefs of other market participants, or simply due to not wanting to make the first move in a game theoretic "common knowledge" setting. Such misalignments can persist for a considerable length of time as it is individually rational in such circumstances for each market participant not to bet against the market. In these

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[6] A comprehensive discussion of the signaling role of sterilized interventions can be found in Mussa (1981). For a discussion of the signaling role of interventions in Japan, see Watanabe (1994).

contexts, central banks can overcome the collective action problem by using sterilized intervention to signal their assessment of currency misalignment to the entire market.

## D. Interventions and the Exchange Rate

17. This section provides a model of the exchange rate for empirically examining the impact of interventions on the yen-dollar rate. Interventions in this model work through providing information about the future course of monetary policy.

### The Model

18. Consider a simple uncovered interest rate parity (UIP) equation for the exchange rate with no risk premium, where the expected change in the exchange rate over a k-period horizon is equal to the interest rate differential over the same horizon:

$$E(e_{t+k} \mid \Omega_t) - e_t = i_t - i_t^* \qquad (1)$$

where $e_t$ is (the logarithm of) the price of the dollar in terms of yen, $k$ is the maturity of the interest rate, and $i_t$ and $i_t^*$ are, respectively, interest rates in Japan and the U.S. Rewriting this condition as an equation for the current exchange rate without restricting the coefficients gives:

$$e_t = \gamma E(e_{t+k} \mid \Omega_t) + \beta(i_t - i_t^*) \qquad (2)$$

Under UIP, $\gamma$ would be equal to 1 and $\beta$ equal to –1. Equation (2), generalized further to include a risk premium term, is the basis of most recent econometric models of the exchange rate. These models are usually estimated by replacing the expected value of the exchange rate by its actual value (see, for example, Wadhwani, 1999). In this paper we highlight the role of expectations by focusing on the rational expectations solution of (2). Under the assumption that $\gamma$ is less than one, which is required for stability, the solution of (2) is:

$$e_t = \beta \sum_{j=0}^{\infty} \gamma^j E[(i_{t+j,k} - i^*_{t+j,k}) \mid \Omega_t] \qquad (3)$$

where expectations of the interest rate differential appear in $k$-period sequences because the order of the rational expectations equation is $k$. The implied long-run coefficient of the interest-rate differential in this equation is equal to $\beta(1-\gamma)$, which for $\gamma$ smaller than 1, would be negative.

19. To compute future expectations of the interest rate differential, assume that this variable follows an auto-regressive process and, as argued above, is also influenced by announcements of interventions over a relevant horizon. Past exchange rates could also influence perceptions about the future course of monetary policy and are included in the equation. Representing interventions by $D_t$ we have:

$$E[i_{t+j,k} - i^*_{t+j,k} \mid \Omega_t] = \sum_{i=0}^{h} \alpha_i (i_{t-i} - i^*_{t-i}) + \sum_{i=1}^{l} \psi_i e_{t-i} + \sum_{i=1}^{j} \lambda_i D_{t-i} \qquad (4)$$

This simple formulation abstracts from explicitly incorporating expectations of future interventions on current interest rates.[7] Substituting (4) into (3) gives a dynamic equation relating the exchange rate to its past values, current and past values of interest rate differentials, and intervention dummies. This equation would have the following general representation:

$$e_t = \sum_{i=1}^{n} \lambda_{t-i} e_{t-i} + \sum_{i=0}^{m} \delta_i (i_{t-i} - i^*_{t-i}) + \sum_{i=1}^{p} \eta_i D_{t-i} \qquad (5)$$

Although this relationship is loosely derived from a rational expectations model, it does not impose the restrictions implied by rational expectations on the coefficients. Note also that while interventions in this model are assumed to operate primarily through their signaling effect regarding future interest rates, empirical support for the model would clearly not exclude the possibility that interventions could operate through other channels as well—for example through the risk premium, as in Dominguez and Frankel (1993).

**Estimation of the Long-Run Relationship**

20. The model leading to equation (5) can be estimated using the VAR methodology. Since both the yen-dollar rate and the interest rate differentials appear to contain unit roots[8], it is necessary to test for a cointegrating VAR relationship. For simplicity, we do not include the intervention dummies in the long-run relationship, but only in the resulting short-run error correction model; including the dummies in the long-run relationship, however, makes little difference to the results. It is important to note in this context that since the yen-dollar rate is a non-stationary variable, any temporary shock to it will have an impact on its long-run path. Thus, a finding that interventions have an impact on the change in the yen-dollar rate during any particular period (see below) also implies that they have a long-run effect on the yen-dollar rate.

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[7] Given the discrete nature of the intervention variables and their dependence on past exchange rates (as modeled below), an explicit incorporation of their future expectations would make the model highly non-linear and intractable (see Pesaran and Samiei, 1995).

[8] ADF tests of order 12 including an intercept and a linear trend gives a value of –1.67 for the logarithm of the exchange rate and –2.83 for the interest rate differential, against a critical value of –3.42. ADF tests on first differences of the two variables gives -10.63 and –11.58, respectively, against a 95 percent critical value of –3.42.

21. The tabulation below reports the results of the Johansen test for cointegration.

Cointegration Likelihood Ratio for the Yen-Dollar Rate Equation[1/]

| | | Maximum Eigenvalue | | Trace | |
|---|---|---|---|---|---|
| Null | Alternative | Statistic | 95% cv | Statistic | 95% cv |
| r = 0 | r = 1 | 21.96 | 19.22 | 30.74 | 25.77 |
| r ≤ 1 | r = 2 | 8.79 | 12.39 | 8.78 | 12.39 |

1/ Based on cointegrating VAR of order 4, with unrestricted intercepts, and restricted trend, which includes both the yen-dollar rate and the interest rate differential as endogenous I (1) variables.

The estimations indicate that there is one cointegrating relationship between the exchange rate and the interest rate differential that includes a trend and an intercept term. Thus, the two variables move together in the long run according to the following relationship: $e = 0.165(i - i^*) + 0.0003t$. Note in this context that this result is not necessarily consistent with the strict UIP condition, which by requiring that $\gamma$ equals unity implies a long-run relationship between the interest rate differential and the *change* in the exchange rate. Moreover, if $\gamma < 1$, as required by the stability condition for the rational expectations solution, then the relationship between the interest rate differential and the exchange rate should be *negative*. Although a positive coefficient for the interest rate differential is consistent with the findings of some other studies—which use lower-frequency data and/or have been estimated over different time periods[9]—restricting the coefficient to be small and negative is not rejected by the data, suggesting that a wide range of coefficients can give a cointegrating relationship. The multiplicity of potential cointegrating relationships, however, has little impact on the results on interventions in the next section.

**Error-Correction and Intervention Dummies**

22. The data on daily intervention in the yen-dollar market obtained from news reports during 1995-99 are classified into 4 categories:

Type 1: BoJ intervenes to weaken the yen (incidence 32 times)
Type 2: BoJ and the Fed intervene to weaken the yen (incidence 6 times)
Type 3: BoJ intervenes to strengthen the yen (incidence 9 times)
Type 4: BoJ and the Fed strengthen the yen (incidence twice)

23. Representing each single intervention by a dummy variable should in principle allow us to test the effectiveness of every intervention made during this period. However, given the number of observations, adopting such a strategy would make the estimations unwieldy. On the other hand, the strategy of distinguishing the interventions only by the above four broad categories would fail to take into account the fact that not all interventions are equally

[9] See, for example, Wadhwani (1999).

effective. A close look at the data on interventions indicates that they tend to occur in clusters. Consequently, to distinguish better the effects of these clusters of interventions within each broad category, we subdivide them based on how they were bunched up during 1995–99. In the case of type 1 interventions, we identify 9 distinct intervention clusters, represented by 9 dummies, $D_{11}$ to $D_{19}$, each taking the value 1 in the event of an intervention of type 1 in that particular episode, and zero otherwise. In the case of type 2 intervention, 3 episodes are identified, $D_{21}$ to $D_{23}$; in the case of type 3 intervention, there are 4 episodes, $D_{31}$ to $D_{34}$; and finally in the case of type 4 intervention, only 1 episode, $D_4$, is identified. Thus, we define 17 intervention dummies altogether for the estimations. The expected signs of the coefficients on types 1 and 2 dummies are positive, and negative on types 3 and 4. An examination of the exchange rate data suggests the presence of an important outlier—i.e., the substantial appreciation of the yen associated with the collapse of the carry-trades during August-October 1998. To isolate this effect, we include a carry-trade-dummy—$D_{ct}$—in the regressions to capture the largest exchange rate movements associated with this particular episode.

24. Table III.1 presents the estimated short-run error-correction model of the yen-dollar rate, with the error-correction term calculated using the cointegrating relationship derived above, and including the intervention dummies and their one-period lagged values. In order to highlight the impact of interventions on the yen-dollar rate, a parsimonious version of the model that includes only the correctly signed significant dummies is presented in Table III.2. The results provide support for the hypothesis that interventions, on the whole, do make a difference to the yen-dollar rate, and that they have been successful on a number of occasions in changing the path of the exchange rate in the desired direction. Exclusion of the intervention dummies from the equation is strongly rejected by the data [F(34,1549)=3.74(0.00)]. Moreover, although as indicated by the R-squared, the estimated model explains only a small portion of the daily fluctuations in the yen-dollar rate, it clearly outperforms a simple random walk model, which would require that no variable has a significant influence on the change in the exchange rate.[10]

25. While the residuals in the above specification fail the normality test—as would be expected with high-frequency exchange rate data—alternative methods of estimating the model to deal with this problem suggest that the results are quite robust. Since an F-test does not reject the presence of Autoregressive Conditional Heteroscedasticity (ARCH) type effects in the residuals (F(6,1536) = 26.01 [0.00]), the normality problem could be dealt with by estimating a Generalized ARCH (GARCH) model. We use the parsimonious specification of the model, as presented in Table III.2, to estimate a GARCH(1,1) model. This model allows the conditional variance of the error term to depend on the absolute value of the

[10] This result holds even when the carry-trade-dummy—which contributes significantly to the value of the R-squared—is excluded. While the inclusion of this dummy variable is justified on economic and statistical grounds, it cannot be treated as a genuine explanatory variable, given that it is defined *ex post*.

Table III.1. Estimated Error Correction Model of Interventions Based on Cointegrating VAR

Dependent variable is $\Delta e_t$
1585 observations used for estimation from 5 to 1589

| Regressor | Coefficient | T-Ratio [Prob] |
|---|---|---|
| C | -0.017 | -2.56 [0.01] |
| $D_{ct}$ | -0.074 | -13.40 [0.00] |
| D11 | 0.002 | 0.62 [0.54] |
| D11(-1) | -0.007 | -2.31 [0.02] |
| D12 | 0.008 | 1.55 [0.12] |
| D12(-1) | 0.003 | 0.55 [0.58] |
| D13 | -0.003 | -0.83 [0.41] |
| D13(-1) | -0.009 | -2.32 [0.02] |
| D14 | 0.000 | 0.02 [0.98] |
| D14(-1) | -0.002 | -0.53 [0.60] |
| D15 | 0.011 | 2.02 [0.04] |
| D15(-1) | 0.004 | 0.72 [0.47] |
| D16 | 0.008 | 2.26 [0.02] |
| D16(-1) | -0.001 | -0.38 [0.70] |
| D17 | -0.003 | -0.54 [0.59] |
| D17(-1) | -0.013 | -2.09 [0.04] |
| D18 | -0.012 | -1.95 [0.05] |
| D18(-1) | 0.006 | 0.99 [0.33] |
| D19 | -0.003 | -0.46 [0.65] |
| D19(-1) | 0.011 | 2.01 [0.05] |
| D21 | -0.002 | -0.46 [0.64] |
| D21(-1) | -0.009 | -1.92 [0.06] |
| D22 | -0.003 | -0.37 [0.71] |
| D22(-1) | 0.031 | 4.10 [0.00] |
| D23 | 0.013 | 2.81 [0.01] |
| D23(-1) | 0.018 | 4.02 [0.00] |
| D31 | 0.003 | 0.45 [0.65] |
| D31(-1) | -0.004 | -0.46 [0.65] |
| D32 | -0.003 | -0.57 [0.57] |
| D32(-1) | -0.002 | -0.39 [0.70] |
| D33 | 0.006 | 1.42 [0.16] |
| D33(-1) | -0.009 | -2.01 [0.05] |
| D34 | -0.001 | -0.13 [0.89] |
| D34(-1) | -0.009 | -2.03 [0.04] |
| D4 | 0.001 | 0.13 [0.90] |
| D4(-1) | -0.030 | -4.70 [0.00] |
| $\Delta e_t$ (-1) | -0.070 | -2.89 [0.00] |
| $\Delta e_t$ (-2) | -0.019 | -0.82 [0.41] |
| $\Delta e_t$ (-3) | -0.070 | -2.94 [0.00] |
| $\Delta(i_t - i_t^*)$ (-1) | -0.001 | -0.41 [0.68] |
| $\Delta(i_t - i_t^*)$ (-2) | 0.000 | 0.04 [0.97] |
| $\Delta(i_t - i_t^*)$ (-3) | -0.009 | -2.41 [0.02] |
| EC(-1) | 0.003 | 2.57 [0.01] |

| | | | |
|---|---|---|---|
| R-Squared = | 0.172 | R-Bar-Squared = | 0.149 |
| S.E. of Regression = | 0.0077 | F-Stat. F( 17,1567) = | 7.62 [.000] |
| Mean of Dependent Variable = | -0.24E-4 | S.D. of Dependent Variable = | 0.0084 |
| Residual Sum of Squares = | 0.092 | Equation Log-likelihood = | 5480.6 |
| Akaike Info. Criterion = | 5437.6 | Schwarz Bayesian Criterion = | 5322.2 |
| DW-statistic = | 2.028 | | |

$\chi^2_{sc}(1) = 1.418$ [0.23] Test for serial correlation

$\chi^2_{ff}(1) = 3.833$ [0.05] Test for functional form

$\chi^2_n(2) = 530.221$ [0.00] Test for normality

$\chi^2_{he}(1) = 0.431$ [0.51] Test for hetroscedasticity

The dependent variable $\Delta e$ is the change in the logarithm of the yen-dollar rate. EC is the error correction term from the cointegrating VAR reelationship. C is the constant. The $D_i$'s represent the dummies for different type of interventions as described in the text.

Table III.2. Parsimonious Estimated Error Correction Model of Interventions Based on Cointegrating VAR

Dependent variable is $\Delta e_t$
1585 observations used for estimation from 5 to 1589

| **Regressor** | **Coefficient** | **T-Ratio [Prob]** |
|---|---|---|
| C | -0.018 | -2.67 [0.01] |
| $D_{ct}$ | -0.074 | -13.27 [0.00] |
| D15 | 0.011 | 2.08 [0.04] |
| D16 | 0.008 | 2.30 [0.02] |
| D19(-1) | 0.011 | 2.03 [0.04] |
| D22(-1) | 0.032 | 4.12 [0.00] |
| D23 | 0.010 | 2.23 [0.03] |
| D23(-1) | 0.018 | 3.98 [0.00] |
| D33(-1) | -0.010 | -1.99 [0.05] |
| D34(-1) | -0.009 | -2.02 [0.04] |
| D4(-1) | -0.029 | -5.28 [0.00] |
| $\Delta e_t$ (-1) | -0.062 | -2.58 [0.01] |
| $\Delta e_t$ (-3) | -0.064 | -2.74 [0.01] |
| $\Delta(i_t - i_t^*)$ (-3) | -0.009 | -2.41 [0.02] |
| EC(-1) | 0.003 | 2.67 [0.01] |

| | | | |
|---|---|---|---|
| R-Squared = | 0.152 | R-Bar-Squared = | 0.145 |
| S.E. of Regression = | 0.0077 | F-Stat. F( 17,1567) = | 20.17 [.000] |
| Mean of Dependent Variable = | -0.24E-4 | S.D. of Dependent Variable = | 0.0084 |
| Residual Sum of Squares = | 0.092 | Equation Log-likelihood = | 5462.2 |
| Akaike Info. Criterion = | 5447.2 | Schwarz Bayesian Criterion = | 5406.9 |
| DW-statistic = | 2.00 | | |

$\chi^2_{sc}(1) = 0.24E\text{-}4$ [0.99] Test for serial correlation

$\chi^2_{ff}(1) = 4.02$ [0.05] Test for functional form

$\chi^2_{n}(2) = 523.41$ [0.00] Test for normality

$\chi^2_{he}(1) = 0.305$ [0.58] Test for hetroscedasticity

The dependent variable $\Delta e$ is the change in the logarithm of the yen-dollar rate. EC is the error correction term from the cointegrating VAR reelationship. C is the constant. The $D_i$'s represent the dummies for different type of interventions as described in the text.

residual in the previous period and its own lagged value, as well as the carry-trade-dummy.[11] The results, reported in Table III.3, indicate clearly that the significance of the interventions dummies is essentially unaffected by allowing for ARCH effects in the residuals.

26. The inference to be drawn from these estimation results is that interventions appear to have had a reasonable chance of success in the yen-dollar market, especially when they were coordinated. Out of the seventeen episodes of interventions identified in the analysis, eight appear to have led, within two days, to a significant movement of the exchange rate in the desired direction; and the remaining nine are mostly associated with no significant movements in either direction. This is a particularly noteworthy result given that interventions are, by design, likely to take place when the exchange rate is moving in an undesired direction, and hence, create a tendency for the estimated coefficients to be wrongly signed. That is, even when an intervention succeeds partially in precluding the exchange rate from moving further in the undesired direction, one would not necessarily observe a correctly signed estimated coefficient on the dummy variables. The fact that we observe the estimated coefficients on the dummy variables to be correctly signed and significant in about 50 percent of the episodes is a testament to the reasonable level of success achieved by interventions in the yen-dollar market.

27. The results also indicate that coordinated interventions tend to be clearly much more effective than unilateral interventions when it comes to both strengthening the yen as well as weakening it. The least effective have been type 1 interventions—attempts by the BoJ to weaken the yen—with only three successful episodes (the coefficient of either the dummy or its lagged value is significant with the right sign at 5 percent rejection probability) out of a total of nine. All other categories of interventions appear to have had a higher success rate than type 1 interventions. Two out of the three episodes of type 2 intervention have been successful, as have been two of the four episodes of type 3 interventions. The only episode of type 4 intervention also proved effective. In particular, the two successful cases of coordinated interventions to weaken the yen, lowered it by 2–3 percent against the dollar in each case ($D_{23}$ and $D_{33}$). In the case of interventions to strengthen the yen, the only episode of coordinated action succeeded in pushing up its exchange value by 3 percent ($D_4$). Unilateral interventions, in contrast, are associated with smaller changes in the exchange rate, generally by about 1 percent or less. The fact that unilateral interventions by the BoJ to strengthen the yen appear to have been somewhat more successful than interventions to weaken it poses interesting policy issues, given that interventions in the yen-dollar market have largely been unilateral actions by the BoJ to weaken the yen. It is necessary to emphasize again that, given the non-stationarity of the exchange rate variable, the short-run effects of the interventions captured in the regressions have persistent effects on the yen- dollar rate. Also, the

[11] The alternative of including the square of the residuals instead of their absolute value caused computational difficulties.

Table III.3. Estimated GARCH(1, 1) Model of Interventions

Dependent variable is $\Delta e_t$
1585 observations used for estimation from 5 to 1589

| **Regressor** | **Coefficient** | **T-Ratio [Prob]** |
|---|---|---|
| C | -0.020 | -39.51 [0.00] |
| $D_{ct}$ | -0.072 | -5.80 [0.00] |
| D15 | 0.012 | 1.68 [0.09] |
| D16 | 0.009 | 2.98 [0.03] |
| D19(-1) | 0.014 | 4.14 [0.00] |
| D22(-1) | 0.032 | 21.08 [0.00] |
| D23 | 0.011 | 2.36 [0.02] |
| D23(-1) | 0.018 | 3.96 [0.00] |
| D33(-1) | -0.012 | -2.72 [0.01] |
| D34(-1) | -0.010 | -2.47 [0.01] |
| D4(-1) | -0.029 | -5.12 [0.00] |
| $\Delta e_t$ (-1) | -0.045 | -1.77 [0.08] |
| $\Delta e_t$ (-3) | -0.039 | -1.85 [0.06] |
| $\Delta(i_t - i_t^*)$ (-3) | -0.006 | -2.02 [0.04] |
| EC(-1) | 0.004 | 38.85 [0.00] |

| | | | |
|---|---|---|---|
| R-Squared = | 0.150 | R-Bar-Squared = | 0.141 |
| S.E. of Regression = | 0.0078 | F-Stat. F( 17,1567) = | 16.27[.000] |
| Mean of Dependent Variable = | -0.24E-4 | S.D. of Dependent Variable = | 0.0084 |
| Residual Sum of Squares = | 0.095 | Equation Log-likelihood = | 5566.9 |
| Akaike Info. Criterion = | 5548.9 | Schwarz Bayesian Criterion = | 5500.5 |
| DW-statistic = | 2.028 | | |

Parameters of the Conditional Heteroscedastic Model
Explaining H, the Conditional Standard Error of the Error Term

| | Coefficient | Asymptotic Standard Error |
|---|---|---|
| Constant | 0.260E-3 | 0.326E-4 |
| ABS (E(- 1)) | 0.106 | 0.015 |
| H (- 1) | 0.886 | 0.011 |
| $D_{ct}$ | 0.004 | 0.003 |

H stands for the conditional standard error of the error term.
E stands for the error term.
The dependent variable $\Delta e$ is the change in the logarithm of the yen-dollar rate. EC is the error correction term from the cointegrating VAR reelationship. C is the constant. The $D_i$'s represent the dummies for different type of interventions as described in the text.

significance of the intervention dummies is quite independent of the nature of the long-run relationship discussed in the previous section.[12]

28. The finding that coordinated interventions are probably more effective than unilateral ones can be related to the fact that the former provides signals about the future course of monetary policy in both countries, which is obviously of greater relevance to exchange rate determination. Moreover, coordinated interventions also provide implicit external sources of validation for the decision taken by each central bank to intervene, and motivate market participants to assign a higher probability to the expectation that the signals will portend changes in the future course of monetary policy.

29. Finally, an issue that is of interest to central bankers in this context is the so-called momentum factor. While interventions normally occur in response to unfavorable movements in the exchange rate, central banks, in making choices about the appropriate time to intervene, may prefer to wait for a misaligned currency to move spontaneously for a few days in the desired direction, so that intervention can make use of the momentum in the exchange rate to push it further in the desired direction. It could be argued that interventions are likely to have a higher chance of success when momentum is present than when the central bank tries to lean against the wind. Testing this hypothesis formally in the dummy variable setting is not straightforward. Including interaction terms involving the cumulative change in the yen-dollar rate over a period prior to intervention and the intervention dummies can produce correctly signed coefficients which can, however, be the result of an ineffective intervention combined with prior movements of the exchange rate in the undesired direction (results not reported here). Given the ambiguities involved in using this methodology, an alternative approach is simply to check the data visually for the momentum factor. That, however, does not provide much support one way or the other about the importance of momentum. In particular, of the eight intervention episodes that appear to have been successful, only two or three could be considered to have taken place in an environment where the exchange rate was already moving in the desired direction for a reasonable period of time prior to intervention (see Figure III.2).

### E. Triggers for Interventions

30. There are two distinct sets of issues relating to the triggers for intervention in the yen-dollar market. The first is the question of why the BoJ intervenes so much more frequently than the Fed in the yen-dollar market, particularly when it comes to stemming yen appreciation. The second revolves around the search for patterns in past exchange rate movements that can offer clues about when the probability of interventions is high.

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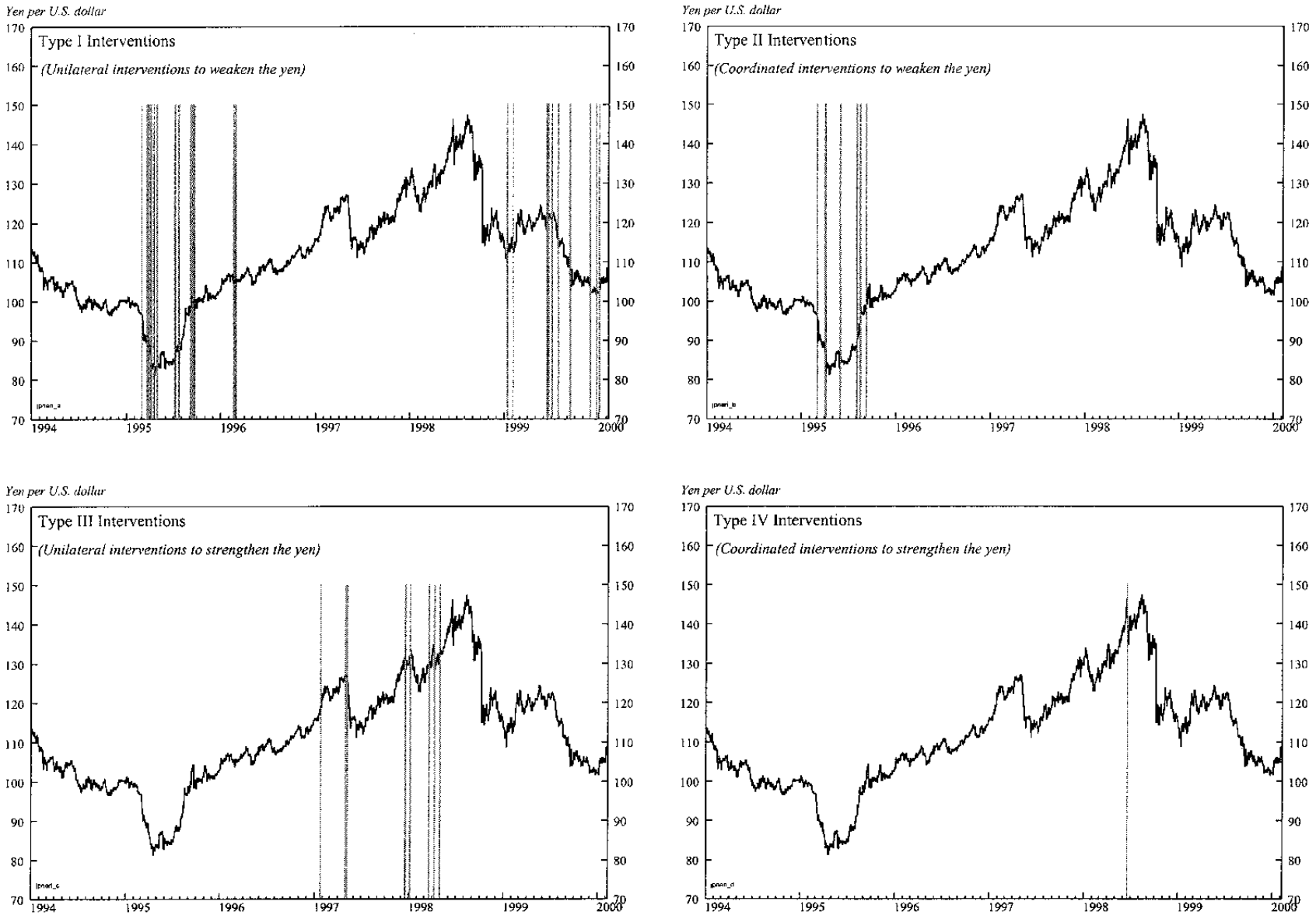
[12] In particular, the absence of clear support for the interest rate parity hypothesis has no bearings for the short-run model, and removing the error-correction term from the equation makes little difference to the estimation results.

# Figure III.2. Japan: Exchange Rate Interventions




Sources: Bloomberg, LP; and staff calculations.

31. An intuitive answer to the question of why the BoJ intervenes much more frequently than the Fed would be that the exchange rate matters more to the Japanese economy than it does to the U.S. economy. This would indeed be the case if foreign trade played a more important role in Japan than it did in the United States. However, the exposure of the Japanese economy to foreign trade is broadly similar to that of the United States. The average value of exports and imports expressed as a percentage of GDP, a standard measure of the degree of "openness", was about 12 percent in Japan in the latter half of the 1990s, compared to about 14 percent in the United States.

32. Even though the exposure of the Japanese economy to foreign trade is marginally lower than in the United States, it still happens to be the case that fluctuations in the yen-dollar rate have stronger effects on the former than they do on the latter. Figure III.3 offers clues to the source of this puzzle. Japan's nominal effective exchange rate (the exchange value of the yen against a weighted average of the exchange rates of trading partners) has tended to move closely in tandem with the yen-dollar rate. The dollar's nominal effective exchange rate, in contrast, has moved quite independently of the yen-dollar rate. The reason for this dichotomy lies in the fact that Japan trades with a number of countries that have linked their currencies to the dollar. Consequently, every time that the yen strengthens against the dollar, it also strengthens against the other currencies that are fixed to the dollar, which has the effect of dampening the external sector's support for the economy. Fluctuations in the yen-dollar rate, however, impact on the U.S. economy only in as far as they affect trade with Japan. The relatively stronger impact of changes in the yen-dollar rate on the Japanese economy provides a plausible explanation for why the BoJ intervenes much more frequently than does the Fed.

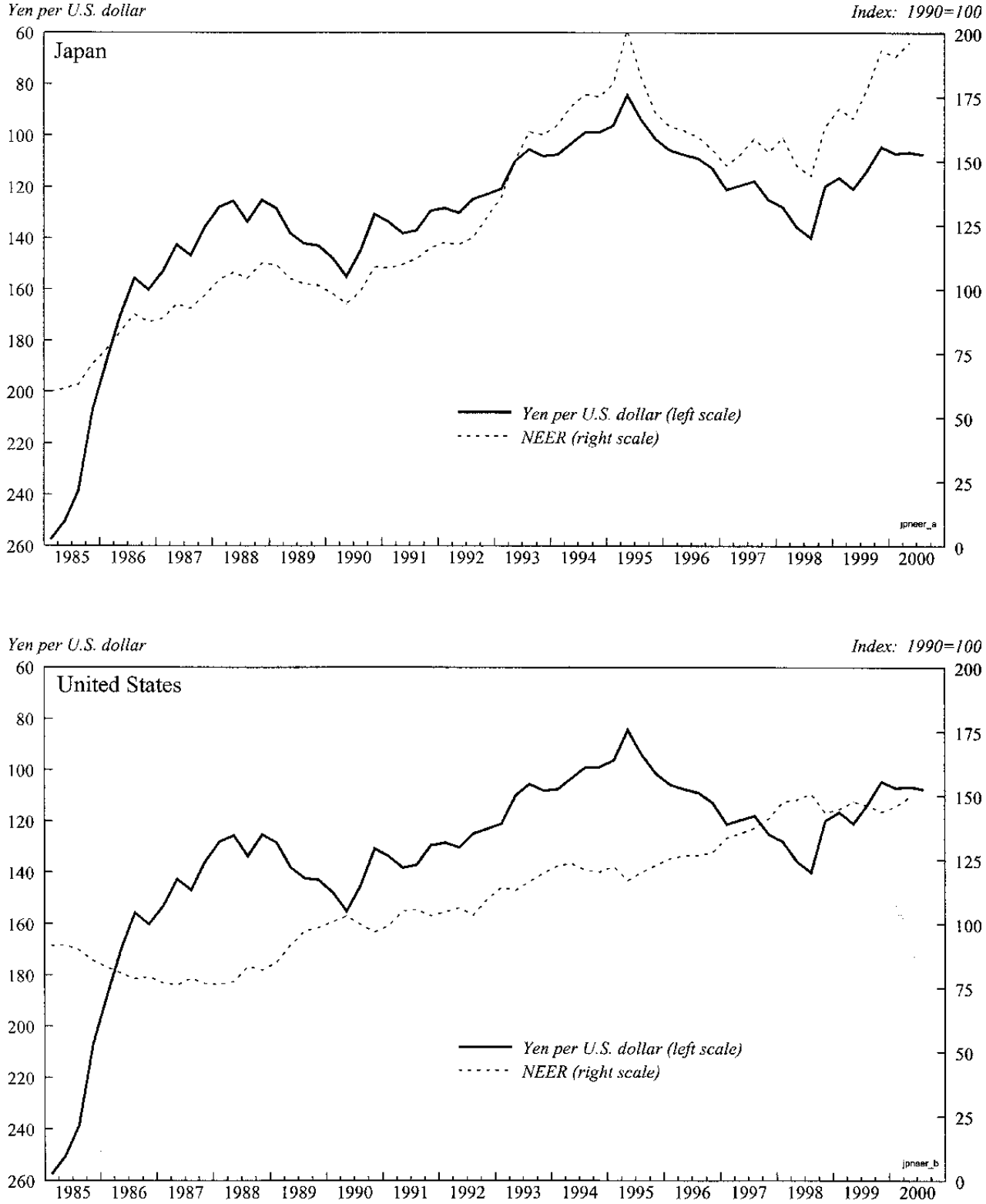
33. What precisely sets off interventions in the yen-dollar market? Neither the BoJ nor the Fed are in the practice of providing detailed explanations for why they intervened in particular instances. The Japanese authorities, however, emphasize in their public statements that they do not target any particular value of the exchange rate; they claim, instead, to intervene primarily for resisting both an "excessive appreciation" and an "excessive depreciation" of the yen. An interesting issue to examine, therefore, is whether episodes of rapid changes in the yen-dollar rate have in practice triggered interventions.

34. Probit models provide a useful econometric technique for identifying the triggers for intervention. In this setting, the intervention event, $D_t$, defined as a dummy that takes the value 1 in the event of intervention (of any type) and zero otherwise, could be considered as the observed counterpart of the underlying smooth response variable, $D^*_t$, which responds linearly to variables such as the extent of the absolute change in the exchange rate during a specified period. Thus:

$$D_t^* = \theta' x_t + u_t \qquad (7)$$

where $x_t$ is the set of exogenous variables that influence the response variable, and $u_t$ is an error term. Then:

Figure III.3. Japan: Exchange Rate Comparisons




Source: IMF, Information Notice System.

$$D_t = 1 \quad \text{if } D_t^* \geq 0$$
$$= 0 \quad \text{otherwise} \qquad (8)$$

The system of equations 7-8 can be estimated by the maximum-likelihood method. The absolute value of the cumulative change in the yen-dollar rate over the previous 5 days is included as an explanatory variable. The change in the exchange rate on the same day of the intervention is excluded to avoid simultaneity problems. The estimations also include the lagged value of $D_t$, and the results are reported in Table III.4.

35. The estimated results of the probit model indicate that the Japanese authorities have in practice intervened to stem both an "excessive" appreciation and an "excessive' depreciation of the yen-dollar rate, consistent with their official pronouncements about exchange rate policy. It needs to be emphasized, however, that the probit model does not provide a complete explanation of the triggers for interventions. This is not surprising, given that the Japanese authorities are likely to be more comfortable with exchange rate fluctuations around certain levels of the yen-dollar rate than over others, even though there are no official pronouncements about what these zones of comfort are. Consequently, movements in the yen-dollar rate over some ranges are unlikely to provoke interventions in practice.

36. As discussed earlier, there could also be an asymmetry between how the Japanese authorities respond to yen appreciation and yen depreciation—being somewhat quicker to move when the yen appreciates rather than when it depreciates. Another factor that might explain the relatively low explanatory power of the probit model is related to the fact that the exchange rate can, at times, move autonomously in the direction desired by the BoJ. For instance, the sharp appreciation of the yen following the collapse of the yen-carry-trades during the global financial crisis in August 1998, is an example of a rapid and sustained change in the yen-dollar rate that did not initially warrant any interventions.

Table III.4. Probit Model of Triggers for Interventions

Dependent variable is the intervention dummy, D
1583 observations used for estimation from 8 to 1590

| **Regressor** | **Coefficient** | **T-Ratio [Prob]** |
|---|---|---|
| C | -2.0646 | -22.4899 [.000] |
| D (-1) | 1.2102 | 5.8929 [.000] |
| AE | 7.1924 | 1.9543 [.051] |

Factor for the calculation of marginal effects = .062756
Maximized value of the log-likelihood function = -207.9102
Mean of D = .032217
Pseudo-R-Squared = .077461

The dependent variable D denotes intervention of all types. C is a constant, and AE denotes the absolute change in the yen-dollar rate over a five-day period.

37. The probit model indicates that interventions in the yen-dollar market tend to occur in clusters. Lagged intervention has a statistically significant coefficient, implying that if there has been an intervention today, then there is a good chance that there will be another one tomorrow.

## F. Conclusions

38. As the Japanese economy attempts, haltingly, to pull out from a decade long stagnation, with short-term interest rates close to zero and fiscal stimulus having approached its practical limits, the role that foreign exchange interventions can play in providing support to the economy has gained attention. The findings of this paper indicate that there may indeed be a role for foreign exchange interventions in providing stimulus at the current conjuncture, given that interventions have succeeded on a number of occasions during 1995-99 in changing the path of the yen-dollar rate in the desired direction. Nevertheless, the impact that interventions can have on the economy needs to be put into the proper perspective, as the typical intervention when successful has a relatively small, though persistent, impact on the yen-dollar rate.

39. Both the BoJ and the Fed, like central banks in other industrial countries, routinely sterilize interventions. The fact that interventions in the yen-dollar market have made a difference implies that sterilized interventions, contrary to conventional wisdom, have mattered. The paper has argued that sterilized interventions work by altering market participants' expectations of the future course of monetary policy and economic fundamentals, and also by overcoming bandwagon effects. As the signaling effects of sterilized interventions are far more powerful than the portfolio effects, market perceptions of disagreements between central banks and the authorities in charge of intervention decisions have the potential to mute the effectiveness of interventions. The paper also finds that coordinated interventions are more effective than unilateral interventions—they have a higher probability of success, and when successful move the yen-dollar rate by a larger margin (on average by about three times) than unilateral interventions do.

40. The BoJ intervenes more frequently in the yen-dollar market than the Fed does. This paper has argued that the higher frequency of interventions by the Japanese authorities is in part related to the fact, that unlike in the United States, Japan's nominal effective exchange rate moves in close synchronization with the yen-dollar rate. Consequently, when the yen strengthens against the dollar, it implies a stronger negative shock for the Japanese economy than an appreciation of the dollar against the yen does for the U.S. economy. However, the disconcerting finding in this context is that unilateral interventions by the BoJ to weaken the yen have had somewhat less success in practice than its actions to strengthen the yen.

41. Official statements by the Japanese authorities often emphasize that they do not target any particular value of the exchange rate; instead, they claim to intervene primarily for resisting both an "excessive appreciation" and an "excessive depreciation" of the yen. The estimated probit model indicates that relatively large and sustained changes in the exchange value of the yen in either direction during 1995–99 did have a high probability of triggering

interventions. And these interventions occurred in clusters—if there is an intervention today, there is a strong likelihood that there will be another one tomorrow.

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# IV. Deposit Insurance Reform

by James Morsink

## A. Introduction

1. Deposit insurance reform is a central element in the authorities' strategy to strengthen the Japanese banking system. While blanket deposit insurance has been helpful in containing systemic strains during recent difficult years, the re-imposition of limited deposit insurance coverage is critical to enhancing market discipline and reducing moral hazard in the future, thus decreasing the risk of a recurrence of systemic banking problems. Moreover, the prospect of limited coverage has complemented the authorities' broader efforts to strengthen the supervisory and regulatory framework, and is thus reinforcing the pressure on banks to speed up their restructuring efforts.

2. International experience points to three conditions that are critical for a robust system of limited deposit insurance:

- Market discipline by large depositors and creditors. Successful systems of limited deposit insurance expose creditors and large depositors to risk, and thereby provide the incentives for them to monitor the condition of their bank. For the risk of bearing losses to be credible, resolution methods for dealing with failed banks must be well-understood and the authorities must be prepared to use them. To minimize the burden on the taxpayer, resolution tools need to be endowed with flexibility and speed, while aiming at least-cost solutions.

- A strong regulatory and supervisory framework. To protect the deposit insurance fund and to limit systemic risks, troubled banks need to be identified at an early stage and their problems addressed expeditiously, preferably well before a weak bank becomes insolvent. Key elements of such a framework include strong capital adequacy standards and a well-funded and well-staffed supervisory agency.

- Depository institutions that are basically sound. The banking system as a whole, including smaller financial institutions, needs to be sufficiently strong to withstand the removal of the blanket guarantee and the associated increase in market discipline. It is also important that the banking system be *perceived* as basically sound.

3. After a background section, the remainder of this chapter addresses each of these issues in turn. The discussion draws lessons from international experience in general and recent U.S. experience in particular, since the present U.S. system seems to offer the closest parallel to the approaches being introduced by the Japanese authorities.

## B. Background[1]

4. While Japan established an explicit deposit insurance system in 1971, the deposit insurance fund has never been used to pay off depositors of a failed bank.[2] The original mandate of the Deposit Insurance Corporation (DIC) was limited to collecting insurance premia and paying off insured depositors of failed institutions.[3] Thus, unlike the U.S. Federal Deposit Insurance Corporation, the DIC of Japan was not expected to play an active role in the resolution of distressed financial institutions. Even with this limited mandate, the DIC's funding was low by international standards.[4] Moreover, no formal guidelines for the suspension of a bank's operations existed until recently, and there were no separate insolvency procedures for banks until 1998. Finally, resort to the bankruptcy process would have automatically resulted in deposit payoffs, an outcome that is generally less favorable than the wide variety of possible purchase and assumption (P&A) transactions.[5]

5. Until the 1990s, the process for managing bank failures was in practice largely *ad hoc*. Using its branch licensing authority, the Ministry of Finance (MOF) encouraged stronger banks to absorb insolvent institutions through what amounted to informal, administratively-orchestrated, whole-bank P&A transactions.[6] In addition, at times the Bank of Japan (BOJ) provided loans to distressed banks in order to prevent systemic crises. This regulatory approach to bank failure was sometimes referred to as the "convoy system." The informal framework was supported by the practice of limited disclosure, high barriers to entry, no failures (other than through mergers), and implicit full deposit insurance coverage. The concentration of information in the hands of MOF regulators and stronger banks, which

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[1] This section draws heavily on Milhaupt (1999).

[2] The statutory payoff limit was initially set at ¥1 million, increased in 1974 to ¥3 million, and rose in 1986 to ¥10 million, the current level. A second deposit insurance system, covering agricultural and fishery cooperatives, was established in 1973.

[3] A 1986 amendment to the Deposit Insurance Law allowed the DIC to provide financial assistance in connection with mergers of troubled banks. However, the amount of assistance was limited to the hypothetical cost of paying off depositors. The cost of resolving troubled institutions usually exceeded this ceiling, so mergers continued to take place outside the formal deposit protection system.

[4] For example, the ratio of insurance fund reserves to covered deposits in Japan was only 0.07 percent in 1995, compared to 1.30 percent in the United States.

[5] In a purchase and assumption transaction, the acquiring bank purchases some or all of the failed bank's assets and assumes some or all of the failed bank's liabilities.

[6] Branch growth constituted the principal form of competition between city banks under the regulated interest rate regime.

monitored weaker banks, greatly limited the role of market discipline. Ueda (1996) noted that "the most important safety-net system in our country has not been the deposit insurance system, but the public's confidence in the MOF and BOJ's ability to avoid a major instability in the financial system."

6. This implicit blanket deposit protection had some advantages in an economy dominated by bank finance and bank-led corporate governance. As banks held considerable borrower-specific information that could not be transferred costlessly to other lenders, bank failure would jeopardize these valuable economic relationships. At the same time, high entry barriers increased the value of a bank charter, which may have helped to constrain excessive risk taking. The informal system functioned well in a favorable economic environment and gained credibility from the stable political and bureaucratic structures.

7. The collapse of asset prices in the early 1990s undermined this informal system for protecting depositors and dealing with troubled banks. The declines in asset prices implied substantial losses for banks, which held large portfolios of stocks and relied mostly on real estate collateral to back up their loans, while the ensuing recession undermined borrowers' ability to service their loans. As a result, regulators found it increasingly difficult to persuade banks to provide assistance to other banks, because even relatively strong banks faced serious bad loan problems. In addition, a 1993 amendment to the Commercial Code made bank managers personally liable for the misuse of shareholder funds.

8. Given the reluctance of banks to help each other out, the authorities began to use public funds in the resolution of troubled banks. Starting in 1992, the authorities made greater use of DIC funds to promote mergers among troubled credit cooperatives, nonprofit cooperative banks, and regional banks. In 1996, the authorities reorganized the Tokyo Kyodo Bank—established in 1995 to dispose of the assets of failed credit cooperatives—into a subsidiary of the DIC called the Resolution and Collection Bank (RCB), with its liabilities guaranteed and losses compensated by the DIC. Also in 1996, the Diet approved the use of public funds for resolving the *jusen* (home mortgage lending companies).[7] While the amount of public funds was relatively small (¥680 billion or $6.2 billion), many observers regarded the protection afforded to some of the *jusen* creditors as nontransparent and unfair.

9. The public outcry forced the government to start putting in place more transparent and formal processes to govern bank failure and depositor protection. Legislation enacted in 1996 and 1997 provided for the introduction of prompt corrective action starting in 1998, which—by specifying supervisory actions that had to be taken at various capital ratios—decreased regulatory discretion in dealing with troubled banks, and for the establishment of an independent Financial Supervisory Agency (FSA) in June 1998. Another law gave regulators for the first time the authority to initiate corporate reorganization or bankruptcy

[7] Another resolution company, the Housing Loan Administration Corporation (HLAC) was established to handle the remaining jusen assets.

procedures for financial institutions, which allowed a more timely handling of troubled banks.

10. At the same time, to reduce the risk of a banking crisis during the development of the new framework, the government made explicit the blanket deposit guarantee. Legislation enacted in 1996 raised deposit insurance premia from 0.012 percent to 0.084 percent (including a special premium) and provided a government guarantee to the DIC to borrow up to ¥2 trillion from the BOJ or private financial institutions through the Special Account for Credit Cooperatives through March 2001. Moreover, all credit cooperative deposits, including those beyond the insurance payment limit of ¥10 million, were explicitly insured for this period. Notwithstanding the fact that this government guarantee strictly applied to only credit cooperatives, the authorities stressed that all bank deposits would be protected until March 2001. At the same time, a temporary exception to the payoff cost limit (the hypothetical cost of paying off depositors) for DIC financial assistance was made.

11. Despite the effective blanket guarantee, Japan suffered a financial crisis in late 1997 and 1998, which was the final blow to the informal "convoy system." In contrast to the support offered to Hokkaido Takushoku Bank and Nippon Credit Bank in the first half of 1997, major shareholders and firms associated with failing financial institutions in late 1997—including Hokkaido Takushoku Bank, Yamaichi Securities, and Sanyo Securities—refused to come to their aid. Moreover, relatively strong, unaffiliated institutions resisted attempts to be drawn into rescue mergers.

12. In response to the financial crisis, legislation was enacted in 1998 that improved the framework and the amount of public funds available for bank resolutions. The deposit insurance system was strengthened by the authorization of ¥17 trillion for depositor protection (¥7 trillion in the form of government grants and ¥10 trillion as loan guarantees), an increase in DIC staff to almost 300 (compared to fewer than 10 until the early 1990s), and enhanced capacity to collect bad loans (with the creation of a committee to investigate civil and criminal liability in connection with bank failures). At the same time, ¥43 trillion of public funds were authorized for recapitalizing weak but solvent banks and nationalization of very weak banks. The legislation also established a high level body (the Financial Reconstruction Commission) to oversee banking system stability and restructuring, consolidated the two existing bad loan collection and disposal agencies (the RCB and the HLAC) into a new agency (the Resolution and Collection Corporation, RCC), and introduced a new tool—bridge banks—to deal with failed banks.[8]

13. While the broad framework for resolving banking problems helped to put an end to the financial crisis in early 1999, the banking system was not considered sufficiently sound to proceed with the reintroduction of limited deposit insurance as originally planned in April 2001. In particular, some smaller deposit-taking institutions, including some cooperative-type

[8] A bridge bank is a bank under temporary state administration, which gives the authorities time to find a suitable private buyer.

financial institutions, were not considered to be sufficiently strong. At the same time, the authorities took the view that deposits used for immediate living expenses and business operations should be protected until speedy resolution methods were well-established and a variety of private payments services introduced.[9] As a result, the government decided in late 1999 to extend blanket deposit insurance for an additional year (until March 2002) and full protection for liquid deposits until March 2003.[10]

### C. Design of Limited Deposit Insurance and Bank Resolution Tools

14. The recently-enacted deposit insurance system and associated bank resolution tools provide many of the right incentives and instruments to keep the financial system sound, the potential for cost-minimizing bank resolutions, and an escape clause in cases of systemic crisis.

#### Limited Deposit Insurance

15. After April 2003, deposit insurance coverage in Japan will be subject to credible limits, which will help to curb moral hazard and promote market discipline. The level of coverage (¥10 million) is about two and a half times GDP per capita, about average for G7 countries (Table IV.1). Coverage is per depositor rather than per deposit. All private deposit-taking institutions, whose head offices are located in Japan, are required to participate in the system, and no non-deposit-taking institution may participate. As in other G7 countries, interbank deposits are not covered, so as to promote monitoring by large depositors. The new legislation establishes procedures for

Table IV.I. G7 Countries: Ratio of Deposit Coverage to Per Capita GDP, 1999

| | Coverage 1/ | GDP per capita 2/ | Ratio of deposit coverage |
|---|---|---|---|
| | (In U.S. dollars) | | |
| Canada | 40,385 | 20,874 | 1.9 |
| France | 64,968 | 24,594 | 2.6 |
| Germany | 21,790 | 25,782 | 0.8 |
| Italy | 122,310 | 20,734 | 5.9 |
| Japan | 87,789 | 34,402 | 2.6 |
| United Kingdom | 32,364 | 24,633 | 1.3 |
| United States | 100,000 | 33,934 | 2.9 |
| Average (unweighted) | 67,087 | 26,422 | 2.6 |

Source: Garcia (1999), International Financial Statistics, World Economic Outlook, and staff calculations.

1/ From Garcia (1999) using average 1999 exchange rates.
2/ From World Economic Outlook.

[9] Reflecting the history of blanket deposit insurance and no bank failure in Japan, many depositors are not presently accustomed to assessing the creditworthiness of their banks, and the authorities are not used to conducting rapid bank resolutions.

[10] Liquid deposits are defined as those with interest rates of zero or close to zero, and include checking and savings deposits, but not time deposits or certificates of deposit.

paying off insured deposits, including information on multiple deposits at a single bank (so as to enforce the maximum limit on deposit insurance coverage), though the efficiency and speed of these procedures have not yet been tested. However, the full protection of liquid deposits between April 2002 and March 2003 perpetuates moral hazard, especially as such deposits are difficult to demarcate from other deposits.[11]

16. A target level for the deposit insurance fund has not been established.[12] Adequate funding of the deposit insurance system is essential to avoid the temptation to engage in regulatory forbearance. For example, in the savings and loan crisis in the U.S., the inadequate funding of deposit insurance was partly responsible for the delay in resolving troubled institutions. In Japan, the government recently granted a further ¥6 trillion to the DIC (in addition to the ¥7 trillion grant approved in 1998), but this may not be enough to deal with past problems, let alone provide an adequate cushion for future ones. One mechanism to ensure financial viability would be to set a target level for the deposit insurance fund, usually expressed as a percentage of insured deposits, based on forecasts of the fund's income and expenses, including outlays to compensate depositors of failed banks.[13] The target would then provide an indication of how much recapitalization of the deposit insurance fund is needed—both to address past problems and ensure an adequate cushion for future problems—and of the deposit insurance premia that need to be set.[14]

17. While the deposit insurance function is separate from bank supervision and the lender of last resort, further steps could be taken to assure the independence of the DIC. Ideally, the organizational structure of a deposit insurance system provides independence from political

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[11] Banks might be able to provide full protection for a wider range of deposits, by periodically sweeping non-liquid deposits into liquid deposits (sweep accounts are common in other countries). One solution would be to offer a system of coinsurance for the amount above ¥10 million. In other words, depositors would face the possibility of losing a small fraction (say 10 percent) of the covered deposit, which could help alleviate moral hazard while limiting the amount of loss.

[12] The special deposit insurance premium (0.036 percent) will be eliminated in April 2003, reducing the premium to 0.048 percent.

[13] Setting an appropriate target would require a realistic assessment of the condition of the banking industry, the size and timing of financial demands that are likely to be placed on the fund, and the industry's ability to pay the necessary premia without prejudicing its profitability, solvency, and liquidity. In the United States, the target level is 1.25 percent of insured deposits and the actual level currently exceeds the target level.

[14] In Japan, deposit insurance premia are not adjusted for bank risk. While risk-adjusted criteria could play a role in controlling moral hazard, in practice it is difficult to measure risk. In the United States, the additional premium for weak banks has been kept quite low in part because of concerns about the impact on these banks' financial condition.

interference and industry domination, while ensuring accountability. In Japan, the DIC is a special juridical entity, with its Governor appointed by the government and its Policy Board dominated by representatives of the banking industry. The independence of the DIC could be increased by having the chairman and majority of the Policy Board consist of worthy members of the public with no current ties to the banking industry, while bankers' valuable experience could be utilized through their presence on an advisory board.

18. The DIC's ability to protect the interests of depositors and taxpayers could be strengthened by giving it some back-up supervisory powers. In any deposit insurance system, a balance needs to be struck between the danger of inappropriate forbearance by the supervisor on the one hand, and the deposit insurance agency's potential over-eagerness to close troubled banks to safeguard its own resources on the other. Some countries have resolved this conflict of interest informally, while others—such as the United States—have legislated formal back-up powers for the deposit insurance agency to be present at the on-site inspections of troubled banks, and to publicly revoke the deposit insurance of a bank it deems to be nonviable (which is equivalent to closing a bank).

**Bank Resolution Tools**

19. The new legislation improves the flexibility and speed of bank resolution tools. To avoid prolonged periods of public administration, which would be likely to substantially erode a failed bank's franchise value, the legal procedures for business transfers have been simplified and expedited, while *ex post* procedures have been introduced to protect creditors in such transfers. At the same time, the flexibility of bank resolution methods has been enhanced by allowing the DIC to provide financial assistance in a wider variety of P&A operations. The success of the new procedures will depend on early starts to the process of preparing for the resolution of a troubled bank (so that a purchaser is ready by the time the bank is actually closed) and openness to using P&A operations that involve sales of asset pools to different investors, rather than insisting on preserving the bank as a going concern, which in many cases is not likely to be the least cost solution.

20. The new legislation also provides for loss-sharing arrangements. Loss-sharing arrangements are a key vehicle for keeping the management of a failed bank's loans in the private sector, while ensuring a speedy resolution process, by protecting the purchaser of the bad loans from excessive downside risk. In Japan, the repurchase agreement in the recent sale of nationalized LTCB was an important step towards loss sharing arrangements. However, the nature of the agreement—under which for three years the DIC will bear the loss on any existing loan that is greater than 20 percent of book value (net of reserves)—would not appear to give the new owners of LTCB (now renamed Shinsei Bank) the right incentive once the loss approached 20 percent.[15] It might be more effective to allocate a fraction (say 20 percent) of any loss to the purchaser, as is the practice in the United States, so as to ensure

[15] Indeed, Shinsei Bank recently sold its claims on Sogo, a troubled major retailer, to the DIC for their full face value (net of specific loan loss reserves).

that the purchaser continues to share in the downside risk from poor collections on bad loans. More generally, the usefulness of loss-sharing arrangements will depend on tailoring them to individual banks' circumstances and providing appropriate incentives to maximize the value of the assets. At the same time, more extensive use of loss-sharing arrangements will allow for a smaller public-sector role in managing bad assets.[16]

21. The systemic risk exception in Japan is similar to that in other countries, but the criterion guiding bank resolutions in normal times falls short of the least-cost principle. In cases of systemic risk, a Cabinet-level council headed by the Prime Minister will have the authority to reinstitute a blanket deposit guarantee, make wide ranging capital injections into banks, and/or nationalize failing banks.[17] In normal times, the cost of the chosen bank resolution option must be less than the cost of a deposit payoff, which is a less demanding criterion than the least-cost principle required under U.S. law, which helps to minimize the burden on the taxpayer and encourage market discipline by large depositors.[18]

### D. Addressing Remaining Bank Weaknesses

22. To ensure that deposit-taking institutions are sufficiently strong to withstand the increase in market discipline associated with removing the blanket deposit guarantee, further efforts are needed to ensure bank soundness. Under the new framework, the incentives facing large depositors and creditors will be very different from those at present. Once deposit insurance is limited, uninsured deposits will be much more prone to run from banks that are perceived to be weak, which could spread to other financial institutions that are perceived to face similar weaknesses.

- To reduce the risks of further systemic shocks once limited deposit insurance is reintroduced, the regulatory and supervisory framework could be strengthened. In particular, disclosure standards in Japan still fall short of international best practice in terms of breadth and frequency.[19] While important progress has been made in loan loss provisioning, concerns remain that the full extent of the bad loan problem has not

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[16] International experience suggests that most bad assets should be managed by the private sector—either in the receiving bank or in specialized loan collection vehicles—so as to maximize their value, especially once the economic recovery is underway. In Japan, the RCC acts primarily as a collection agency, rather than trying actively to dispose of its bad assets.

[17] In the U.S. under FDICIA, the Secretary of the Treasury—after consulting with the President and with the recommendation of the FDIC and Federal Reserve System—may grant an exception to the least-cost requirement in case of systemic risk.

[18] The payoff cost principle provides more flexibility in dealing with a banking crisis.

[19] Specifically, standards could require the disclosure of the results of stress tests using the banks' internal risk assessment model; the full disclosure of the self-assessments of asset quality, including gross amounts of loans by asset class, the amounts covered by collateral or guarantees, and provisions; and quarterly—rather than semiannual—disclosure.

yet been recognized. Similarly, in the area of on-site inspections, much has been accomplished, but further efforts and resources are needed to ensure adequate frequency, thoroughness, and sophistication. Finally, Japanese banks with exclusively domestic operations are required to hold only 4 percent capital, which does not provide an adequate cushion against adverse shocks or inadequate bad loan recognition.

- Most banks have made important strides in recognizing bad loans while taking advantage of public capital injections to strengthen their capital base. Moreover, the weakest banks have now been identified and intervened, using the new resolution tools created in the 1998 banking legislation. As a result, the remaining banks now seem to be more stable, as reflected in market indicators such as the Japan premium. However, core profitability remains low. It is not clear how the recently-announced mergers among major banks will substantially raise profitability and create globally competitive financial institutions. Restructuring in regional banks is still at an early stage.

- Important vulnerabilities remain among smaller regional banks and cooperative-type institutions, which hold about 30 percent of deposits. Credit cooperatives are only now beginning to be inspected by the FSA. While each individual institution is small, a generalized loss of confidence could have systemic effects.

23. Based on recent experience in other countries, an official assessment that the financial system is basically sound would help to ensure a smooth transition to limited deposit insurance (Garcia, 2000). For example, prior to the removal of the blanket deposit guarantee in Sweden in 1996, the Swedish government prepared an assessment of banking system soundness that was presented to the Swedish parliament and made public more than seven months before the planned removal of the blanket guarantee.[20]

[20] The Swedish government's report was thorough, covering the banking system as a whole, categories of banks, and selected individual banks, and considered a wide range of indicators, including problem assets, loan losses, capital adequacy, profitability, and fund raising premia. The report took into account not only the views of the financial supervisory authority, but also those of banks themselves and of external observers, such as credit rating agencies. The report was far reaching, in that it considered the macroeconomic outlook and prospects for the real estate market, and evaluated the banking system's prospects under different interest rate and asset price scenarios. Finally, the report was candid in recognizing remaining problems, including at individual institutions—these problems were considered manageable.

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# V. JAPAN: THE UNEMPLOYMENT DEFLATION PUZZLE

by Takashi Nagaoka

## A. Introduction

1. Since the middle of 1997, the Japanese economy has experienced a sharp widening of the output gap and a steep increase in unemployment (Table V.1). The IMF's estimate of the output gap reached 4½ percent of GDP by 1999, while the unemployment rate reached a record high of just below 5 percent in the summer of 1999.

Table V.1. Selected Indicators

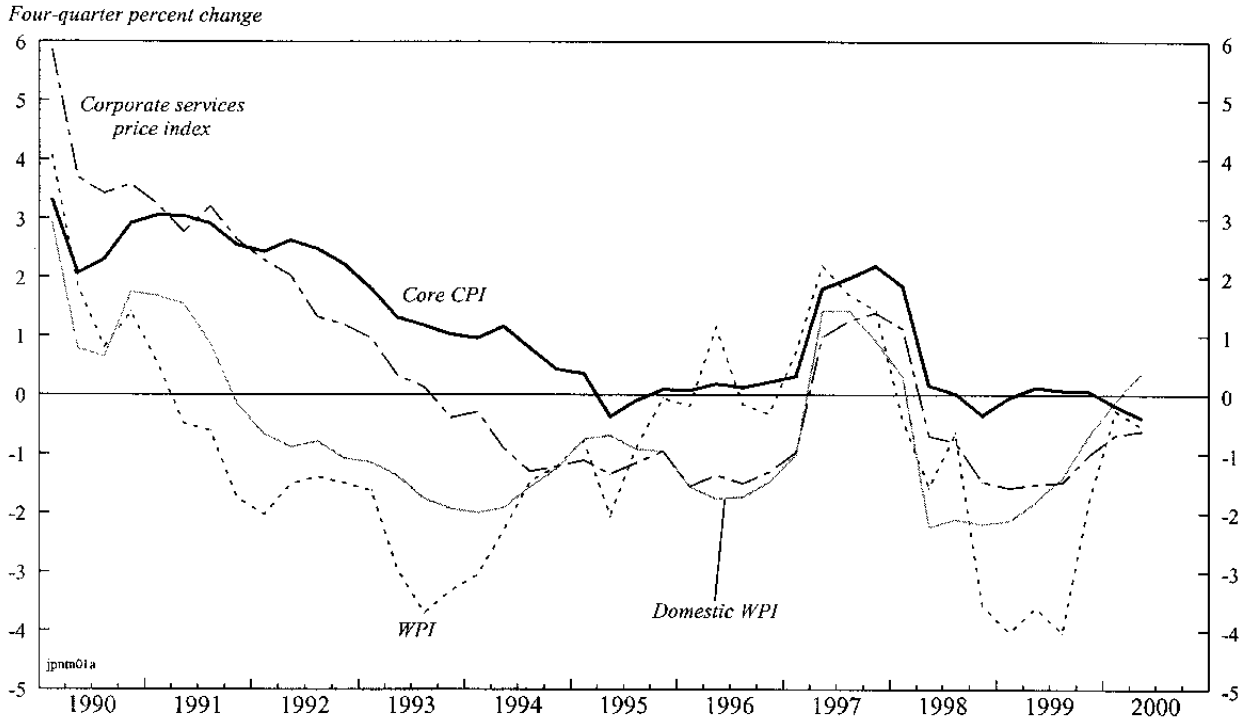
| | 1991–1995 average | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| | (Percent change from previous period, unless otherwise indicated) | | | | | |
| Real GDP | 1.4 | 1.5 | 5.0 | 1.6 | -2.5 | 0.2 |
| Output gap (in percent of potential GDP) | 0.3 | -1.7 | 1.3 | 0.9 | -3.4 | -4.5 |
| Unemployment rate (in percent) | 2.6 | 3.1 | 3.3 | 3.4 | 4.1 | 4.7 |
| GDP deflator | 0.9 | -0.6 | -1.4 | 0.3 | 0.3 | -0.9 |
| CPI | 1.4 | -0.1 | 0.1 | 1.7 | 0.6 | -0.3 |

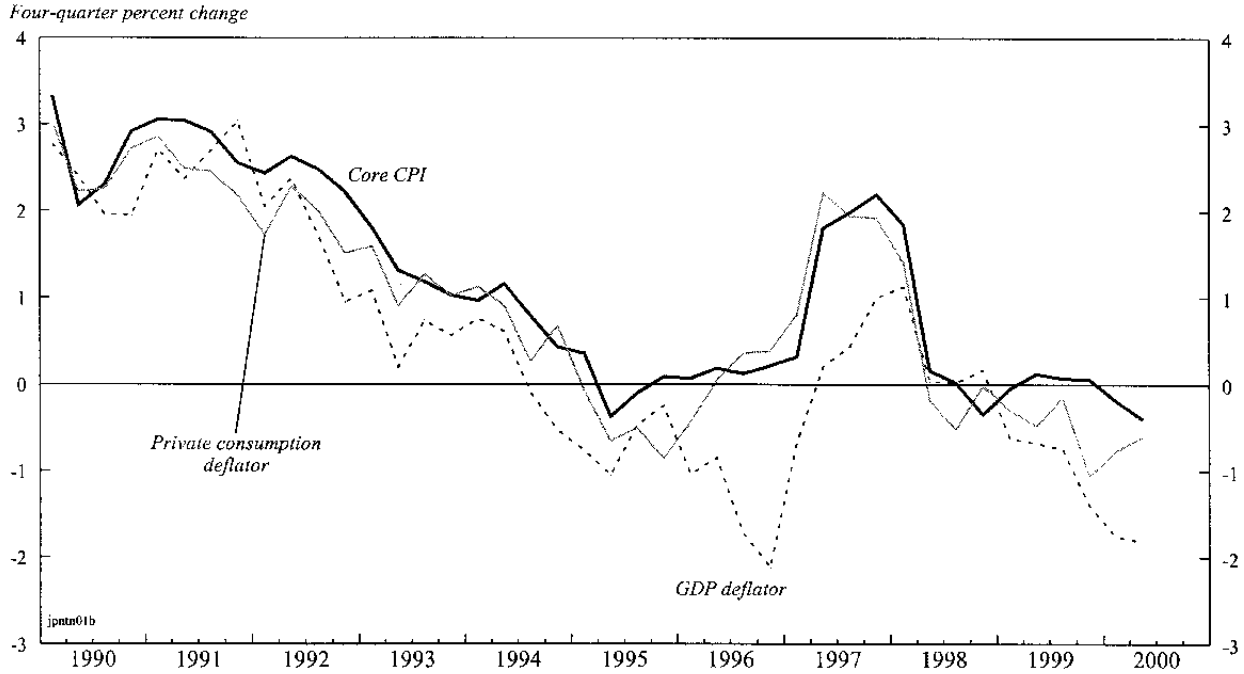
Source: Nikkei Telecom; WEFA; and staff estimates

2. Prices, however, have remained broadly stable since 1998, notwithstanding widespread concerns about the potential for a deflationary spiral (Figure V.1). Although the various price indicators have followed somewhat different paths over the last decade, the core CPI (which *excludes fresh food*) has shown little change since mid-1998, despite the deterioration of output and employment indicators (Figure V.2).[1] This recent behavior seems at variance with earlier experience when the core CPI moved broadly in line with

[1] For Figure V.2, adjustments are made to the original CPI series by eliminating the effects of exogenous factors, such as changes in indirect tax rates, to focus on the underlying development of prices. Estimates by the Economic Planning Agency (EPA) suggest that the introduction of the consumption tax (at 3 percent) in April 1989, coupled with the repeal of various excises, pushed up the overall CPI by 1.2 percent for the initial years, and 1.1 percent afterwards, with the phasing-out of transitional treatment on automobiles. The EPA also estimated that the increase in the consumption tax rate in April 1997 (to 5 percent) pushed up the CPI by 1.5 percent and the reform in the medical insurance system in September 1997 had an additional effect of 0.2 percent. As the weight of the fresh food component in the CPI is only 5 percent, the above estimates for the overall CPI are used for the adjustment of the core CPI.

# Figure V.1. Japan: Price Developments 1/

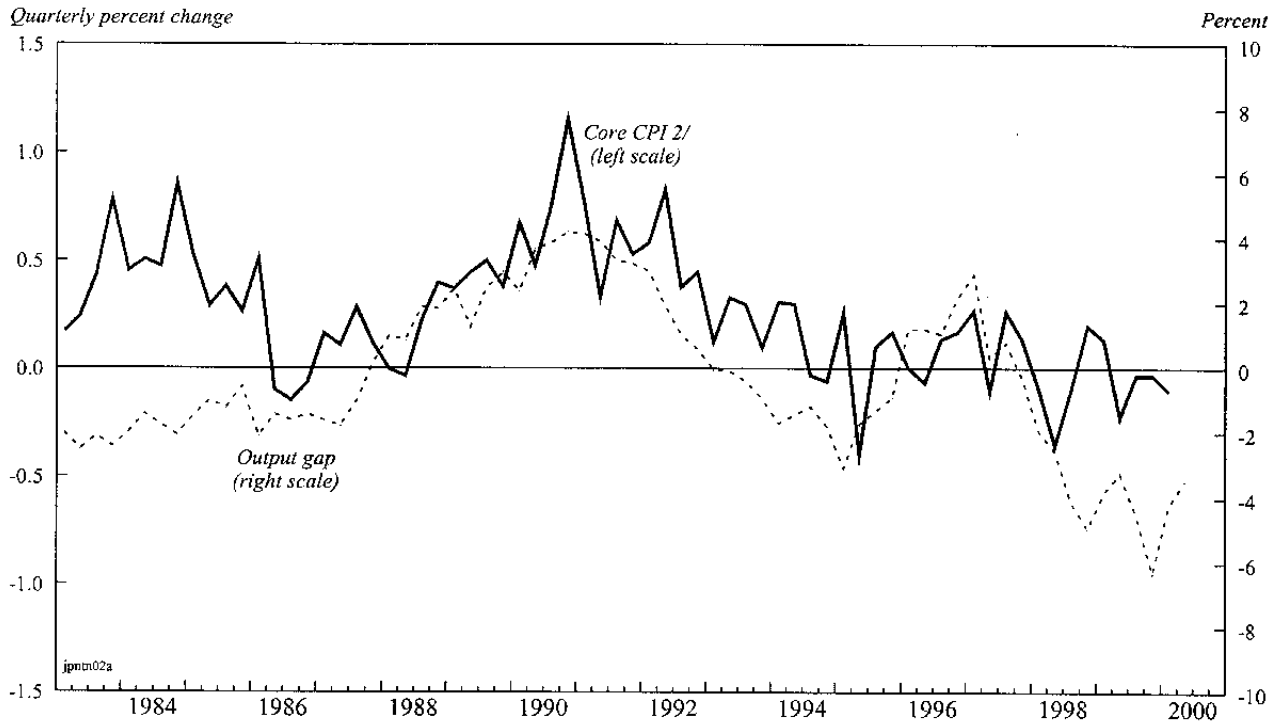


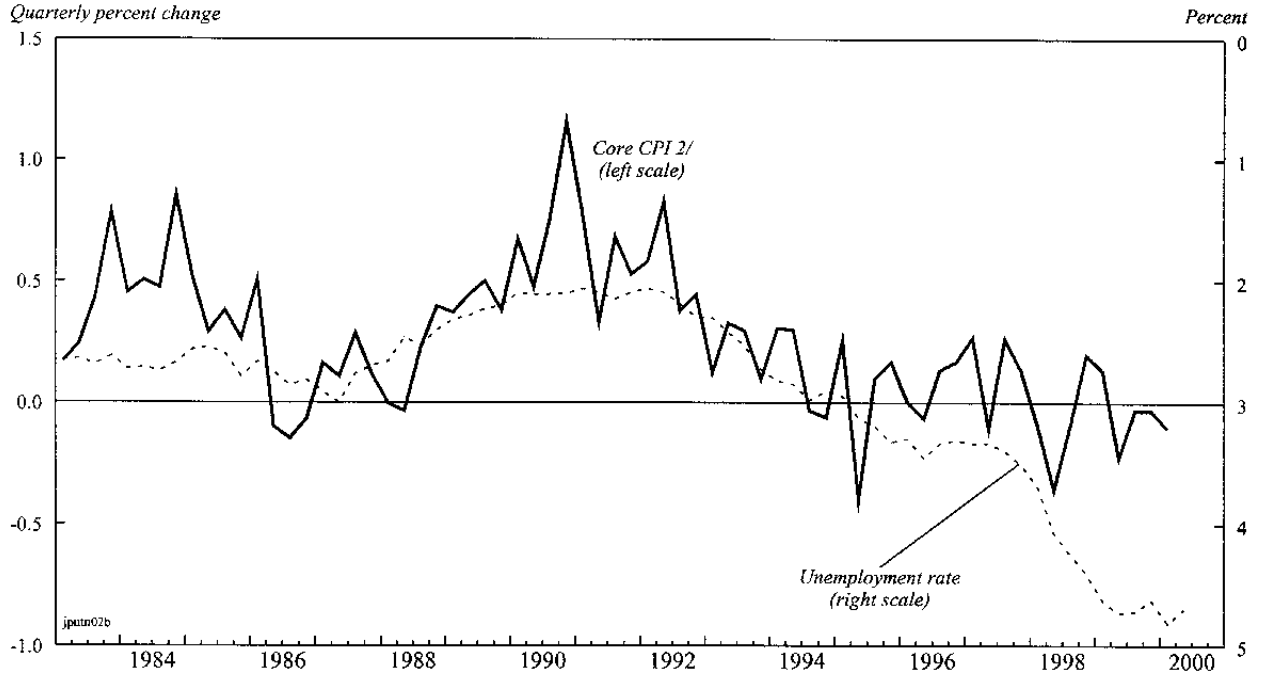




Sources: Nikkei Telecom; WEFA; and staff estimates.

1/ Not adjusted for changes in consumption tax rate and medical insurance system.

Figure V.2. Japan: Development of Output Gap, Unemployment, and Core CPI 1/




Sources: Nikkei Telecom; and staff estimates.

1/ Seasonally adjusted.
2/ Adjusted for introduction of consumption tax and repeal of excises in April 1989, increase in consumption tax rate in April 1997, and medical insurance system reform in September 1997.

both the output gap and the unemployment rate, as also suggested by a (linear) Phillips curve. This observation raises the question of *why prices have not gone down further.*

3. There are two possible arguments that could dismiss this question outright. The first is that the Phillips curve could in fact be nonlinear.[2] If the relationship between the output gap (or the unemployment rate) and price changes is indeed convex, then there is no puzzle between a broadly stable inflation rate (near zero) despite the increase in unemployment or the output gap in recent years. Another possibility is that the output gap is much smaller than estimated by the staff and some other observers (see Hayakawa and Maeda (2000) for a view that the output gap in Japan at present is smaller than generally believed). In this case, price changes in recent years might in fact be consistent with past relationships between the gap and inflation.

4. While recognizing these possibilities, there could also be other factors that help explain recent inflation performance, and that do not depend on a nonlinear Philips curve or mismeasurement of the output gap. In this vein, this chapter discusses a number of possible causes for the failure of prices to decline more significantly in recent years. The next section looks at the issue of CPI measurement bias, while subsequent sections discuss downward rigidity of nominal wages, pricing behavior of companies, and perceptions about price developments in the private sector. A final section summarizes the main conclusions.

### B. Measurement Bias in the CPI—Not A Major Cause

5. As in other countries, the CPI in Japan is compiled using the Laspeyres method, which fixes the basket of items in the base year.[3] Subsequent shifts in the actual mix of items, as consumers react to changes in relative prices by shifting their consumption basket to lower cost items, generate an upward bias in the measure of the increase in the cost of living. Consumption of items with quality changes and newly introduced products (which may not be captured in consumer price surveys) can also produce bias in measured inflation. A further potential source of error relates to sampling problems, in particular, failure to fully reflect seasonal discount pricing and increasing use of new retail outlets offering lower prices (including the internet).

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[2] The international evidence on the linearity of the short-run Phillips curve is mixed. For example, evidence of nonlinearity can be found in: Laxton, Meredith and Rose (1994), Debelle and Laxton (1997), Clark and Laxton (1997), and Nishizaki and Watanabe (1999), while the case for linearity is apparent from Turner (1995), Summers (1988), Gordon (1994), and Research Committee on Fundamental Issues Regarding Prices under Zero Inflation (abbr. "Kentou Iinkai"(1999)).

[3] Among major OECD countries, Canada, Germany, Italy, Japan, Korea, and the United States use Laspeyres indices, while France and the United Kingdom use chained Laspeyres indices (as of March 1998 for the U.S., and October 1998 for others).

6. Statisticians make efforts to try to reduce the degree of measurement bias in the CPI. Possible distortions from shifts in the composition of the consumption basket are mitigated by base revisions every five years, and continuing efforts to ensure that vendor samples are representative of the evolving population. Most OECD countries (including Japan) try to make allowance for quality improvements through a combination of overlap methods (where price differences between old and replacement items are considered to reflect quality differences, based on the assumption that the price per unit of quality is identical for both the old and replacement item) and direct comparison methods (where no quality difference is assumed except for quantity metric), rather than the increasingly advocated hedonic approaches (see Greenlees (1999) for quality adjustment methods).[4] Although the usefulness of the hedonic approach for quality adjustment has been widely acknowledged, the approach has limitations in that it requires too much time and information to be used for the construction of monthly indicators. Nevertheless, for product categories with rapid technological innovations and short product life cycles (such as personal computers), the conventional adjustment methods would not fully capture the impact of quality changes or the introduction of new products, thus leaving some degree of upward bias in measured CPI inflation.

7. Quantitative estimation of the upward bias in the Japanese CPI series, based on the assumptions of Shiratsuka (1999), suggests that the total measurement bias could be around 0.9 percentage points (the estimates range from 0.35 to 2.00 percentage points, depending on assumptions).[5] This result compares with the estimated upward bias in the United States, which lies around 1.1 percentage points (with a slightly narrower range).[6]

8. In the recent deflationary environment, a bias of such magnitude may have a substantial impact on correctly gauging price development. However, it does not appear to be a strong candidate to explain the change in the traditional price-unemployment

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[4] The Bank of Japan, in its compilation of the wholesale price index and corporate service price index, partially employs a hedonic approach (Bank of Japan (1998)) and introduces new products (services) into the basket more promptly than in the case of the CPI.

[5] The authorities' official view is that there is no clear evidence of an upward bias in the Japanese CPI series (OECD (1997)). However, the Management and Coordination Agency, which compiles the CPI, acknowledges the potential effect of quality changes and the introduction of new products on the accuracy of the CPI inflation, and accordingly has announced that new items including personal computers and mobile phone services will be added to the sample basket in the next revision for 2000 base.

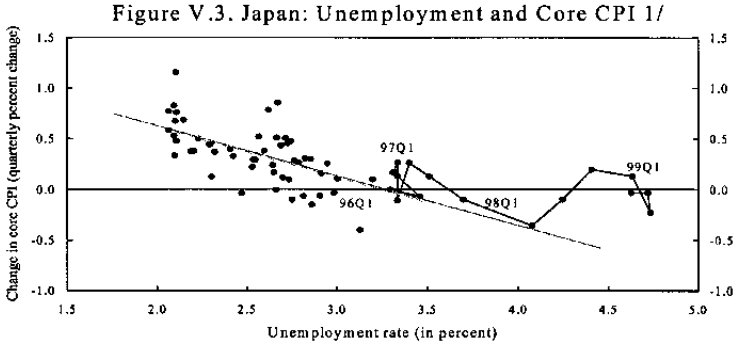
[6] The report "Toward a More Accurate Measure of the Cost of Living," known as the "Boskin Report," was presented to the U.S. Senate Finance Committee in December 1996, by its Advisory Commission to Study the Consumer Price Index, led by former CEA Chairman Michael Boskin. It classified the sources of measurement error into: a) upper level substitution, b) lower level substitution, c) new products/quality change, and d) new outlets. Shiratsuka followed a similar classification and suggested that the new product/quality change effect was larger in Japan and substitution effects smaller.

relationship in the late 1990s, since the explanatory factors underlying the bias have not changed drastically over time, let alone jumped discontinuously since 1998.

## C. Prices and Unemployment

9. Figure V.3 shows the historical relationship between the core CPI and unemployment as a scatter diagram from the first quarter of 1983 to the end of 1999. The superimposed trend line fits the data quite well through 1996. However, this historical relationship seems to have broken down since 1998.

Figure V.3. Japan: Unemployment and Core CPI 1/




Sources: Nikkei Telecom; and staff estimates.
1/ Seasonally adjusted. Core CPI is adjusted for introduction of consumption tax and repeal of excises in April 1989, increase in consumption tax rate in April 1997, and medical insurance system reform in September 1997.

10. To reinforce the notion, a reduced-form short-run Phillips curve is estimated, using data from the first quarter of 1983 to the fourth quarter 1996. The equation is specified as:

$$\Delta P_t / P_{t-1} = \alpha + \beta \Delta P_{t-1} / P_{t-2} + \gamma U_t + \varepsilon_t ,$$

where $\Delta P_t / P_{t-1}$ is the quarterly percentage change in the core CPI and $U$ is the unemployment rate.[7] The result is as shown in Table V.2.

Table V.2. Estimate of Reduced Form Phillips Curve, 1983Q1–1999Q4

| | | Independent Variables | |
|---|---|---|---|
| | *Constant* | $\Delta P_{t-1} / P_{t-2}$ | $U_t$ |
| Coefficient | 1.184 | 0.2781 | -0.3662 |
| *t*-statistics | (-4.078) | (-2.189) | (-3.677) |
| $R^2$ | 0.477701 | | |
| Adjusted $R^2$ | 0.457992 | | |
| *DW* statistics | 1.83 | | |

Regression by PcGive 9.0 for Windows.

11. Next, a one-step ahead forecast is conducted on this specification for the twelve quarters through end-1999 to compare the traditional relationship and the actual core CPI

[7] As the equation uses lagged inflation as a proxy for expected inflation, the estimation started with twelve lags after Fuhrer (1995), eliminating lagged terms in turn until the coefficients on lagged inflation became statistically significant.

movement (Figure V.4). The sizable discrepancies for multiple quarters in 1998 and 1999 support the view that there have been successive departures of the core CPI from the historical relationship through 1996, on the assumption of a linear Phillips curve.

### D. Downward Rigidity of Wages

12. A possible reason for downward price rigidity could be the downward rigidity of nominal wages. Nominal wage rigidity could be due to features of multi-year wage contracts that do not permit renegotiations when the economy experiences a downturn. The possibility that wage contracts in different sectors are agreed on overlapping schedules may inhibit firms from reducing nominal wages at renegotiations for fear of losing capable workers. There may also be greater psychological resistance to nominal wage cuts as opposed to erosion of real wages through price increases.

13. Downward wage rigidity, however, appears to be less relevant in Japan than elsewhere. Indeed, a stylized fact about the Japanese economy is that Japanese firms in general turn to nominal wage adjustments rather than labor shedding for flexibility in reducing labor costs during downturns. That is, a cooperative labor-management relationship since the mid-1950s has allowed firms to accommodate cyclical fluctuations in demand mainly by adjusting nominal wages by varying overtime and bonus payments. The practice of annual base salary revisions through synchronized labor-management negotiations across industries (*Shunto*) has also diminished the possible effects of long intervals between wage negotiations and overlap of such intervals among sectors.

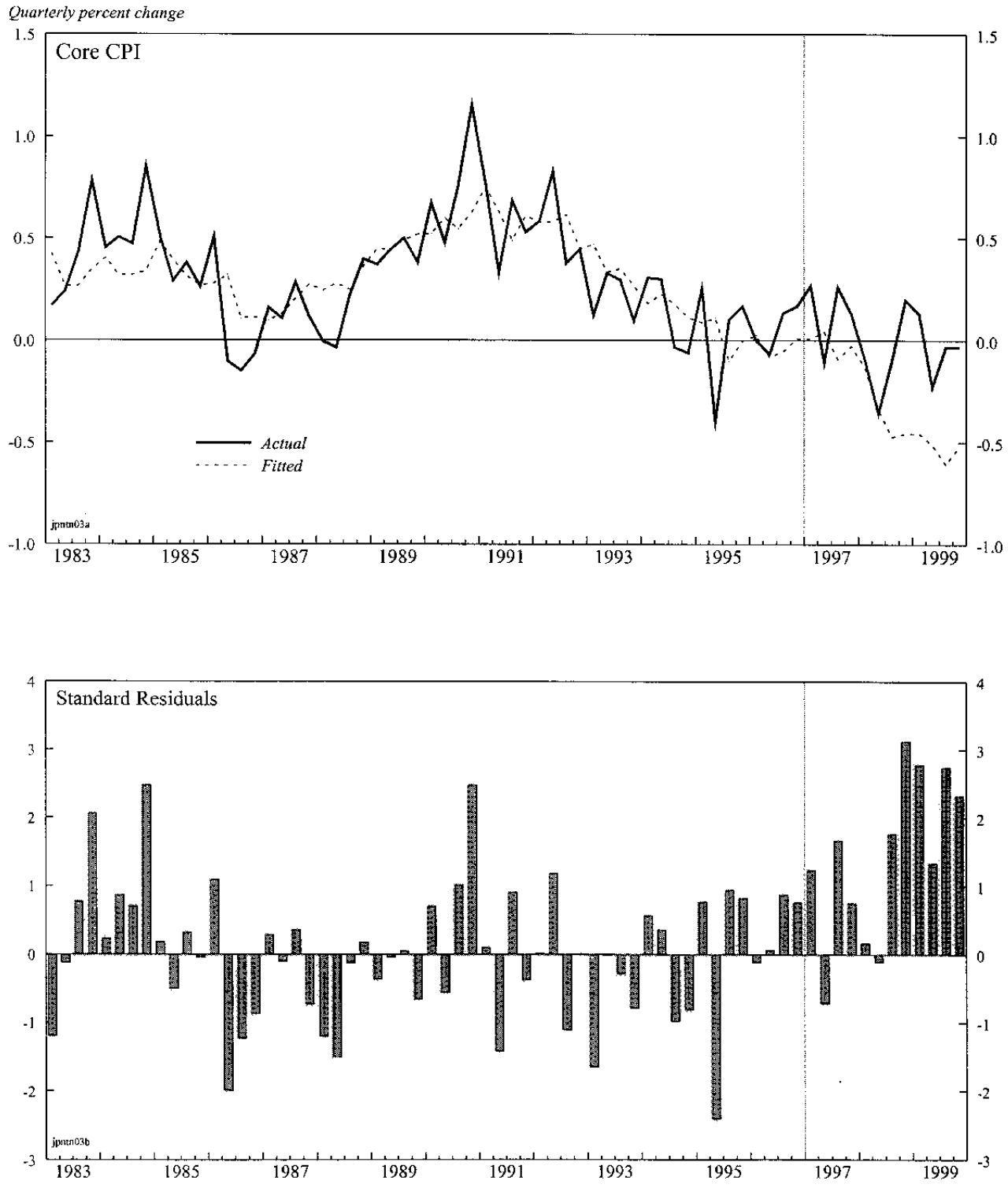
14. Nominal wage developments since 1998 are in fact consistent with considerable downward flexibility (Figure V.5).[8] Total cash earnings as a whole fell by 1.3 percent on a year-on-year basis in both 1998 and 1999. Bonus payments have been the primary source of the downward flexibility, contributing over 1 percentage point of the decline in total cash earnings in both years.[9] Overtime earnings have also contributed to downward flexibility through adjustment of working hours. A small contribution to downward flexibility is also evident in the behavior of scheduled earnings in the last two years, as the number of hours worked has declined, offsetting the steady increase in hourly earnings. While some noncyclical factors such as the spread of a 2-day weekend system have reduced the number of scheduled working hours, most of the reduction in overall hours worked is explained by lower overtime.

---

[8] Monthly Labor Statistics released by the Ministry of Labor include nominal cash earnings and a nominal cash earnings index adjusted for the gap due to sample changes. The adjusted index is used here to gauge nominal wage developments over time.

[9] Total cash earnings comprise special earnings (primarily bonus payments) and contractual earnings, which can be further decomposed into scheduled earnings and non-scheduled earnings (primarily earnings from overtime work).

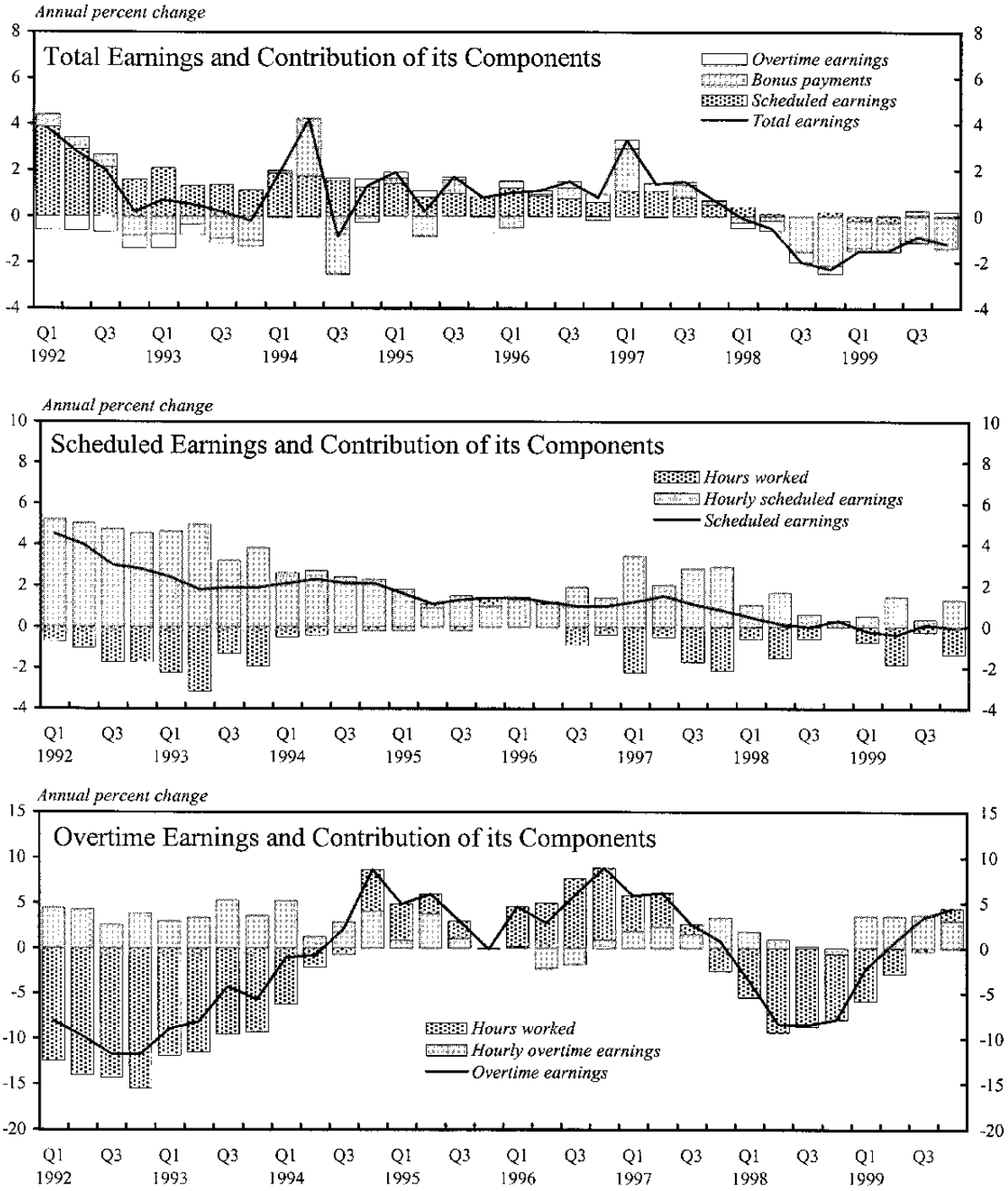
Figure V.4. Japan: Results of the One-Step Forecast Test 1/




Source: Staff estimates.

1/ 1-step forecast test conducted using PcGive 9.0 for Windows, for 1997Q1 through 1999Q4, using the specification derived from data sets over 1983Q1 to 1996Q4.

# Figure V.5. Japan: Development of Nominal Cash Earnings 1/ 2/ 3/ 4/




Sources: Nikkei Telecom; Ministry of Labor; and staff estimates.

1/ Not seasonally adjusted.
2/ Nominal cash earnings and hours worked per regular employee (for establishment with 5 employees or more) are used as the indicators for nominal wages and hours worked, respectively.
3/ Total earnings comprises contractual earnings and non-contractual earnings (bonuses), of which contractual earnings can be divided into scheduled earnings and non-scheduled earnings (overtime earnings).
4/ Regular employees are those who are either a) employed without a term or with a term exceeding one month, or b) employed daily or with a term of less than one month, who have been employed for more than 18 days in each of the preceding two months. Thus, the data include those for part-time employees, i.e., regular employees who have either a) shorter scheduled daily work time than general employees or b) identical scheduled daily work time but less scheduled weekly work day than general employees.

15. In fact, scatter diagrams of year-on-year changes of cash earnings against the unemployment rate appear to suggest a linear relationship between the two variables, consistent with a linear wage-unemployment Phillips curve (Figure V.6). The diagrams suggest that firms have responded to the changes in economic conditions first by controlling nominal wages, and then by turning to employment control, once wage increases have been brought close to zero. Subsequent upturns in the business environment appear to have boosted wages rather than employment. An econometric study by Kimura (1999) supports this analysis, finding that the hypothesis of downward earnings rigidity, which could not be rejected using data set through 1997, could be rejected when the data are extended through 1998.

16. Moreover, ongoing structural changes in the labor market have tended to increase the degree of wage flexibility over time (Tachibanaki, Fujiki and Nakada (2000)). The increasing share of part-time workers may provide a partial explanation of the decline in the number of hours worked and the slowdown of scheduled hourly earnings growth. Moreover, the fact that female workers have constituted most of the increase suggests further flexibility in nominal wages, as female part-time workers' wages have structurally remained at low levels (Figure V.7).[10] A study by the Ministry of Labor suggests that the increase in the share of part-time employees has reduced scheduled earnings for regular employees (including part-time employees) by about ½ percent per year since 1996.

17. Corporate restructuring, and the associated shift away from the traditional lifetime employment system, together with other structural shifts towards the "knowledge-based" economy, are also likely to have raised the natural rate of unemployment, and so increased the amount of inflation expected for any particular degree of economic slack. EPA (1999) suggests that job mismatches have become more prevalent for older age groups, indicating a higher degree of involuntary unemployment for older workers (Figure V.8), while younger workers appear to be growing more tolerant of voluntary unemployment. Impediments to labor mobility—in particular lack of private portable pension schemes—may also have raised the noncyclical component of unemployment in recent years, as structural changes in the economy have accelerated.

18. Rising structural unemployment is also apparent from a chart of vacancy rates and the unemployment rate during the 1990s. The top panel of Figure V.9 shows the Beveridge curve (which compares the vacancy rate and the unemployment rate excluding the self-employed) over the last fifteen years. In the figure, data points from end-1994 to mid-1997 generally move in the direction along the 45-degree line, suggesting a rising unemployment rate in an environment of expanding job openings. Such moves imply increases in the structural/frictional unemployment rate. An estimate of structural/ frictional unemployment by the Ministry of Labor (MOL), reproduced in Figure V.9 (bottom panel), shows a rising trend since the mid-1990s.

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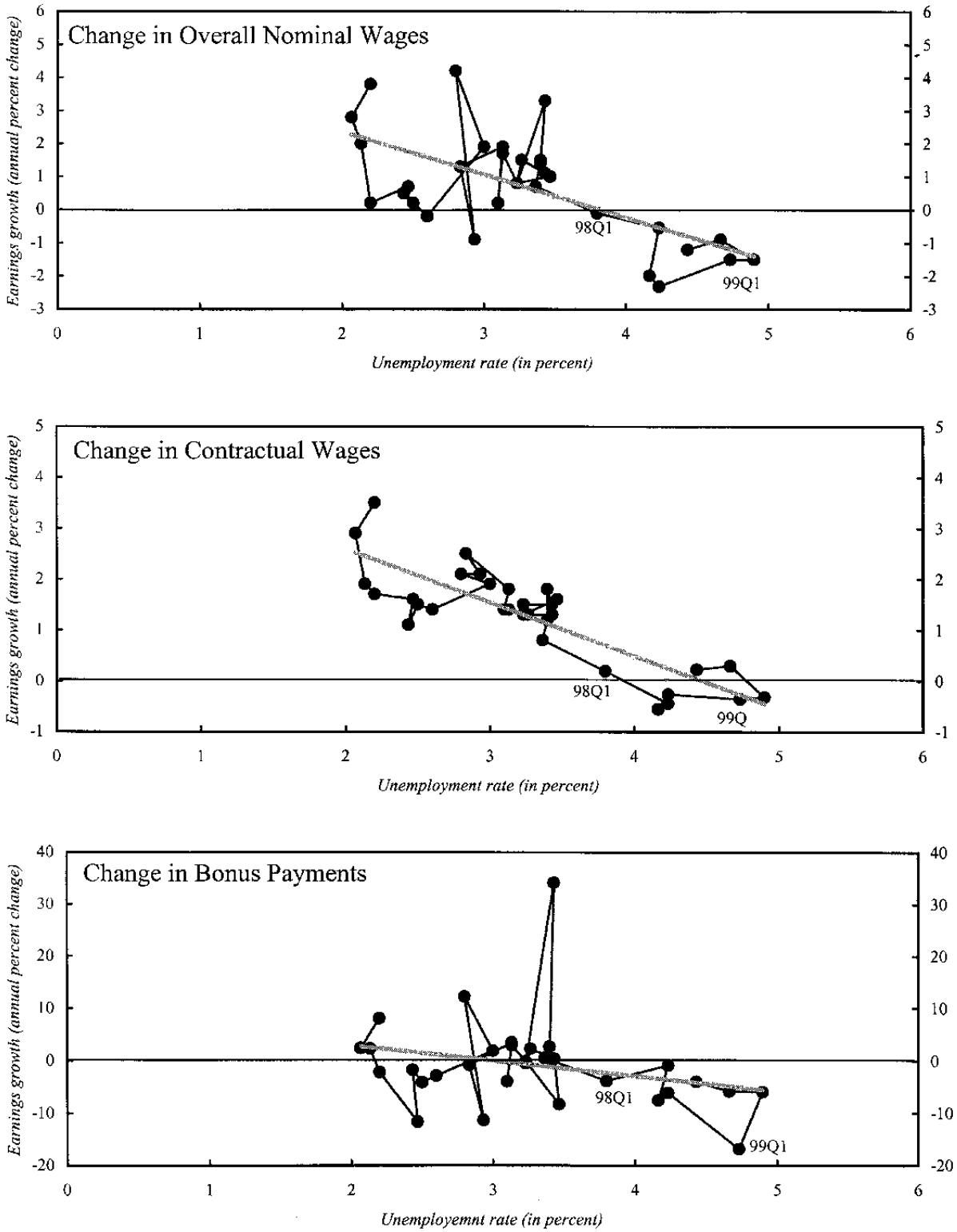
[10] Tachibanaki, Fujiki and Nakada (2000) suggest that institutional factors, such as tax thresholds, may have kept female part-timers' payrolls at low levels despite the fact that the demand for such part-timers seems to have exceeded the supply in recent years.

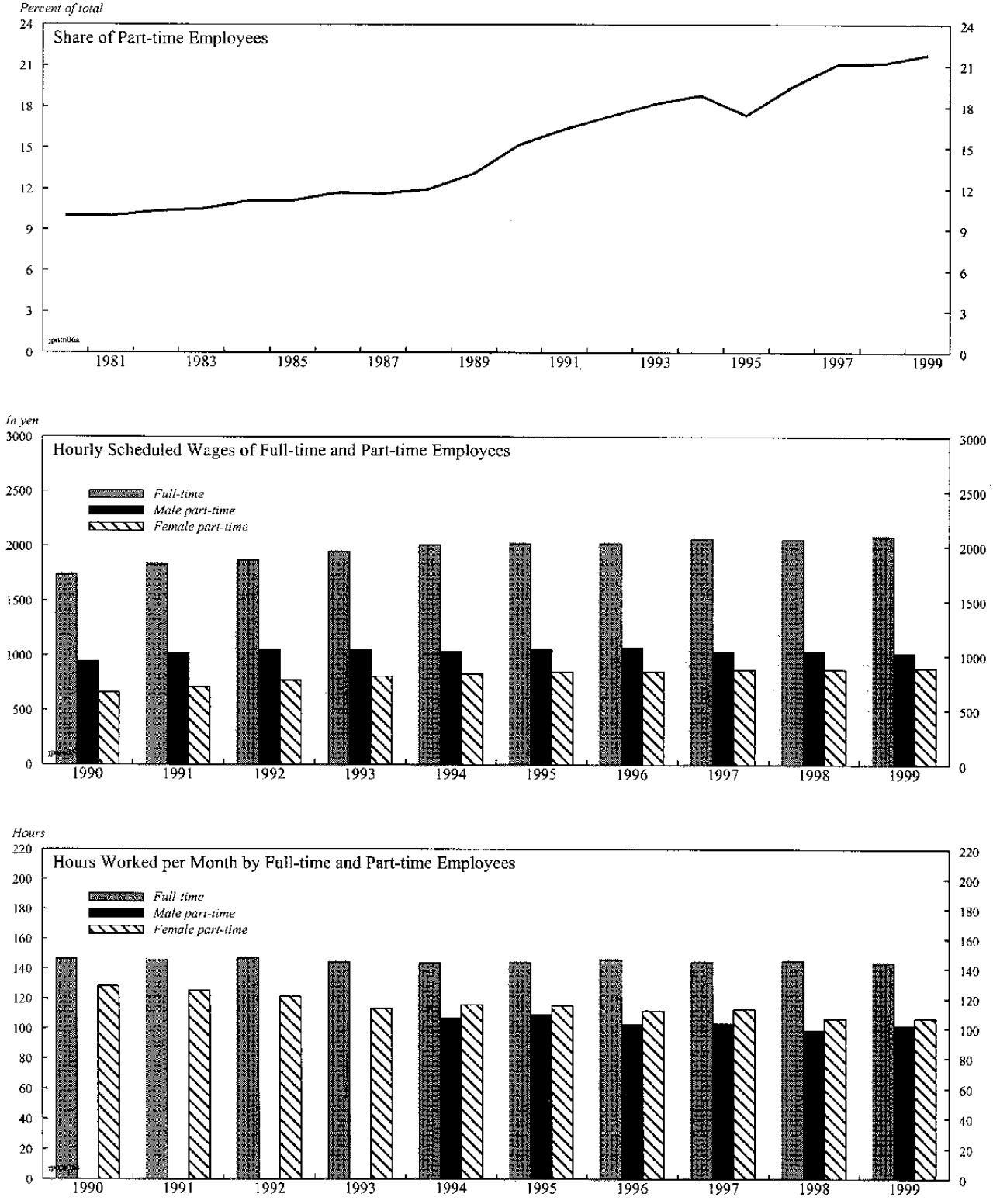
Figure V.6. Japan: Unemployment and Nominal Wages




Sources: Nikkei Telecom; and staff estimates.

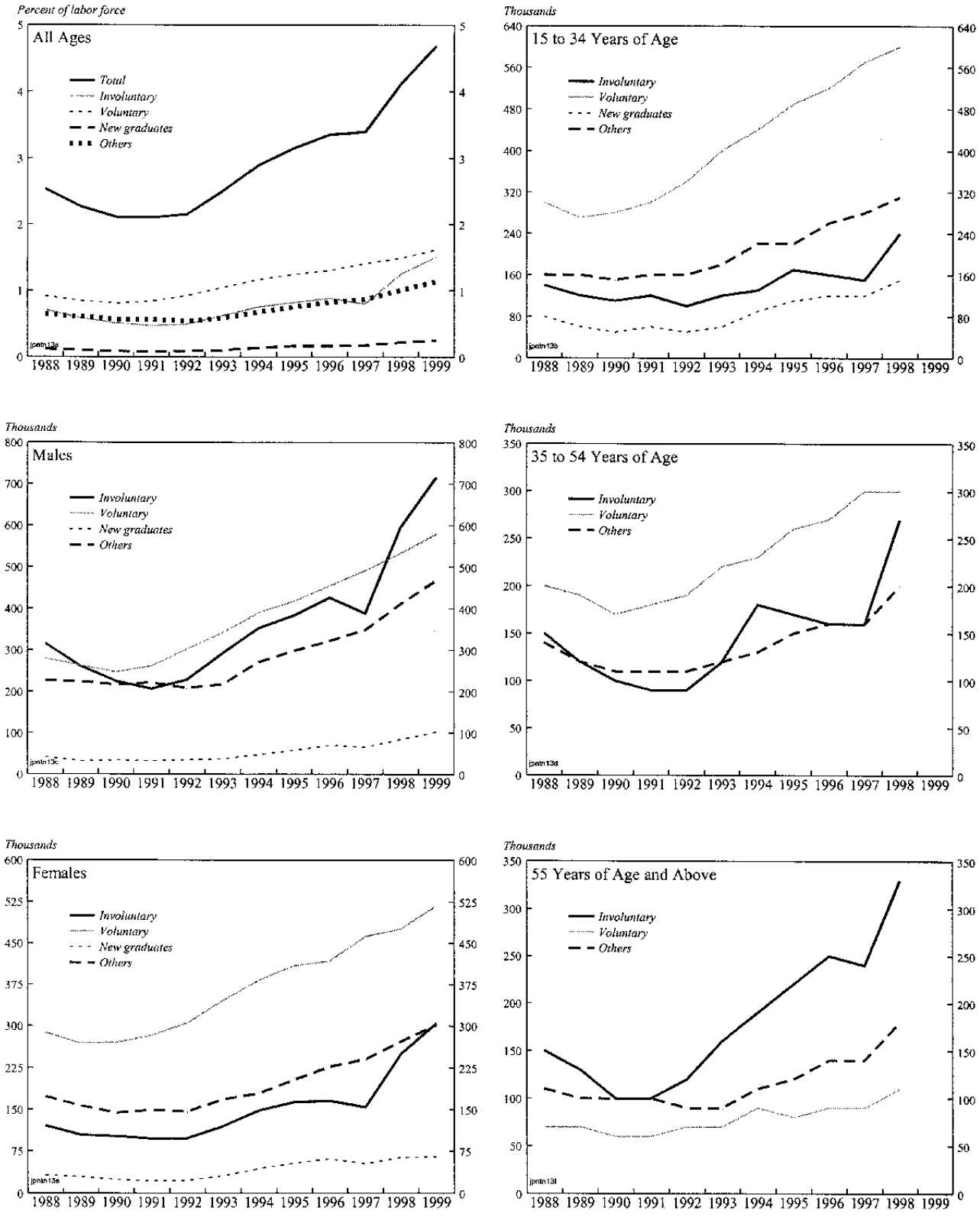
1/ Seasonally adjusted.

# Figure V.7. Japan: Part-Time Employment



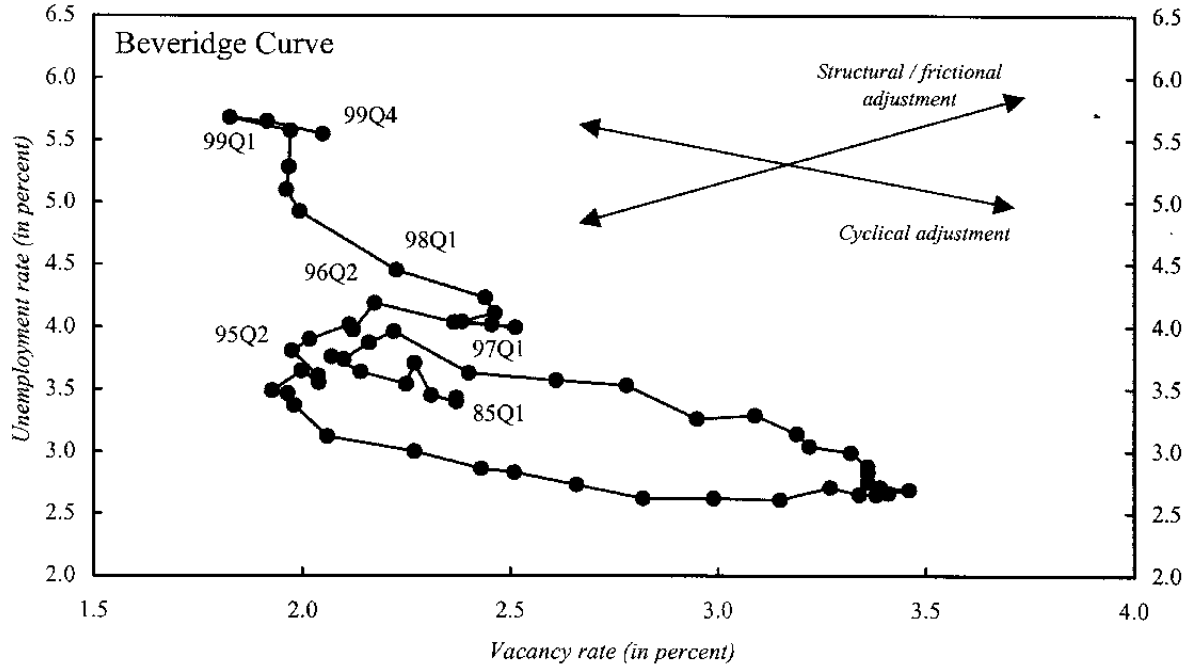

Sources: Management and Coordination Agency; Ministry of Labor; and staff estimates.

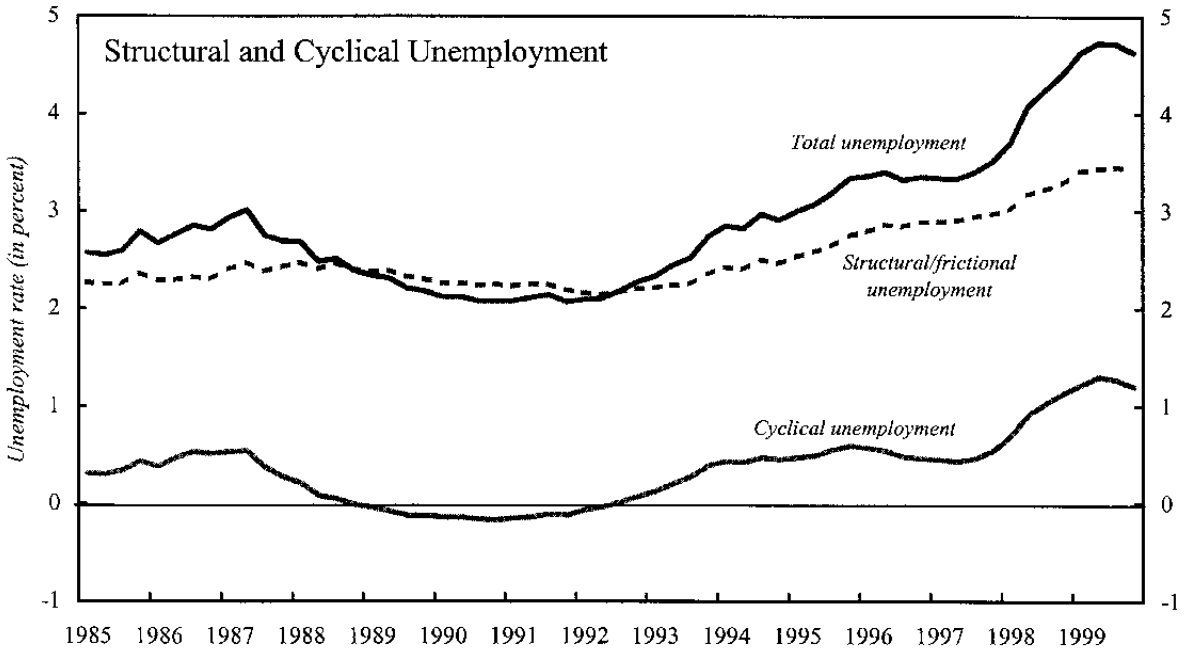
# Figure V.8. Japan: Composition of Unemployment




Source: Management and Coordination Agency; and CEIC Database.

Figure V.9. Japan: Development of Structural Unemployment



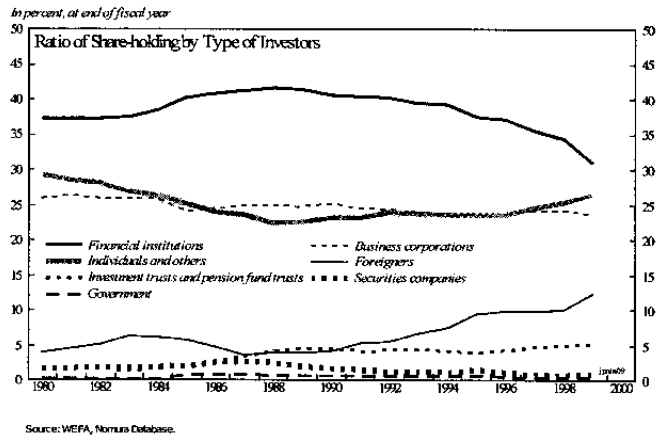




Sources: Ministry of Labor; Management and Coordination Agency; and staff estimates.

## E. Pricing Behavior of Companies

19. Firms' efforts to raise gross margins provide another possible explanation of why prices have not declined more significantly in Japan in recent years. Some observers have suggested that there has been a shift in Japanese firms' pricing behavior in recent years with firms becoming more focused on profits rather than market share as in the past (see Hayakawa and Maeda (2000)). This change could reflect a range of factors, including the impact of increased competition, deregulation, a reassessment of growth prospects, improved risk assessment by banks, and increasing reliance on capital market financing associated with financial sector reforms. The surge of foreign and individual investment in the Japanese equity market (Figure V.10), as well as the unwinding of low-return cross-shareholdings by the corporate sector and former main-banks, is also likely adding to pressures on firms to raise ROE.

Figure V.10. Japan: Composition of Shareholders




20. While margins increased gradually through most of the 1990s, the rise seems to have accelerated in the last few years (Figure V.11). Gross margins for all enterprises rose from just below 20 percent in 1996 to almost 21 percent in 1997 and to 21.7 percent in 1999. This feature is most apparent for smaller-sized enterprises with capital of ¥10 million to less than ¥100 million. Gross margins in the manufacturing sector peaked in 1997–1998, whereas nonmanufacturers' margins increased steadily after 1997.[11]

21. Rising corporate margins in recent years could also reflect the counter-cyclical behavior observed in other countries, as suggested by some game theory approaches.[12] An empirical study by Rotemberg and Woodford (1999) concluded that U.S. data were consistent with counter-cyclical markups. Although empirical studies using Japanese data are not available, changes in the domestic terms of trade suggest a tendency of margins to rise in economic downturns in the manufacturing sector—gross domestic output prices

[11] This picture coincides with market views that show the relative difficulty of some larger manufacturers in the so-called "old Japan" to shift their corporate behavior.

[12] For details on counter-cyclical markups, see, for example, Rotemberg and Saloner (1986) and Rotemberg and Woodford (1991 and 1999). Arguments for pro-cyclical markups can be found in, for example, Green and Porter (1984).

have increased more rapidly than gross input prices in most of the recessionary periods in the past, implying rising margins per unit sales (Figure V.11 (bottom panel)).

### F. Household and Business Perceptions About Price Developments

22. Another factor that could be supporting the price level is biased perceptions of households and businesses. If prevalent, misperceptions of current price developments could have contributed to downward price rigidity in recent years.[13] The top panel of Figure V.12 shows the movement of the actual core CPI (*not* adjusted for consumption tax and medical insurance rates) and the Consumers' Sentiment Index (CSI) about future price developments.[14] As the CSI indicates consumers' expectations of the *direction* of price developments over a 6-month horizon, the forecast values are shifted two quarters ahead to be comparable with the actual outcome. While developments over the past decade suggest that households' perceptions have generally moved in line with the actual outcome of the core CPI, they also indicate that the CSI has never crossed the 50 percent line; i.e., a majority of households have expected prices to continue to rise, even when actual prices have been falling. This feature is especially clear during 1997–1998 when the CSI remained well below 50 percent amid the largest decline in the core CPI since 1983. A number of EPA surveys reinforce the view that consumers over-assess current inflation.[15]

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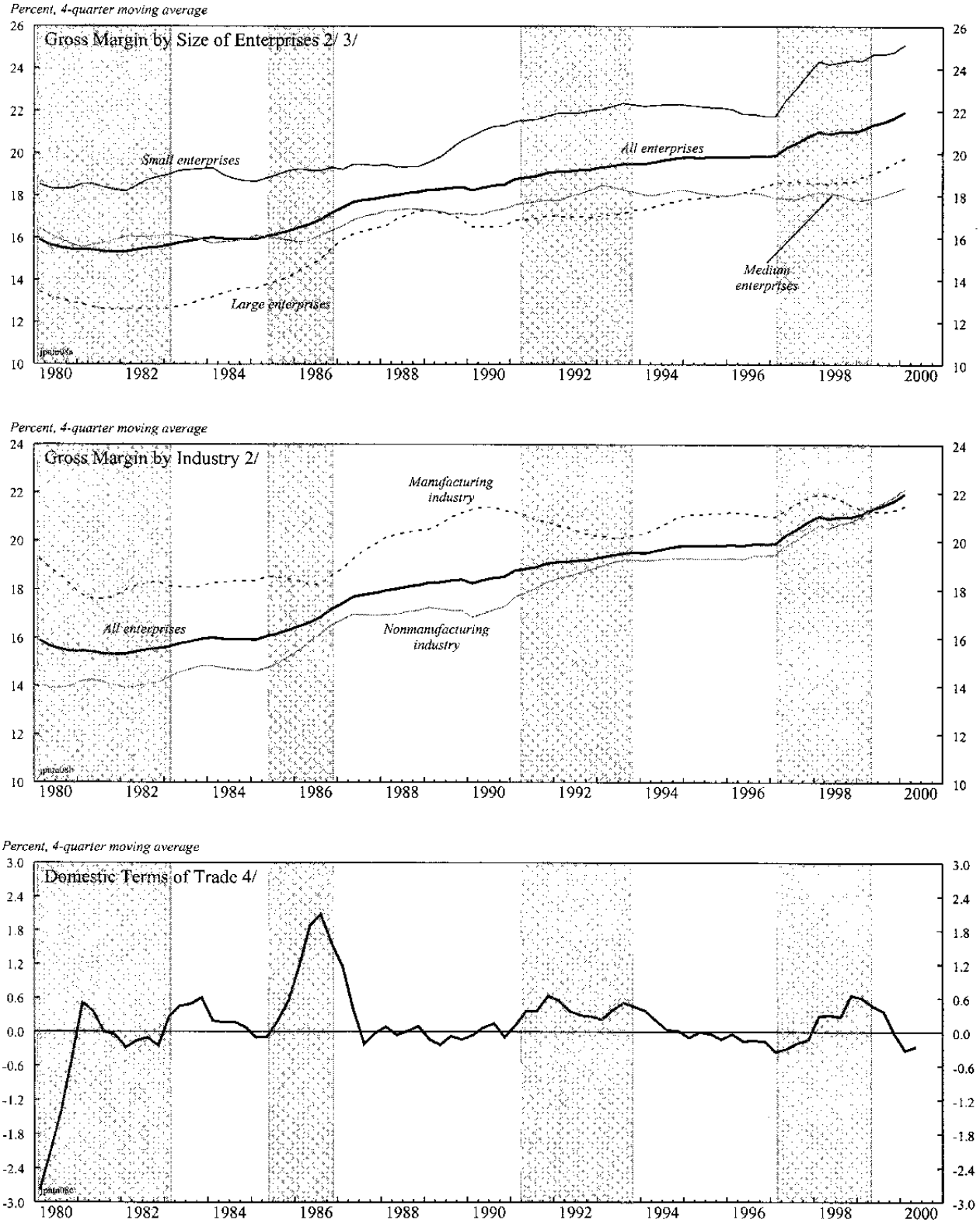
[13] Unfortunately, no data are readily available on expectations of future inflation rates in Japan, as there is no market for indexed government bonds, and the surveys of expected inflation rates are limited. However, as discussed below, it is possible to draw some implications from existing indicators and some limited surveys on the future course of price developments.

[14] The source of the CSI is the Consumer Behavior Survey by the EPA. In formulating the index, consumers are asked to translate their perception of future price developments into one of five alternatives—whether such developments seem likely to be good, slightly good, neutral, slightly bad, or bad for future consumption (falling prices would be regarded as having a favorable impact on consumption). Each alternative is given a value of +1, +0.75, +0.5, +0.25, and 0, respectively, and the values are added up to obtain the index. Consequently, when the consumers' aggregate perception is neutral, the index will have the value of 50. In order to match the time horizon of consumers' forecasts before and after the change in the survey questionnaire (1 year through the first quarter of 1991 and 6 months since the second quarter), changes in the core CPI over 2 quarters are compounded to obtain the annualized inflation rates for the period after the change.

[15] For example, a survey in 1996 concluded that almost 60 percent of the sample expressed that they felt the price level to be rising by more than 2 percent (of which about 42 percent chose "2–3 percent increase") over the past 12 months, despite the fact that contemporaneous CPI inflation (including fresh food) was only 0.6 percent.

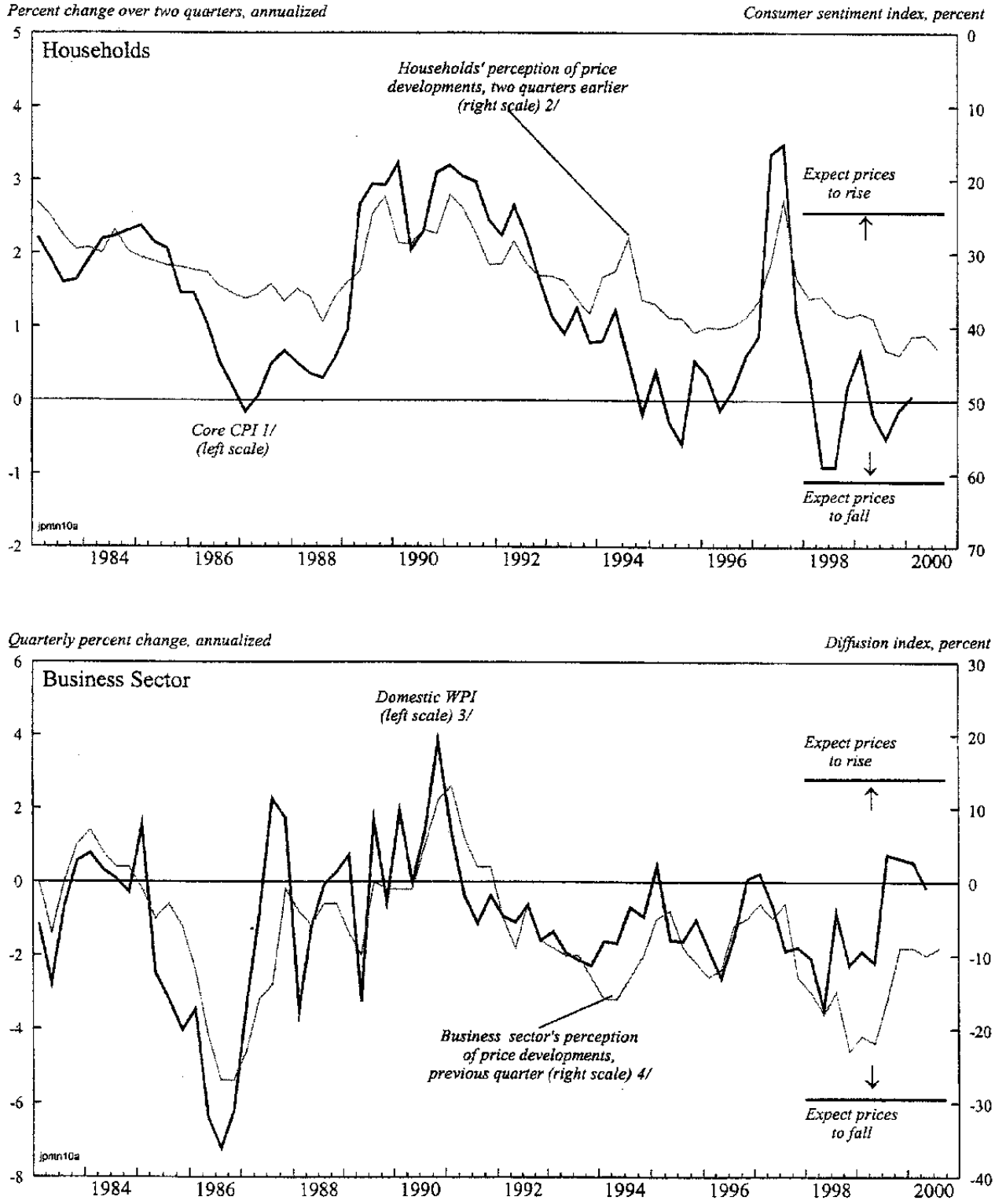
# Figure V.11. Japan: Corporate Markups 1/




Sources: Ministry of Finance, WEFA, Nomura database; and staff estimates.

1/ Shaded areas indicate recessions, starting at the peak and ending at the trough, based in EPA's designation.
2/ Gross margin is defined as: (Net sales-Costs of sales) / Net sales.
3/ Definition of the size of enterprises:
Large enterprises: those with capital of ¥1 billion or more
Medium enterprises: those with capital of ¥100 million to less than ¥1 billion
Small enterprises: those with capital of ¥10 million to less than ¥100 million.
4/ Domestic terms of trade is defined as: Quarterly change in gross domestic output prices - Quarterly change in gross domestic input price.

# Figure V.12. Japan: Perceived and Actual Development of Prices by Different Sectors




Sources: Ministry of Finance; WEFA, Nomura database; and staff estimates.

1/ Core CPI is not adjusted for consumption tax factors since the consumers expectations include the impact of such shocks. Four-quarter percent change prior to 1991Q3; annualized percent change over two quaters thereafter.
2/ In formulating the index for households' perception of price developments, households are asked to translate their perception of future price developments into one of five alternatives--whether such developments seem likely to be: good; slightly good; neutral; slightly bad; or bad for future consumption. Each alternative is given a value of +1, +0.75, +0.5, +0.25, and 0, respectively. Each value is then weighted and totaled to obtain the index. Thus, the neutral perception would have the value of 50.
3/ Domestic WPI is adjusted for consumption tax factors since the tax burden is passed through to the ultimate consumers.
4/ Diffusion index is calculated by subtracting the percentage of the total with perception of price falling from that with perception of price rising. Thus, the neutral perception would have the value of 0.

23. Forecasts made by the corporate sector seem to be more sensitive to the actual evolution of prices. The *Tankan* quarterly survey by the Bank of Japan produces diffusion indices (DI) for corporate perceptions of the direction of price developments one quarter in the future, as well as for contemporaneous price developments. The bottom panel of Figure V.12 shows that the forecast DI, shifted one quarter rightward, has moved in parallel with the actual movement of the domestic WPI (adjusted for consumption tax factor).[16] Yet, the comparison between the expected price movements and the assessment of current price movements shows that the corporate sector still has a tendency to overestimate inflationary risks (Figure V.13).

24. These observations are consistent with studies focusing on the formulation of inflationary expectations in Japan: see, for example, Nakayama and Ooshima (1999). They reported that inflationary expectations by households remained positive even in deflationary periods (1998–1999), while leading the actual movement of the core CPI by 3 quarters on average. Expectations of the business sector, on the other hand, did not show downward rigidity, and the movement coincided with the actual movement of domestic WPI.

## G. Conclusions

25. This chapter has identified a number of factors that could help explain the "unemployment-deflation" puzzle in Japan, without appealing to nonlinearities in the Phillips curve or possible overestimation of the output gap. Downward rigidity of nominal wages does not appear to be responsible for the absence of more pronounced deflation in Japan, as nominal wages (including bonuses) have in fact shown considerable flexibility, particularly after considering that ongoing corporate restructuring is likely to have increased the natural rate of unemployment, thereby reducing the degree of downward wage pressure (and price pressure) one might expect from any given degree of unemployment. On the other hand, rising markups associated with firms' increasing focus on profits over market share do appear to provide a partial explanation. The persistence of inflationary expectations among both households and (to a lesser degree) the corporate sector, despite ongoing mild deflation, also appears to have supported prices from falling further. While mismeasurement of the output gap and nonlinearities in the Phillips curve may be part of the story, the factors identified in this chapter should also be taken into account in forming a view of why deflationary pressures have not been more severe given the deterioration in Japan's economic performance in recent years.

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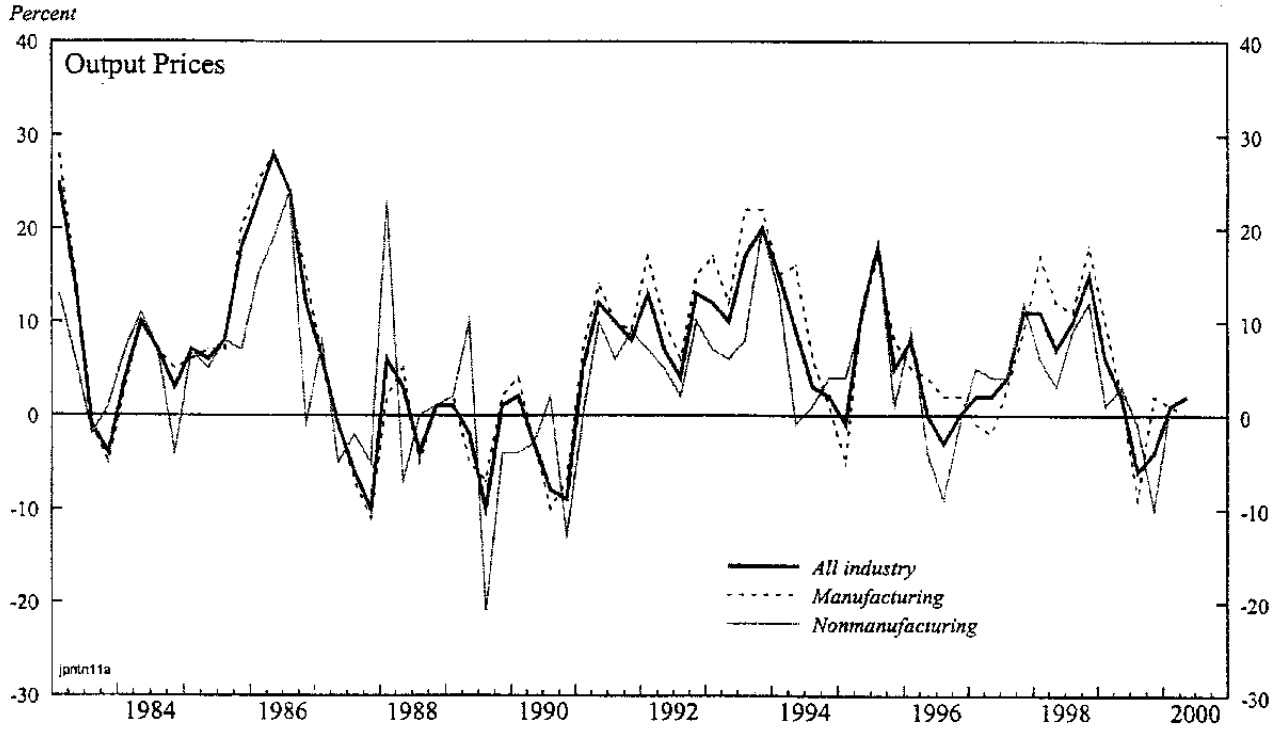
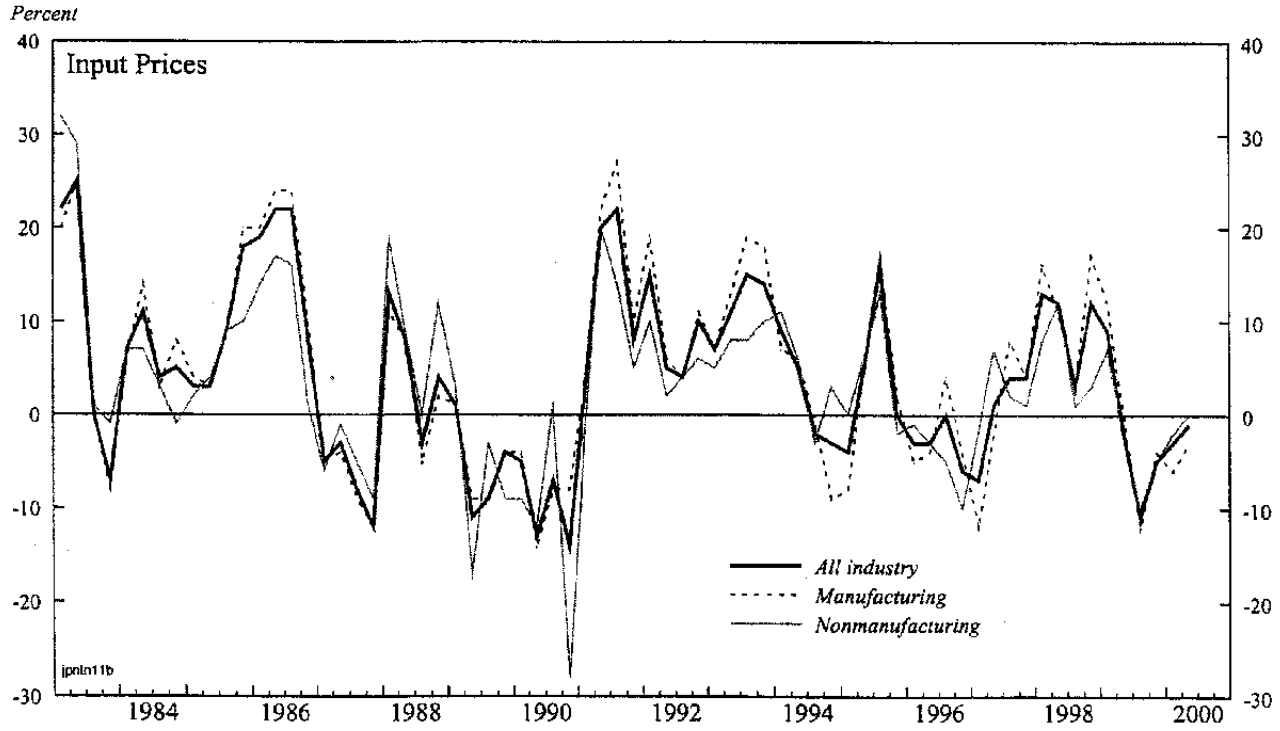
[16] Changes in the domestic WPI over 3 months are compounded to obtain the annualized inflation rates. The EPA estimated the impact of the consumption tax rate hike in April 1997 on the WPI to be about 1.9 percent.

Figure V.13. Japan: Gaps between Corporate Sector's Perception of Future and Current Prices 1/




Source: WEFA, Nomura Database.

1/ The gaps are calculated by subtracting the current duffusion index from the forecast diffusion index in the previous quarter.

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