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Japan's High Saving Rate Reaffirmed

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Compared to the U.S. national accounts, the Japanese accounts understate consumption and government spending, and therefore overstate the national saving rate. Recently, Hayashi has recalculated Japan's national saving according to the American Department of Commerce definition and found that from the mid-1970s until today, Japan's national saving rate is nearly halved. In this paper, we argue that Hayashi's adjustments to the Japanese income accounts are exaggerated, and present measures of Japanese and U.S. private saving that are immune from national income accounting biases. Our saving measures are constructed from the balance sheets of the household sectors in the United States and Japan. Far from being equal, we find that the two country gap in saving rates in the early-1980s has averaged between 15 and 30 percentage points, depending on the measure.

I. Introduction

U.S.-Japan comparisons of aggregate saving rates have traditionally been based on the national income accounts. Recently, the notion that Japan's national saving rate is high has been challenged by Hayashi (1986, 1989, 1990). Hayashi argued that before comparisons are made, the definitions of consumption and government spending in the two countries must be made consistent. Relative to the U.S. national accounts, the Japanese accounts understate consumption and government spending. First, in Japan, depreciation is treated at historical cost, and in times of high inflation, the historical cost depreciation will tend to underestimate the true cost of capital consumption. Second, since government spending in the Japanese accounts does not include government investment, the Japanese government budget deficit is lowered relative to the American deficit. Hayashi carefully recalculates Japan's national saving according to the American Department of Commerce definition and finds that from the mid-1970s until today,

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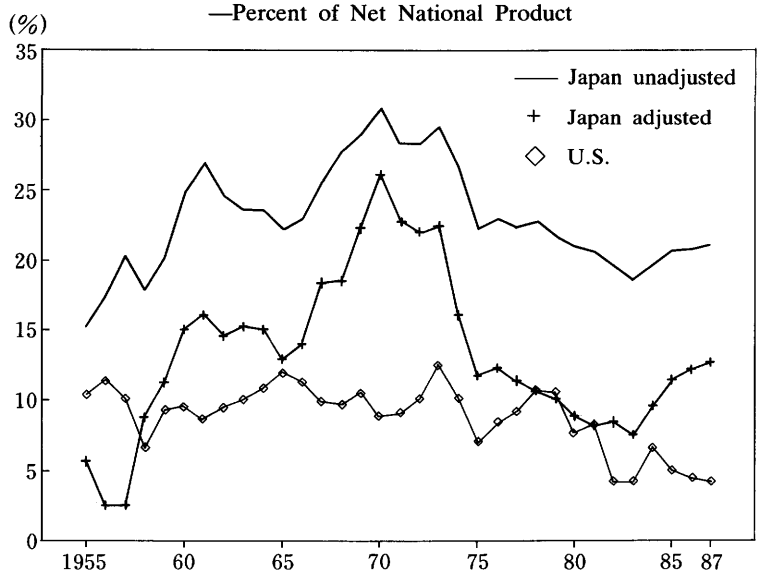
Japan's national saving is nearly halved (Figure 1). Figure 1 shows that during the early 1980s, there is almost no difference between American and Japanese saving rates.

In this paper, we argue that Hayashi's adjustments to the Japanese income accounts are probably exaggerated, and present measures of Japanese and U.S. private saving that are immune from the above income accounting biases. We find that the Japanese saving rate is indeed much higher than the American saving rate. Far from being equal, the two country gap in saving rates in the early 1980s has averaged between 15 to 30 percentage points, depending on the measure. The gap after 1985 appears to have widened further.

This paper is organized as follows. Section II shows that Hayashi's estimates of replacement cost depreciation imply implausibly that Japanese capital depreciates at a rate three times as fast as American capital. It is likely that Hayashi has imputed to Japanese depreciation, unrelated residual items, or that the Japanese Economic Planning Agency, which constructs the national accounts, has exaggerated the true cost of capital consumption.

Section III presents our measures of saving constructed from the balance sheets of the household sectors in the United States and Japan. If there are no capital gains to reproducible capital and land, then our measures of saving will equal the national accounts definition of private saving: corporate retained earnings plus household income minus consumption. The U.S.-Japan saving gap becomes much larger according to our

Figure 1
National Saving Rate
—Percent of Net National Product



Source: Hayashi (1990)

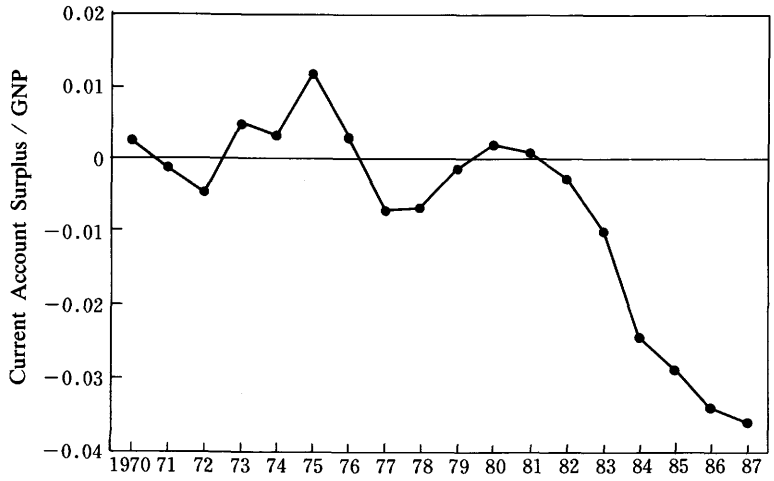
measures because of the large capital gains to reproducible capital and especially to land that Japan has experienced during the post-war period.

II. Hayashi's Implausibly High Replacement Cost Depreciation Estimates for Reproducible Capital

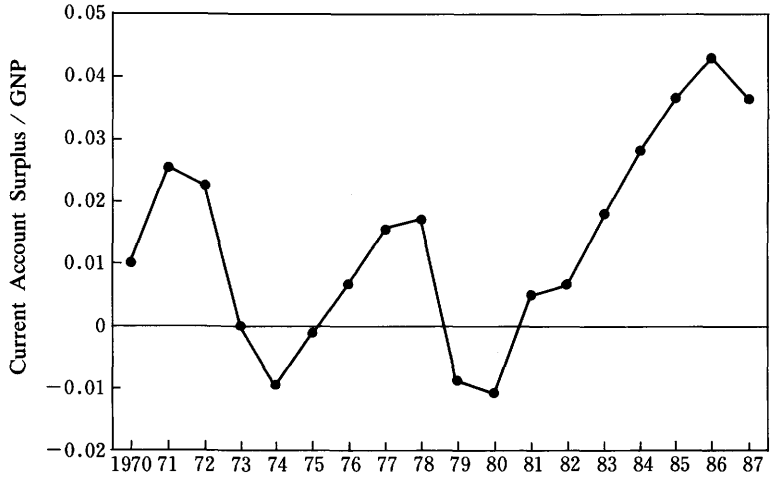
Figures 2 (a) and (b) exhibit the current account surpluses for the United States and Japan. If both the current surplus (CAS) and gross domestic investment (I) are high, then

Figure 2

(a) America's Current Account / GNP



(b) Japan's Current Account / GNP



Source: OECD National Accounts, Detailed Tables

gross saving must be high.[1]

The ratios of gross investment to GNP are shown in Tables 1 (a) and (b). Unlike in the Department of Commerce definition, investment here, taken from the *OECD National Accounts*, is inclusive of government investment.[2] Government spending, therefore, is *exclusive* of government investment in both countries. On average, the ratios of nominal investment to nominal GNP are lower than the "real-real" ratios; in both countries, there has been a fall in the relative price of capital goods.

Between 1975 and 1987, the gross saving rate, (CAS+I) / GNP, for Japan was on average higher than that in the United States by 14.7 percentage points. Figure 1 shows that during this period, Hayashi's estimates of the average Japan-U.S. gap in the net saving rates was about 2 percent. Since government investment is treated identically in both countries, Hayashi would be attributing much of the 12.7 (=14.7−2) point gap to the two countries' differing depreciation accounting practices. Depreciation at historical cost will understate that at replacement cost during and after the inflationary 1970s.

Tables 2 (a) and (b) depict replacement cost depreciations for the United States and Japan as fractions of GNP and the beginning of period capital stock.[3] The value of depreciation for Japan between 1970 and 1984 is from Hayashi (1986).[4] His method was applied to update to 1987, the replacement cost of private capital, excluding consumer durables.[5] All American data except for the depreciation of government capital are from the Bureau of Economic Analysis, Department of Commerce's *Survey of Current Business*.[6] As expected, the table shows that Japanese depreciation rates are very high compared to the United States. The U.S.-Japan gap in the ratios of total depreciation to GNP ranges from 10.5 percent in 1977 to 15.1 percent in 1982.[7] The magnitude of the gap in private depreciation / GNP is similarly large.[8]

Columns (3) and (4) display implicit depreciation rates, and again, the two country gap is significant. It appears unreasonable that implicit depreciation rates in Japan are

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[1]In the Japanese national accounts, national saving differs from the sum of the current account surplus and domestic investment by the statistical discrepancy, which is usually small. For example, in 1981, the statistical discrepancy was 0.513 trillion yen, when gross national saving was 47.012 trillion yen.

[2]It appears that what is reported as American government investment in the OECD accounts is the sum of non-military durable purchases by the Federal, state and local governments.

[3]For both countries, GNP and depreciation are divided by their respective deflators.

[4]Hayashi (1989, 1990) only present graphs showing the gap between Japanese and American net saving rates. No values for replacement cost depreciation are given.

[5]Hayashi's calculation of the replacement cost of consumer durables and government capital proved intractable, requiring the application of the perpetual inventory method to stock and flow data from 1970 in primary sources not readily available.

[6]The depreciation of government capital is from the *OECD National Accounts, Detailed Tables.*

[7]Hayashi (1986) overstates the U.S.-Japan depreciation gap. By using the Department of Commerce capital consumption data, Hayashi neglects to include in his estimates of American depreciation, the depreciation of government capital. Essentially he is comparing Table 2 (a), column (2) with Table 2 (b) column (1). The correct comparison is performed in the text.

[8]Private depreciation is the sum of corporate (non-financial and financial) and household depreciation.

Table 1
American and Japanese Gross Investment Rates
(a) Nominal Investment / Nominal GNP

Year	Total / GNP	Inventory / GNP	Resid. / GNP	Non-resid. / GNP	Other Struc. / GNP	Equip. / GNP
	U.S.					
1970	0.176	0.002	0.038	0.034	0.031	0.072
1971	0.181	0.008	0.048	0.033	0.030	0.070
1972	0.187	0.007	0.048	0.032	0.029	0.078
1973	0.191	0.011	0.052	0.034	0.029	0.077
1974	0.184	0.008	0.040	0.034	0.032	0.078
1975	0.169	−0.003	0.035	0.029	0.031	0.073
1976	0.171	0.007	0.041	0.026	0.030	0.074
1977	0.183	0.014	0.049	0.024	0.028	0.081
1978	0.195	0.013	0.051	0.027	0.030	0.087
1979	0.198	0.006	0.049	0.029	0.031	0.089
1980	0.185	−0.002	0.039	0.030	0.032	0.084
1981	0.179	0.009	0.035	0.029	0.033	0.082
1982	0.165	−0.004	0.029	0.029	0.033	0.074
1983	0.172	−0.003	0.045	0.025	0.027	0.075
1984	0.180	0.017	0.048	0.027	0.025	0.079
1985	0.181	0.006	0.047	0.029	0.025	0.080
1986	0.177	0.005	0.051	0.027	0.021	0.077
1987	0.173	0.008	0.050	0.027	0.020	0.076
	Japan					
1970	0.391	0.035	0.071	0.058	0.074	0.154
1971	0.357	0.015	0.069	0.056	0.074	0.144
1972	0.351	0.014	0.074	0.055	0.075	0.134
1973	0.380	0.017	0.087	0.059	0.081	0.137
1974	0.373	0.026	0.079	0.056	0.085	0.127
1975	0.328	0.003	0.076	0.054	0.084	0.110
1976	0.319	0.006	0.078	0.051	0.080	0.104
1977	0.311	0.007	0.075	0.049	0.080	0.102
1978	0.312	0.005	0.074	0.049	0.081	0.103
1979	0.329	0.083	0.074	0.056	0.084	0.108
1980	0.322	0.067	0.064	0.061	0.085	0.105
1981	0.315	0.054	0.062	0.059	0.084	0.105
1982	0.304	0.046	0.060	0.057	0.079	0.102
1983	0.283	0.0008	0.053	0.051	0.080	0.098
1984	0.282	0.004	0.050	0.049	0.078	0.102
1985	0.284	0.007	0.048	0.048	0.075	0.105
1986	0.281	0.004	0.050	0.046	0.074	0.106
1987	0.291	0.002	0.059	0.042	0.078	0.109

Notes: **Total**: total investment; **Inventory**: inventory investment; **Resid.**: residential structures; **Non-resid.**: non-residential structures that are buildings such as plants, business and government offices; **Other Struc.**: structures that are not buildings, such as bridges, roads, and railway tracks; **Equip.**: equipment.

Source: OECD National Accounts, Detailed Tables

Table 1
American and Japanese Gross Investment Rates
(b) Real Investment / Real GNP

Year	Total / GNP	Inventory / GNP	Resid. / GNP	Non-resid. / GNP	Other Struc. / GNP	Equip. / GNP
	U.S.					
1970	0.189	0.003	0.040	0.039	0.039	0.071
1971	0.193	0.009	0.051	0.037	0.036	0.069
1972	0.199	0.009	0.057	0.036	0.035	0.072
1973	0.202	0.013	0.052	0.036	0.033	0.080
1974	0.190	0.009	0.041	0.034	0.033	0.082
1975	0.169	−0.003	0.034	0.029	0.031	0.073
1976	0.172	0.007	0.040	0.026	0.031	0.074
1977	0.181	0.014	0.046	0.025	0.028	0.081
1978	0.189	0.015	0.045	0.027	0.030	0.087
1979	0.190	0.006	0.042	0.028	0.028	0.091
1980	0.179	−0.005	0.033	0.028	0.029	0.088
1981	0.176	0.009	0.031	0.029	0.028	0.089
1982	0.168	−0.005	0.026	0.029	0.028	0.084
1983	0.183	−0.003	0.048	0.025	0.029	0.081
1984	0.198	0.018	0.051	0.027	0.029	0.091
1985	0.204	0.006	0.049	0.029	0.029	0.096
1986	0.200	0.006	0.054	0.027	0.025	0.094
1987	0.199	0.008	0.052	0.026	0.025	0.097
	Japan					
1970	0.377	0.032	0.073	0.058	0.083	0.131
1971	0.359	0.014	0.074	0.059	0.084	0.128
1972	0.364	0.014	0.080	0.059	0.085	0.125
1973	0.383	0.017	0.084	0.059	0.088	0.134
1974	0.361	0.024	0.076	0.054	0.086	0.121
1975	0.328	0.003	0.076	0.054	0.084	0.111
1976	0.324	0.007	0.078	0.051	0.080	0.110
1977	0.324	0.007	0.075	0.050	0.080	0.112
1978	0.335	0.006	0.077	0.050	0.083	0.119
1979	0.344	0.010	0.071	0.054	0.080	0.128
1980	0.330	0.008	0.062	0.056	0.076	0.128
1981	0.327	0.008	0.057	0.048	0.077	0.137
1982	0.323	0.007	0.055	0.046	0.073	0.142
1983	0.299	0.002	0.056	0.048	0.082	0.111
1984	0.303	0.006	0.052	0.046	0.077	0.122
1985	0.310	0.009	0.051	0.044	0.075	0.131
1986	0.318	0.007	0.053	0.045	0.075	0.136
1987	0.331	0.003	0.062	0.046	0.078	0.143

Notes: **Total**: total investment; **Inventory**: inventory investment; **Resid.**: residential structures; **Non-resid.**: non-residential structures that are buildings such as plants, business and government offices; **Other Struc.**: structures that are not buildings, such as bridges, roads, and railway tracks; **Equip.**: equipment.

Source: OECD National Accounts, Detailed Tables

Table 2
Depreciation of Fixed Reproducible Capital as a Proportion of GNP and the Net Capital Stock

Year	(1) Gov. and Private Deprec. / GNP	(2) Private Deprec. / GNP	(3) Gov. and Private Deprec. / Total Capital	(4) Private Deprec. / Private Capital
	(a) U.S.			
1970	0.094	0.079	0.039	0.046
1971	0.099	0.085	0.041	0.048
1972	0.104	0.089	0.043	0.050
1973	0.105	0.090	0.042	0.050
1974	0.089	0.074	0.033	0.038
1975	0.093	0.077	0.035	0.040
1976	0.099	0.085	0.039	0.045
1977	0.104	0.090	0.041	0.047
1978	0.102	0.088	0.040	0.046
1979	0.094	0.079	0.036	0.041
1980	0.079	0.064	0.029	0.032
1981	0.076	0.061	0.029	0.031
1982	0.061	0.047	0.024	0.024
1983	0.079	0.065	0.030	0.032
1984	0.089	0.076	0.035	0.039
1985	0.091	0.077	0.035	0.039
1986	0.091	0.078	0.035	0.039
1987	0.091	0.077	0.035	0.038
	(b) Japan			
1970	0.137	0.126	0.139	0.167
1971	0.161	0.147	0.125	0.148
1972	0.166	0.151	0.121	0.141
1973	0.193	0.175	0.123	0.143
1974	0.245	0.223	0.127	0.147
1975	0.205	0.183	0.109	0.126
1976	0.209	0.187	0.111	0.128
1977	0.209	0.186	0.123	0.123
1978	0.208	0.185	0.116	0.123
1979	0.216	0.190	0.118	0.124
1980	0.222	0.195	0.122	0.123
1981	0.210	0.182	0.111	0.116
1982	0.212	0.184	0.104	0.114
1983	0.214	0.186	0.102	0.114
1984	0.215	0.187	0.101	0.115
1985	—	0.123	—	0.082
1986	—	0.137	—	0.087
1987	—	0.189	—	0.120

Source: **For the United States:** Capital stock, GNP, and depreciation of private capital, *Survey of Current Business,* Department of Commerce, various issues. Depreciation of government capital, *OECD National Accounts, Detailed Tables.* **For Japan:** Depreciation, for 1970-84, Hayashi (1986). For 1985-87, the authors' calculation using the method of Hayashi (1986). For 1985-87, we did not calculate the depreciation of government capital. The depreciation of private capital for 1985-87, unlike Hayashi (1986), does not include the depreciation of consumer durable goods. GNP and government and private capital stock figures are from the *Japanese National Accounts*, 1986 and 1990 editions.

often three times that in the United States. Assuming straight-line depreciation, a dollar of capital installed at time t would after 10 years be worth 60 cents in the United States, but only 25 cents in Japan.[9] Given the high Japanese investment rates in Table 1, it would seem that the vintage of Japanese capital is on average lower than the vintage of American capital; since newer capital would tend to have longer service lives, for the same dollar of capital, Japanese depreciation should be lower.

There are at least two reasons why Japanese replacement cost depreciation may be overestimated. First, Hayashi estimates the Japanese replacement cost-historical cost differential from the reconciliation tables linking investment to the change in the market value of the capital stock. Official calculations of depreciation at replacement cost by the Economic Planning Agency exist, but are not released. Its value must be inferred from the "reconciliation balance," which is equal to,

capital gains + (replacement cost-historical cost gap) + residual.

Hayashi obtains his depreciation gap by subtracting from the balance, capital gains, but his measure is an overestimate of the gap by the amount of the residual.[10] It is not possible from the national accounts to determine the magnitude of the residual, but it may be large during some years. For example, the entire capital stock of Okinawa appeared in the reconciliation balance for several years after the islands were returned to Japan in May 1972, which may explain why Hayashi's estimates of replacement cost depreciation are especially high for 1973 and 1974.

Second, in calculating their (unreleased) estimates of replacement cost depreciation, the Economic Planning Agency use the same asset service lives that are used by Japanese corporations for tax purposes. These service lives seem to be considerably shorter in Japan than in the United States for the same asset. For example, the "useful life" of an automobile in Japan is 4 years, but on average is 7 in the United States (Uno, 1987, p. 103; Ture, 1967, p.185).[11] At least until the late 1970s, the Japanese government had a

[9]For implicit depreciation rates, we have used 0.12 for Japan and 0.04 for the United States.

[10]According to the Economic Planning Agency (1978), the residual includes reclassifications of capital that occur in a given year. For example, at the end of the year when a publicly owned firm is privatized, the capital stock of the firm will show up as the residual in the reconciliation account for private sector capital.

[11]The table below compares the average service lives of some common capital assets.

	U.S.	Japan
Engines and Turbines	21	16
Ships and Boats	22	9
Railroad Tracks	51	26
Residential Structures	80 (single family house)	25 (wooden)

For the service lives on other assets, see for the U.S., Department of Commerce (1982, p. T17-T20), and for Japan, Economic Planning Agency, (1964, p. 190-194).

policy to stimulate corporate investment through tax incentives, and the short service lives may have been part of this policy (Ishi, 1989, p. 177).

III. American and Japanese Saving at Asset Market Values

If we accept the Haig-Hicks-Simon (HHS) concept of income as that which can be consumed without decreasing the real value of wealth, then income and saving should include real capital gains.[12] Differences in depreciation accounting should not bias our U.S.-Japan comparisons of the HHS measure of saving. Other things being equal, a country with a higher rate of capital depreciation should have lower capital gains and the market value of wealth should increase more slowly. In this section we compare the asset holdings of American and Japanese households and show that the market value of Japanese assets has increased faster than the value of American assets.

Table 3 depicts the ratio of net wealth to net disposable income for U.S. and Japanese households.[13] In spite of the persistently high level of postwar Japanese saving, the ratio of non-land assets to disposable income (DI) in Japan still appears to be smaller than in the United States. It is, however, well-known that in the balance sheets of the Japanese household sector, equity and land are substantially underestimated (Ando, 1985).[14] The underestimate of corporate equity arises mainly because non-publicly traded stocks are valued in the national accounts at par, usually at 50 yen per share.[15] Only the equity listed on the stock exchanges are at market prices. Table 4 column (2) shows the

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[12]For a careful statement of the HHS income concept, see Bradford (1989).

[13]Net wealth is the difference between gross wealth and household liabilities. Gross wealth includes inventories, non-reproducible assets such as land, the structure of the owner occupied home, and financial assets such as money, deposits, bonds, and equities. Disposable income is defined as household income minus the sum of direct taxes, social security payroll taxes, and various minor fines and fees. For Japan and the United States, the household sector includes private unincorporated enterprises and not-for-profit organizations.

[14]In 1984, corporate equity held by the household sector was reported in the balance sheets to be only 15 percent of the market value of assets held by the corporate sector. A painstaking analysis of Hoshi and Kayshap (1990) of 353 Japanese manufacturing firms listed on the Tokyo stock exchange revealed that in 1984, Tobin's q was 1.10.

The Economic Planning Agency imputes the value of land held by the household sector using the National Land Agency's "Posted Land Values (*Kōji-chika*)." It is estimated that in recent years, the *Kōji-chika* is about 70 percent of the market value of land. Since there are no official compilations of the actual transactions prices of real estate, it is not possible to develop a series for the market value of Japanese land.

[15]For example, the par value of Bank of Japan stock is 100 yen, and there are a million shares outstanding. On very rare instances, Bank of Japan equity is exchanged over-the-counter and in January 1990, shares were traded at 680 thousand yen a share.

Most unlisted corporations in Japan are very small. A firm can adopt the corporate form with 7 employees and 100,000 yen in capitalization, and take advantage of limited liability and generous physical capital depreciation tax allowances. To be listed on a stock exchange, a firm's equity must be above a given amount, be widely traded, and the firm must run a profit two years in succession. In Japan at the end of March 1990, there were 975,861 corporations, and 4,872 were listed on the two sections in Tokyo, and the seven... [to page 74]

Table 3
Net Wealth to Net Disposable Income (DI) Ratios for U.S. and Japanese Households

Year	U.S. Households			Japanese Households		
	Wealth / DI	Land / DI	Non-Land / DI	Wealth DI	Land / DI	Non-Land / DI
1955	4.83	0.17	4.66	3.13	1.85	1.28
1956	4.84	0.19	4.65	3.22	1.91	1.31
1957	4.63	0.19	4.44	3.27	1.97	1.30
1958	4.97	0.20	4.77	3.34	2.05	1.29
1959	4.93	0.20	4.73	3.32	2.04	1.28
1960	4.85	0.22	4.63	3.43	2.16	1.27
1961	5.08	0.22	4.86	3.45	2.15	1.30
1962	4.77	0.22	4.55	3.45	2.23	1.22
1963	4.87	0.21	4.66	3.50	1.99	1.51
1964	4.79	0.21	4.58	3.25	1.99	1.26
1965	4.78	0.23	4.55	3.19	1.92	1.27
1966	4.57	0.22	4.35	3.24	1.94	1.30
1967	4.76	0.23	4.53	3.32	2.00	1.32
1968	4.88	0.23	4.65	3.47	2.14	1.33
1969	4.62	0.23	4.37	3.64	2.31	1.33
1970	4.42	0.22	4.20	3.79	2.41	1.38
1971	4.49	0.22	4.27	4.32	2.66	1.66
1972	4.59	0.23	4.36	5.25	3.25	2.00
1973	4.23	0.24	3.99	5.34	3.33	2.01
1974	4.04	0.25	3.79	5.64	3.33	2.31
1975	4.15	0.25	3.90	4.22	2.44	1.78
1976	4.28	0.27	4.01	4.33	2.30	2.03
1977	4.29	0.30	3.99	4.18	2.26	1.92
1978	4.35	0.34	4.01	4.39	2.37	2.02
1979	4.49	0.36	4.13	4.86	2.67	2.19
1980	4.65	0.37	4.28	5.12	2.90	2.22
1981	4.54	0.39	4.15	5.11	3.13	2.28
1982	4.48	0.37	4.11	5.53	3.19	2.34
1983	4.55	0.38	4.17	5.57	3.16	2.41
1984	4.36	0.37	3.99	5.67	3.17	2.50
1985	4.47	0.37	4.10	5.83	3.24	2.62
1986	4.55	0.38	4.17	6.58	3.83	2.75
1987	4.58	0.40	4.18	7.91	4.81	3.10

Source: For the United States, *Balance Sheets for the U.S. Economy*, Federal Reserve Board, 1988 edition. For Japan, *Japanese National Accounts*.

Table 4
Ratio of Japanese Household Non-land Wealth to Disposable Income (DI) when the Equity of Unlisted Corporations is Valued at Market Prices

Year	(1) q from the National Accounts	(2) Non-land* / DI	(3) Change in Non-land* / DI
1970	0.14	2.88	
1971	0.15	2.90	0.19
1972	0.24	3.14	0.50
1973	0.18	3.51	0.71
1974	0.13	3.33	−0.07
1975	0.12	3.18	−0.02
1976	0.14	3.15	0.10
1977	0.12	3.17	0.09
1978	0.16	3.23	0.18
1979	0.15	3.57	0.44
1980	0.13	3.77	0.23
1981	0.13	3.87	0.16
1982	0.11	3.98	0.19
1983	0.13	3.95	0.08
1984	0.15	3.96	0.12
1985	0.16	4.04	0.17
1986	0.22	4.15	0.25
1987	0.24	4.61	0.57
		Averages	
1971-75		3.21	0.26
1976-80		3.38	0.21
1981-85		3.96	0.14
1986-87		4.38	0.41
1971-87		3.61	0.23

Notes: See Appendix for details in the construction of the three columns. Average Tobin's q observed in the *Japanese National Accounts* is the ratio of corporate equity held by the household sector to the net wealth of the non-financial and financial corporate sectors. The market value of both listed and unlisted firms is assumed to be equal to the replacement cost of the net wealth of the firms (q=1). Non-land* is the value of household non-land assets when the equity of unlisted corporations is valued at market prices.

Table 5
U.S. and Japanese Saving Rates Derived from the Harrod-Domar Condition
$s=g*W/Y$
Saving Rates (in percent)

	W/Y=Non-land / DI	W/Y=Land+Non-land / DI
	Japan	
1955-87 g=7.8%	W/Y=1.79 s=13.14	W/Y=4.35 s=33.07
1978-87 g=4.2%	W/Y=2.44 s=10.25	W/Y=5.66 s=23.78
1978-87 g=4.2%	W/Y=Non-land* / DI W/Y=3.93 s=16.51	
	U.S.	
1955-87 g=3.2%	W/Y=4.28 s=13.69	W/Y=4.59 s=14.69
1978-87 g=2.9%	W/Y=4.50 s=13.05	W/Y=4.13 s=11.98

Source: Tables 3 and 4. Non-land* corrects for the underestimate of corporate equity that is reported in the *Japanese National Accounts*.

levels of Japanese household non-land assets, "Non-land*," when the equity of unlisted firms is valued at market prices. The calculation procedure, described in the Appendix, assumes that Tobin's q for listed firms is one and equal to the q of unlisted firms.[16] The market valuation of unlisted firms raises Japanese non-land/disposable income ratios by over 50 percent.

According to the Harrod-Domar identity, the steady-state saving rate, s is equal to $g*W/Y$, where g is the growth rate of real income and W/Y is the wealth-income ratio.[17] Table 5 shows the equilibrium saving rates for the two countries for various combinations of g and W/Y. Since the Japanese economy was probably not in the steady-state until the

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[footnote 15 continued]... regional stock exchanges. Unfortunately, without information on the market values of unlisted firms, it is difficult to accurately adjust upwards, the equity reported in the national accounts. In the text, a crude attempt is made to estimate the market value of unlisted firms by assuming that the q ratio of unlisted firms is unity and equal to that of listed firms.

[16]It was not possible to adjust the equity holdings of Japanese households prior to 1970. Before 1970 in the Japanese household balance sheets, the value of equities for listed firms were not at market but at "book," the price of the stocks at the time when the stocks were obtained.

[17]In the steady-state, the wealth income ratio is constant. If income grows at g, saving or the change in wealth must equal $g*W$. The saving rate that keeps the wealth-income ratio constant is $g*W/Y$.

late 1970s, s is also calculated for the period starting in 1978.

When non-real estate wealth is adjusted upwards to reflect the market valuation of unlisted firms, the derived saving rates for Japan become higher than America's. When wealth includes land, the Japanese saving rates rise to over twice the American rates.

The saving rate derived from the Harrod-Domar condition is valid only when the wealth-income ratio is constant. Table 6 and Table 4 column (3) depict the ratio of the annual changes in real wealth to real disposable income.[18] Because the volatility in year-to-year asset prices makes international comparisons difficult, period averages are shown at the bottom of the table. Averages over sub-periods show that the Japanese first-differences have been rising since the mid-1960s, while that for the United States have been falling. The Japan-U.S. gap in the changes in non-land wealth has widened to about 15 points in the early 1980s.[19] The Japanese saved 15 percent of their disposable income; Americans saved none.

The inclusion of land in wealth greatly increases the U.S.-Japan gap in the first-differences of wealth. The average Japanese changes in wealth over the period 1956 to 1987 and 1986 to 1987 are now over three times and nine times that in the United States.

Can the capital gains on land be included in "saving?" If the capital gains arise because of increases in lifetime income, then present consumption can rise without decreasing wealth; saving in the HHS sense has occured. Dekle (1990) shows that for Japan, the capital gains on land has raised consumption during most of the post-war period. Japanese households appear to view the increase in land prices as increases in their lifetime consumption opportunities.

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[18] $(W(t)-W(t-1))/DI(t)$. Both nominal household wealth and nominal disposable income are deflated by the GNP deflator.

[19] Ignoring the change in the household's ownership of inventories, government bonds, and physical assets, the change in household non-land assets is equal to,

$$k(t+1)K(t+1) - k(t)K(t) - dk(t+1)K(t+1) + p(t+1)L(c) - p(t)L(c),$$

where $k(t)$ is the price of capital goods relative to consumption goods, $K(t)$ is the capital stock, d is the annual rate of capital depreciation, $p(t)$ is the price of land, and $L(c)$ is the land held by the corporate sector, assumed constant. At the end of 1987, the Japanese corporate sector held over 28 percent of the value of privately owned land. Note that when $k(t)=k(t+1)$ and $p(t)=p(t+1)$, the change in wealth will equal private income minus consumption. During the 1980s, the capital gains in corporate land holdings have been on average much larger in Japan than in the United States, which may help explain part of the rising gap in the first-differences of household non-real estate wealth between the two countries.

Table 6
Annual Changes (First-Differences) in the Wealth to Disposable Income Ratios for U.S. and Japanese Households

Year	U.S. Households			Japanese Households		
	Change in Wealth / DI	Change in Land / DI	Change in Non-land / DI	Change in Wealth / DI	Change in Land / DI	Change in Non-land / DI
1956	0.24	0.028	0.21	0.26	0.16	0.11
1957	−0.11	0.0059	−0.11	0.18	0.10	0.08
1958	0.35	0.0056	0.34	0.35	0.25	0.10
1959	0.12	0.057	0.066	0.27	0.17	0.10
1960	0.025	0.024	0.0010	0.40	0.30	0.10
1961	0.30	0.0054	0.29	0.33	0.19	0.13
1962	−0.10	0.0062	−0.11	0.31	0.25	0.063
1963	0.28	0.0049	0.28	0.13	0.00038	0.13
1964	0.21	0.0088	0.20	0.27	0.16	0.11
1965	0.27	0.069	0.26	0.15	0.057	0.094
1966	0.077	0.0035	0.042	0.31	0.18	0.14
1967	0.37	0.0040	0.37	0.36	0.24	0.13
1968	0.33	0.014	0.32	0.43	0.31	0.12
1969	−0.04	0.012	−0.053	0.54	0.39	0.15
1970	−0.03	−0.00010	−0.029	0.47	0.30	0.17
1971	0.20	0.010	0.190	0.64	0.33	0.31
1972	0.20	0.012	0.190	1.33	0.83	0.50
1973	−0.056	0.026	−0.082	0.58	0.38	0.20
1974	−0.0087	0.020	−0.029	−0.81	−0.69	−0.12
1975	0.24	0.0014	0.23	0.027	−0.32	0.059
1976	0.15	0.026	0.13	0.35	−0.0072	0.35
1977	0.022	0.035	−0.013	−0.0016	0.043	−0.045
1978	0.29	0.051	0.25	0.38	0.19	0.18
1979	0.32	0.039	0.28	0.61	0.37	0.24
1980	0.31	0.019	0.29	0.46	0.35	0.11
1981	−0.017	0.028	−0.046	0.43	0.30	0.13
1982	−0.18	−0.031	−0.15	0.26	0.14	0.12
1983	−0.02	0.0047	−0.025	0.26	0.084	0.17
1984	−0.05	−0.0017	−0.049	0.29	0.12	0.17
1985	0.21	0.0044	0.21	0.33	0.17	0.15
1986	0.19	0.028	0.16	0.88	0.66	0.22
1987	0.14	0.027	0.11	1.51	1.087	0.42
	Averages					
1956-60	0.13	0.024	0.10	0.29	0.20	0.086
1961-65	0.19	0.0062	0.18	0.24	0.13	0.106
1966-70	0.14	0.013	0.13	0.42	0.28	0.14
1971-75	0.12	0.014	0.10	0.35	0.16	0.19
1976-80	0.22	0.034	0.19	0.36	0.19	0.17
1981-85	−0.012	0.0011	−0.0013	0.31	0.17	0.15
1986-87	0.17	0.028	0.14	1.19	0.88	0.32
1956-87	0.13	0.015	0.12	0.38	0.23	0.15

Source: For Japan, *Japanese National Accounts*. For the United States, *Balance Sheets for the U.S. Economy*, Federal Reserve Board.

Notes: Numbers may not add up due to rounding.

IV. Concluding Comments

Economic data from different countries are usually not directly comparable. The U.S. and Japanese saving rates as reported in their respective national accounts are no exception. Hayashi's careful efforts at adjusting the Japanese saving rates deserve much praise, but his estimates of replacement cost depreciation are unrealistically high compared to American depreciation rates. The household balance sheet data that we examine do not suffer from the type of biases that Hayashi attempts to correct.

Our results that the gap in U.S.-Japan saving rates is high and increasing is troubling. Unless policymakers urgently address the issue of low American saving, American real economic growth may continue to lag behind Japan's.

Appendix. Construction of Table 4

a) Column (1): Average Tobin's q from the *National Accounts*.

The figures are derived from dividing the value of equity held by the household sector by the net wealth (*shōmi-shisan*) of the non-financial and financial sectors.

b) Assume that Average Tobin's q for both listed and unlisted Japanese corporations is one. The assumption of unitary Tobin's q for listed corporations appears to be satisfied for Japan in the 1970s and 1980s. For example, Hoshi and Kayshap (1990) have painstakingly calculated tax-unadjusted Tobin's q for 353 Japanese manufacturing firms listed on the Tokyo stock exchange, and found that between 1976 and 1984, q ranged from 0.92 to 1.10.

Since in practice Japanese firms with fewer employees have smaller q ratios, and since unlisted firms on average are smaller than listed firms, the wealth-income ratios in the Table may be somewhat biased upwards. However, the possibility of arbitrage by the buying and selling of unlisted firms suggest that the q of unlisted firms on average may not diverge far from the q of the listed firms.

The division of one by the numbers in column (1) gives the ratio of the market value of equity to the value of equity as reported in the *National Accounts*. The replacement costs cancel out.

c) Column (2): The market valuation of equity held by the household sector is derived by multiplying the household equity reported in the *National Accounts* by the inverse of column (1). Other household non-land assets are added and the sum is divided by the disposable income of households.

d) Column (3): is equal to $\{W(t)-W(t-1)\} \ / \ DI(t)$, where $W(t)$ is end of period Non-land* wealth.

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Rejoinder to Dekle and Summers

FUMIO HAYASHI

I. Introduction

In a series of articles (Hayashi, 1986, 1989a, 1989b) I argued that Japan's net saving rate in the National Income Accounts (henceforth NIA) is substantially biased upwards due mainly to an undervaluation of depreciation. In Hayashi (1986), I calculated adjusted saving rates for 1970-84 in a way comparable to the U.S. saving rates. I extended the adjustment back to 1955 in Hayashi (1989a), utilizing the then newly available NIA data for 1955-70. In Hayashi (1989b), I used the long-term statistics from Ohkawa and Shinohara (1979) to examine the prewar saving rates. My conclusion for the postwar period was, and still is, that "Japan's aggregate saving rate — however defined — is indeed higher than the comparable U.S. saving rate, but not by as much as is commonly thought" (Hayashi, 1986, p. 163).

The previous paper in this issue by Dekle and Summers (1991) (hereafter DS) argues that my depreciation adjustments are probably exaggerated and presents a wealth-based measure of saving to conclude that Japan's saving rate is higher than the U.S. rate. Although I certainly agree with their conclusion, I argue in this rejoinder that almost every single building block of their argument is unwarranted. In the next section, I will examine the main point of contention between DS and myself, namely the size of Japanese depreciation, and show that my estimate of depreciation is a reasonable one. Section III is my response to other points raised by DS. A brief conclusion is in section IV.

II. Measurement of Depreciation

A. Data Sources

For Japan, the single most comprehensive source of macroeconomic data is the NIA, which has both the "flow" section (income/expenditure accounts) and the "stock" section (balance sheets). Last year the Economic Planning Agency (EPA) has published the latest benchmark revision (with the benchmark year being 1985) of the NIA (EPA, 1990). The most recent 1991 *Annual Report on National Accounts* also incorporates the 1985 benchmark revision. My calculation reported below will be based exclusively on these two sources, which cover the period 1970-89.[1] Data for 1955-69 are in EPA (1988)

[1]DS used the 1990 edition of the *Annual Report on National Accounts* which does not incorporate the latest benchmark revision. This should not make a substantial difference.

but the price indexes there do not incorporate the latest benchmark revision, and in the near future I suppose the EPA will publish the 1985 benchmark revision for this period as well.

The U.S. national accounts (often referred to as the NIPA) compiled by the Bureau of Economic Analysis (BEA) do not have the stock section. Its handy source is the annual *Economic Report of the President*. Since 1986 the BEA has published its estimate of the capital stock annually in the August issue of the *Survey of Current Business*. The estimates for 1925-85, which are collected in BEA (1987), are consistent, definitionally and numerically, with its flow counterpart, the NIPA.[2] My calculations for the United States to be reported below are based exclusively on the NIPA data from the 1991 *Economic Report of the President* and BEA (1987).

B. Replacement Cost Depreciation for the United States and Japan

As I pointed out repeatedly in the series of papers of mine, there are two major differences in the NIA between the United States and Japan. One is that depreciation in the flow section of the Japanese NIA is at historical costs, and the other is that the U.S. NIA compiled by the BEA treats all government expenditure as consumption. *Unless otherwise noted, in this article I adhere to the BEA definition.* It is relatively straightforward to account for the second difference. Accounting for the first difference, which amounts to estimating the difference between replacement cost depreciation and historical cost depreciation, is a bit complicated. Details of my procedure for the depreciation adjustment, which can be found in Hayashi (1986) and are summarized in DS, are not repeated here.[3]

Figure 1 plots three series: the Japanese national saving rate as reported in the NIA, the Japanese national saving rate adjusted according to the BEA, and the U.S. national saving rate (which of course conforms to the BEA definition) for 1970-89. This is an update of Figure 1 in Hayashi (1989b) which was reproduced in DS as their Figure 1. The figure confirms for the latest revised data that the adjustment makes a big difference. About a half of the adjustment comes from the depreciation adjustment. To see whether my depreciation adjustment is excessive, DS examines two ratios — the depreciation/GNP ratio and the implicit depreciation rate (ratio of depreciation to the capital stock) — implied by my estimate of replacement cost depreciation. Calculating the U.S. ratios should be a trivial exercise because it only requires taking the ratio of published numbers.

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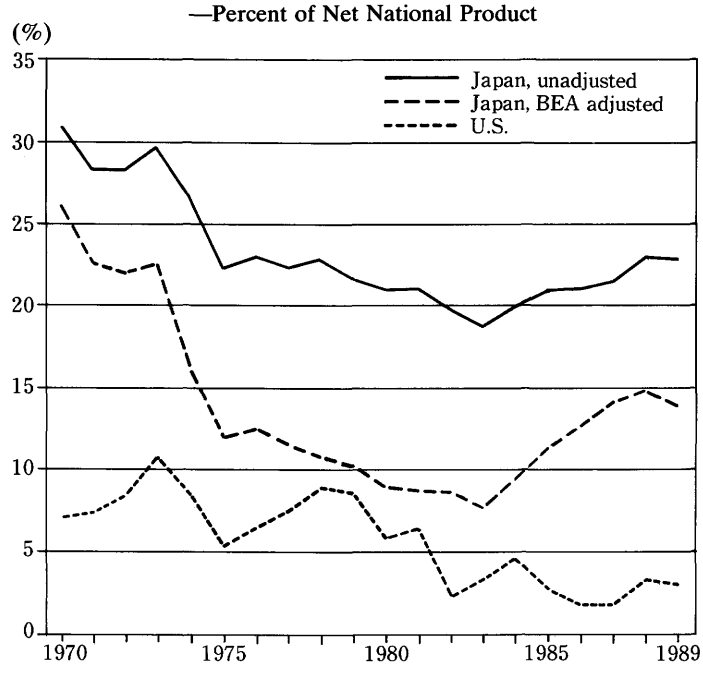
[2]The rest of the balance sheet items such as financial assets and land, along with the capital stock, are in the *Balance Sheet of the U.S. Economy* (various issues) compiled by the Board of Governors of the Federal Reserve System. However, there are minor differences from the BEA estimates.

[3]There is a very minor error in the formula for revaluation in the Appendix of Hayashi (1986). The price change factor applicable to $N(t)$ (net investment) in (A1) should be: $[P(t+1)-PA(t)]/PA(t)$, rather than $[PA(t)-P(t)]/P(t)$. In the calculation in Hayashi (1986, 1989a, 1989b) as well as here, this correct formula was used.

Figure 1
National Saving Rate
—Percent of Net National Product



Calculating the Japanese ratio requires my depreciation adjustment. Very surprisingly, it appears that DS did not get the U.S. numbers right. It is well known that the depreciation/GNP ratio is about 10% for the United States. The numbers reported in DS's Table 2 cannot be right. In my Table 1, I present what I think is the correct version of DS's Table 2.[4] There is no basis for DS's claim that implicit depreciation rates implied by my adjustment are often three times that in the United States. But I agree that Japanese depreciation relative to GNP and the capital stock is substantially larger. As I wrote in Hayashi (1989b, p. 7), one has to subtract more than 15% of GNP from gross national saving to arrive at net saving for Japan.

C. Why is Japanese Depreciation Rate So High?

As is clear from the description of my depreciation adjustment in Hayashi (1986), my estimate of depreciation is the sum of the EPA's estimate of replacement cost depreciation (which has not been published) and the residual component of the reconciliation account in the stock section of the NIA that remains in the reconciliation account after

[4]My numbers for Japan are slightly different from DS's and those in Hayashi (1986) because here I use the latest revision of the Japanese NIA.

Table 1
Depreciation, Capital Stock and GNP for the United States and Japan

Year	U.S.					Japan				
	(1) Depr.	(2) Capital Stock	(3) GNP	(4) (1)/(2)	(5) (1)/(3)	(1) Depr.	(2) Capital Stock	(3) GNP	(4) (1)/(2)	(5) (1)/(3)
1970	88.8	1516.7	1015.5	5.9	8.7	9.7	70.9	74.0	13.6	13.1
1971	97.5	1637.5	1102.7	6.0	8.8	11.1	85.8	81.5	12.9	13.6
1972	107.9	1811.0	1212.8	6.0	8.9	12.5	104.9	93.4	12.0	13.4
1973	118.1	1997.7	1359.3	5.9	8.7	16.2	146.0	114.2	11.1	14.2
1974	137.5	2267.6	1472.8	6.1	9.3	23.4	189.8	136.3	12.3	17.2
1975	161.8	2684.8	1598.4	6.0	10.1	24.7	212.9	150.4	11.6	16.4
1976	179.2	2934.5	1782.8	6.1	10.1	27.7	238.9	169.1	11.6	16.4
1977	201.5	3242.2	1990.5	6.2	10.1	30.4	266.6	188.4	11.4	16.1
1978	229.9	3681.0	2249.7	6.2	10.2	33.0	290.6	207.9	11.4	15.9
1979	265.7	4924.8	2508.2	5.4	10.6	36.6	328.0	225.9	11.2	16.2
1980	303.8	4866.5	2732.0	6.2	11.1	41.8	376.6	245.2	11.1	17.0
1981	347.8	5483.8	3052.6	6.3	11.4	43.8	407.3	262.4	10.8	16.7
1982	383.2	6103.6	3166.0	6.3	12.1	46.2	431.0	276.1	10.7	16.7
1983	396.6	6242.2	3405.7	6.4	11.6	48.2	449.5	287.6	10.7	16.8
1984	415.1	6563.2	3772.2	6.3	11.0	50.9	471.2	306.9	10.8	16.6
1985	437.2	6936.0	4014.9	6.3	10.9	53.2	494.7	327.5	10.8	16.2
1986	460.1	7206.9	4231.6	6.4	10.9	55.0	514.1	341.8	10.7	16.1
1987	487.0	n.a.	4515.6	n.a.	10.8	57.3	535.7	356.9	10.7	16.1
1988	514.3	n.a.	4873.7	n.a.	10.6	61.2	573.3	380.3	10.7	16.1
1989	554.4	n.a.	5200.8	n.a.	10.7	66.1	625.9	405.8	10.6	16.3
Average				6.2	10.3				11.3	15.9

Note: See Appendix for data source.

capital gains are accounted for.[5] It is quite possible, as DS noted, that the EPA's estimate of replacement cost depreciation is on average substantially lower than my estimate if the residual component is consistently large and positive.[6] But that does not solve the mystery of Japanese high depreciation. If the residual component is large and positive for almost every year, it *should* be included in depreciation in order for the estimate of Japanese depreciation to be comparable to that for the United States.[7] The real issue is whether my estimate is reasonable, not whether the EPA's unpublished estimate is different from mine. Since the level of depreciation equals the implicit depreciation rate times the capital stock, any possible biases in my depreciation estimate should be reflected in either the implicit depreciation rate or the capital stock. In the rest of this section I argue that my depreciation estimate is reasonable because its substantial part comes from owner occupied housing (which is the point touched upon in Hayashi (1989b)) and because whatever remaining difference in the implicit depreciation rate between the United States and Japan is attributable to a possible underestimate of the capital stock in the Japanese NIA.

1. Asset composition effect

Since it is a weighted average of depreciation rates for individual assets, the (overall) implicit depreciation rate can differ between the two countries if asset composition is different. In Hayashi (1986, Table 2) I went beyond examining the overall depreciation rate and calculated the asset-specific depreciation rates. Table 2 of the present article updates my previous calculation for three broad asset categories (residential structures, nonresidential structures, and producer durable equipments) along with the corresponding U.S. depreciation rates.[8] It shows quite clearly that the difference comes from the

[5]In Hayashi (1989b) I conjectured that the puzzlingly low adjusted saving rate in the 1950s must be due to the erratic movements in the residual component.

[6]There is one piece of information in the Japanese NIA which may allow us outside the government to directly calculate the EPA's estimate of replacement cost depreciation by asset, at least for the nation as a whole. Table 2-III-1 in the stock section of the NIA shows the end-of-year value of capital stock, net investment during the year, and the reconciliation. They sum to the next year's value of the capital stock. The value of net investment is different from that in the flow section. Thus it is possible that net investment in the table is at replacement costs. *If* that is the case, the difference between replacement cost and historical cost depreciations is zero in Table 2-III-1 and the reconciliation account should equal capital gains less residual components. Therefore the residual component can be identified. According to my calculation, it is on average more than 2% of the nation's capital stock!

[7]In fact, in the capital stock estimate in BEA (1987), there is no item corresponding to the residual component. That is, the change in the capital stock equals gross investment less depreciation (at replacement costs) plus capital gains. Depreciation is defined as "the value of past investment lost through physical deterioration, obsolescence, accidents, and aging" (BEA, 1987, p. xxvi).

[8]It is not possible to calculate from the Japanese NIA the asset-specific depreciation rates for the private sector. The depreciation rates shown in Table 2 are for the nation as a whole which includes government capital. This is the reason why the overall depreciation rate in Table 2 does not agree with that in Table 1 for Japan. The overall depreciation rate for the nation is lower because government capital is mainly in the form of structures.

Table 2
Depreciation Rates by Assets

Year		Residential Structures		Nonresidential Structures		Equipments		Total	
		Value Share	Depr. Rate	Value Share	Depr. Rate	Value Share	Depr. Rate	Value Share	Depr. Rate
1970	U.S.	48.3	2.8	28.0	5.1	23.8	13.0	100.0	5.9
	Japan	20.6	9.9	54.8	7.2	24.7	28.4	100.0	13.0
1975	U.S.	47.0	2.9	29.6	5.1	23.4	13.5	100.0	6.0
	Japan	23.5	8.8	52.6	6.3	23.9	22.7	100.0	10.8
1980	U.S.	49.5	2.9	26.7	5.7	23.8	13.7	100.0	6.2
	Japan	26.1	9.0	56.5	6.5	17.4	23.9	100.0	10.2
1985	U.S.	47.7	2.9	27.3	5.6	25.0	13.5	100.0	6.3
	Japan	23.6	8.5	59.4	5.7	17.0	22.8	100.0	9.3
1989	U.S.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Japan	22.6	8.8	59.5	5.7	17.9	23.8	100.0	9.6

Note: See Appendix for data source.

high Japanese depreciation rate for residential structures (housing) and for equipments. The combination of the high fraction of residential structures and the low housing depreciation rate for the United States explains a lot: if the U.S. depreciation rate for residential structures were 9% as in Japan, then the U.S. overall implicit depreciation rate would rise by nearly 3 percentage points. I think that the Japanese housing depreciation rate of about 9% is reasonable given that a large fraction of Japanese housing is made of paper and wood; it would be puzzling if it were as low as in the United States. What *is* puzzling is the high Japanese depreciation rate for equipments. The Japanese equipment depreciation rate of 23% is 1.8 times as large as the U.S. rate. Equipments are internationally tradable. Why does the same piece of equipment appear to depreciate faster in Japan?

2. The capital stock estimate

Actually, the question of high depreciation rate is an old one. Japan is unique in that we have a direct estimate of the capital stock in the *National Wealth Survey* (NWS). The two most comprehensive surveys are for 1955 and 1970. According to EPA (1978, p. 231), the Japanese NIA takes the 1970 NWS estimate of the net capital stock to be the capital stock for 1970 in the NIA. However, it has been recognized by practitioners of the perpetual inventory method that it requires implausibly high depreciation rates for the EPA's investment series between 1955 and 1970 to be consistent with the NWS net capital stock for the two years. For example, Dean, Darrough and Neef (1990) reports that the depreciation rate has to be about 10% for structures and 30-50% for

equipments.[9] This has prompted some prominent students of productivity growth to take the position that the NWS *gross* capital stock should be used as the capital stock (Kuroda, 1990, p. 266). The detailed examination of the Japan-U.S. productivity comparison in Jorgenson, Kuroda and Nishimizu (1987) is based on this premise. For equipments, the 1970 NWS gross capital stock is about twice as large as its net counterpart.[10] It is, then, not surprising at all that the Japanese implicit depreciation rate for equipments in Table 2 is almost twice as large as the U.S. rate; what is mis-measured in the Japanese NIA is the capital stock, not the level of replacement cost depreciation (recovered from the NIA by my procedure).

III. Miscellaneous Issues

Having disposed the main issue of contention, I now turn to other points discussed in DS.

A. Wealth-Based Saving Rate

The second half of DS is devoted to the wealth-based measure of saving to show that the market value of Japanese assets has increased faster than the value of U.S. assets. This is not at all new; I calculated my own wealth-based saving rate with the Japanese rate higher than the U.S. rate by as much as 20 percentage points on average.[11] DS takes great pains to document that the "market value" of corporate equities in the NIA is substantially undervalued[12] and goes through a procedure to try to correct for that. But their procedure seems seriously flawed. First, DS overlooks the fact that the value of equity on the *asset* side of the balance sheets for the household sector (and other sectors) are at market prices.[13] Thus it is both unnecessary and inappropriate to blow up the value of household equity holdings which are already at market prices. Second, if, as they claim, the EPA's estimate of depreciation is biased, it means that the capital stock series in the NIA are invalid. Thus I do not see why DS's measure of saving is immune from the alleged accounting biases, as DS claims it is.

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[9]This raises a question of why the depreciation rate for structures in Table 2 is substantially lower than the structure depreciation rate in Dean, Darrough, and Neef (1990). I think that the answer lies in the fact that structures in Table 2 includes government capital, while the estimate in Dean, *et al.* is for manufacturing sector only.

[10]See Tables 1-1 and 1-2 of EPA (1975).

[11]See column 5, Table 1 of Hayashi (1986).

[12]This, however, is no longer the case in the latest benchmark revision where corporate equities are at market prices. To appreciate that, compare the value of equity for the nonfinancial corporate sector for, say, 1988, in the 1990 *Annual Report on National Accounts* with that in the 1991 *Annual Report*. The latter is more than ten times as large.

[13]See page 561 of the 1990 edition of the *Annual Report*.

B. Use of Secondary Data Sources

DS relies on the OECD national accounts for U.S. numbers. I understand that it is motivated by their desire to include government capital, but the primary data source on government capital, BEA (1987), is readily available. Reliance on secondary data sources adds a layer of uncertainty about data reliability. This may have contributed to the apparent error in their Table 2 for U.S. depreciation rates.

C. Other Quibbles

The rest of my comments are minor quibbles.

— In section II, last paragraph of DS, it is claimed that the same asset service lives for tax purposes are used by the EPA to calculate economic depreciation. This is not true at least for the set of assets I checked. For example, the asset life used by the EPA for engines and turbines is, as noted by DS in their footnote 11, 16 years, while the asset life for tax purposes as of 1965 is shorter and is 11 years (see 31 May 1965 special issue of the *Official Bulletin*). Moreover, strictly speaking, it is not appropriate to compare asset lives between the two countries, because the procedure used by the BEA to calculate depreciation from the asset life is different from that used by the EPA.[14]

— Since service flows from government capital are included in Japanese GNP but not in the U.S. GNP, one has to adjust for that when making international comparisons. DS's Table 2 does not seem to have done that.

— Contrary to what DS appears to claim in footnote 5, the stock and flow data necessary for carrying out the perpetual inventory method from 1970 have been available in the NIA for at least several years.

— In footnote 7, DS alleges that I failed to make a correct comparison. As far as I can tell from Hayashi (1986), I did not make such a mistake. I did not include depreciation on government capital in my estimate of U.S. depreciation because I wanted to adhere to the BEA definition. The corresponding Japanese depreciation, correctly, does not include depreciation on government capital.

— Of all the points raised in DS, the *only* one which I think has any merit is the treatment of Okinawa's capital stock. The calculation reported in this article still does not properly incorporate it. But, as far as I can tell, DS's wealth-based measure does not appear to have adjusted for Okinawa, either.

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[14]The EPA uses geometric depreciation. If T is the asset life, the geometric depreciation rate d is calculated as $(1-d)^T=10\%$ (see EPA, 1978, p.233). The procedure used by the BEA is more complicated and utilizes what is called the Winfrey S-3 retirement distribution. See Hulten and Wykoff (1981, section IV) for a clear exposition of the BEA methodology.

IV. Conclusion

As much as I appreciate the effort and interest paid by DS, I view their work as wholly misguided. I think that directions for future research should include a more thorough examination of equipment capital in the *National Wealth Survey* and a careful measurement of housing depreciation. The latter would require collecting data on prices of houses of different ages. Also, with all due respect, I urge the EPA to publish, first, their estimate of replacement cost depreciation, and second, an explicit account of exactly what items are included in the reconciliation account besides capital gains and the replacement cost-historical cost gap in depreciation. This will take the detective work out of academics' dealing with the most basic economic statistics published by the Japanese government.

Appendix: Data Source

Figure 1

For Japan, the unadjusted saving rate is defined in the usual way:

$$S / (GNP - DEP)$$

where S = national saving (line 3, Table 1-[2]-I-2 of the 1991 *Annual Report on National Accounts*),
GNP = gross national product (Table 1-[2]-I-1),
DEP = depreciation (at historical costs) (line 3, Table 1-[2]-I-1).

The adjusted rate calculates depreciation at replacement costs. See the Appendix in Hayashi (1986) and footnote 3 of the text for details.

The U.S. saving rate is defined in the usual way:

$$(GS - DEP) / (GNP - DEP)$$

where GS = gross saving (Table B-28 of the 1991 *Economic Report of the President*),
GNP = gross national product (Table B-1),
DEP = capital consumption allowances with capital consumption adjustment (Table B-22).

Table 1

For the United States,

(1) depreciation in billions of dollars (see data source for Figure 1),
(2) capital stock at year beginning (i.e., at the end of the previous year) in billions of dollars (Table A13 of BEA (1987)),
(3) GNP in billions of dollars (see data source for Figure 1).

For Japan,

(1) depreciation at replacement costs (see above),
(2) capital stock at year beginning in trillion yen (sum of: line 2 of Table 2-II-1, line 1 of Table

2-II-2, line 1 of Table 2-II-4, and line 2 of Table 2-II-5),

(3) GNP net of service flows from government capital (see Appendix in Hayashi (1986) for derivation).

Table 2

The depreciation rate is the ratio of depreciation for the asset to the stock of the asset at the end of previous year. For the United States, depreciation and the capital stock are for the private sector and are from Table A10 of BEA (1987) for residential structures, Table A7 for nonresidential structures and for equipments. For Japan, depreciation and the capital stock are for the nation as a whole (including the government sector). The capital stocks by asset are in Table 2-III-1. Depreciations by asset are calculated as explained in the Appendix of Hayashi (1986). In particular, to calculate revaluation using formula (A1) in Hayashi (1986) (see footnote 3 of the text for a very minor modification), net capital stock in Table 2-III-1 is taken to be nominal net investment.

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