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TAXATION, ECONOMIC RATE OF RETURN AND INVESTMENT: A COMPARISON OF U.S. AND JAPANESE MANUFACTURING INDUSTRIES*

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Abstract

When interacted with inflation, corporate income tax has widely been recognized to increase taxable income. However, whether inflation has made the taxable income steadfastly exceed the economic one is not certain. This paper shows empirically while this has been the case in the U.S. manufacturing industry, their Japanese counterpart has been able to gain from inflation. The investment performance of the two nations' manufacturing industries is also examined and is shown to be explained well by the after-tax economic rates of return.

I. *Introduction*

The purpose of this paper is to compare the effects of tax policies and inflation on capital investments of U.S. and Japanese manufacturing industries. On this issue there seem to be two views which call for further scrutiny. The first one is the claim made by Feldstein and his coauthors [Feldstein and Summers (1979), Feldstein (1982), Feldstein, Poterba and Dicks-Mireaux (1983), Feldstein and Jun (1987)]. A conclusive statement of this view may be found in Feldstein's 1980 Fisher-Schultz Lecture, in which he reviewed the U.S. nonresidential investment until 1977 and claimed that "the interaction of inflation and the existing tax rules has contributed substantially to the decline of business investment in the United States" [Feldstein (1982)]. Extending the time horizon up to 1985 and using the revised National Income Statistics, he and Jun draw a brighter picture of the investment in the U.S.: "net fixed nonresidential investment increased substantially in the first half of the 1980s as a result of the improved tax climate for investment that resulted from the 1981 tax legislation and from the reduced rate of inflation."

When interreacted with the tax structure, inflation has been regarded throughout their studies as an obstacle of capital formation in the U.S. One of the tasks of this research is to reexamine this view by comparing investments of U.S. and Japanese corporations which have operated under different tax and financial settings. Actually, in the aforementioned

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lecture Feldstein remarked also that "capital tax rules differ substantially among countries, inflation can have very different effects in different countries on the rate and composition of capital accumulation," This study seeks to provide empirical evidence of this statement.

The second perspective about the effects of tax policies on investment to which we will give a closer look is the one which has recently been seriously advocated in Japan, especially from the business community. According to this view, Japanese effective corporate tax rate has exceeded significantly that of the U.S. and it has depressed investment of Japanese firms. This assertion has now been strengthened to the extent of giving a caution to policy makers that Japanese corporations may want to invest more in foreign countries than at home. We have examined elsewhere the differential of effective corporate tax rates between the two nations, and shown that Japanese rate has in fact surpassed the U.S. rate since the beginning of the 1980s [Tajika and Yui (1989)]. In this paper we will go a step further by simulating the investment of Japanese manufacturing industry when its effective tax rate is reduced to the current U.S. statutory corporate tax rate, i.e., thirty four percent.

We would now like to touch on the characteristics of our study. First, we concentrate on the comparison of investments of manufacturing industries of the two countries. The reason for this narrowing the scope of study is that we considered the capital accumulation in the manufacturing industries would be more conductive to productivity growth and hence to international competitiveness of the two nations' firms. The second characteristic of our study has to do with capital stock data of the industries of the two nations. Since we have to start from income reported in tax statistics to estimate economic income, and in this process the difference between actual and economic depreciation matters, capital stock must be estimated by using the same economic rate of depreciation as the one that we employ when converting the taxable income to the economic one. That is, we have to construct the series of capital stock data of U.S. and Japanese manufacturing industries for ourselves. This calls for somewhat daunting data work. And moreover, the resulting capital stock estimates may not turn out to be the same as those reported in the national income statistics.

The third characteristic of our study is about the specification of investment functions. We will explain the variations of investment basically by the after-tax economic rate of return, paying due concern to avoiding simultaneity bias. This specification itself owes to the above mentioned works of Feldstein and his collaborators. However, we will focus more on the relation between the economic rate of return at the corporate stage and investment than between the return at the household stage and investment. Specifying the investment function in this way is particularly relevant in Japan where the ties among corporations have been so strong that most of their equities have been held mutually by themselves. In this circumstance, it is hard to consider that corporate investment is carried out by taking into account the rate of return at the household stage.

Before going into the details of our analysis, we would like to present an overview of our findings of this paper. As for the growth performance of capital investments, a noteworthy fact would be that the investment behavior of U.S. manufacturing industry has differed rather significantly from that of its Japanese counterpart: the rate of capital accumulation defined as the ratio of net investment to capital stock had a declining trend in the U.S. after 1980 and rebounded only in 1986, whereas in Japan capital investment has

been "back" in the 1980s after a long decline and in 1985 the highest rate of capital accumulation since the first oil shock was achieved.

Investments of both countries are basically explained well by the post-tax economic rates of return at the corporate stage. However, as was alluded to immediately above, the investment behavior of U.S. manufacturing industry in the 1980s, especially since 1983, has been rather exceptional and the investment has reacted negatively to the economic rate of return.

Inflation has affected the economic income of the two countries' industries in contradicting ways: in the U.S. the taxable corporate income has been inflated under the existing tax structure in the process of inflation and has exceeded the economic income, however in Japan the reverse is the case and the taxable income has been below the economic one. This striking difference of the effects of inflation on economic income will be shown to have come from the difference in financial structures between the two countries: Japanese corporations have financed investment more from external funds than their U.S. counterparts.

The plan of the rest of the paper is as follows. In the second section we will deal with the economic rate of return. More specifically, we will first define the economic income and then show empirically how taxable and economic incomes have differed in the two countries. Here, the results of our estimate of the effective corporate income tax rate will also be reported. The third section will be devoted to estimating the investment functions. The fourth section will present the results of two simulations: the first illustrates how investments will be changed when taxable income is completely indexed, i.e., when taxable income is set equal to the economic one; and the second explores the effects of corporate tax cuts in Japan. The last section will conclude the paper.

II. *Economic Rate of Return*

The purpose of this section is to present our estimates of economic rates of return of U.S. and Japanese manufacturing industries. Since the economic rate of return is defined as the ratio of economic income to the prevailing capital stock, we must first have a concrete notion of economic income. This section therefore starts with the definition and measurement of economic income and takes up the effective corporate tax rate and the economic rate of return successively.

II.1 Economic Income

We view the economic income as the one which is fully indexed after proper judgements are made about the inclusion of sales and cost items. In other words, we estimate the economic income in two stages: in the first, we scrutinize the sales and cost components in taxable income, and seek to obtain the economic income before indexation by adding ignored components to and subtracting unnecessary ones from the taxable income; in the second stage, we replace the nominal values of depreciation, interest payments and the costs of inventories with their respective indexed values.

As for the first part of income recalculation, the adjustments we have actually made are the following. First, state (in the U.S.) and prefectural (in Japan) corporate taxes are

deductible in reaching the taxable income. We have added this cost item back to the taxable income. Second, we have also added back various income-deductible reserves to the taxable income. Reserves make corporate tax liabilities smaller by allowing the deduction of certain costs, say costs of bad debts (in the U.S. and Japan) and costs of employees' retirement (in Japan), prior to the actual occurrence of the events. When the events covered by reserves actually happen, reserves are added back to the corporate income and from it the actual costs are subtrated. Therefore, from the view point of corporate tax liabilities, reserves are no more than the vehicles for reducing the corporate tax burden.

The third item of income adjustment is the inclusion of net receipts of dividends. In order to avoid the double taxation of corporate dividends net receipts of dividends are basically exempted from the corporate tax in both countries. This being legitimate for defining the proper tax base for the corporate income tax, it also is true that by so doing the corporate income is undervalued. The third adjustment corrects this undervaluation.[1]

These are the adjustments we have made in the first stage for getting the economic income from the taxable one. What is left for reaching the economic income is to correct nominal measurement of corporate income. In either country no systematic indexation of corporate tax base has been institutionalized, and this might have caused serious distortions in taxable income. In this context accelerated depreciation has not always been a device employed for giving specific investment incentives for certain industries, but rather it often is an ad hoc measure to cope with the underdepreciation in the process of inflation. In a sense the measure may be regarded as a de facto indexation of capital consumption allowances. However, the problem of this adjustment of income is obvious: there is no guarantee that the artificially accelerated depreciation reflects the economic one.

As was briefly mentioned at the outset of this section the corrections of income we have made in the second stage of adjustment are the following three. First, the depreciation listed in tax statistics has been replaced with the economic one. Estimation of the rate of economic depreciation is obviously difficult: here, we have decomposed the depreciable assets of manufacturing industries of the two nations into those classified by Hulten-Wykoff (1981) and applied the same economic rates of depreciation to relevant components of depreciable assets. Therefore, in this estimation procedure the difference of the rates of economic depreciation of the two countries are due to the composition of assets in the industry.

The second correction is the gains from borrowing. When they pay interest, corporations may deduct them fully from their taxable income. A problem here is that the interest deducted is the nominal one. When nominal interest is such that the rate of inflation is put on top of the real part of interest, corporations may be able to deduct even the redemption part of their borrowing from their taxable income. Under this circumstance firms in net debt can have their taxable income smaller than under the one where interest deduction is indexed. We should therefore add these gains from borrowing to the taxable income to reach the economic income. This is our second income adjustment.

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[1] In addition to these corrections common in both countries, we corrected a special cost item in Japan: in Japanese corporate income tax, expenses for entertainment are not allowed to be deductible. Without delving into the difficult classification of legitimate and illegitimate company entertainment costs, we simply regarded all costs of entertainment as legitimate and deducted them from the taxable income.

The last correction is as important as the other two and this is concerned with inventory valuation. It is a well known fact that when a conventional inventory accounting like the FIFO (First-In-First-Out) is employed under inflation, costs of inventory are suppressed. In other words the taxable income will turn out to be inflated. The resulting corporate tax burden is often so huge that some ad hoc special measures are taken.[2] The correction of this blown up part of the taxable income is very difficult, since we have to know not only the construction of inventories, but also the inventory accounting methods used for calculating the taxable income. In this paper we have circumvented this difficulty by appealing to the inventory adjustments reported in the respective country's national income accounts.

The results of our estimate of the economic income of U.S. and Japanese manufacturing industries are shown in Tables 1(a) and (b) respectively. In the tables all numbers are expressed as the proportions to the economic income of the relevant nation's manufacturing industry. That is, in Table 1(a), the first column is the ratio of the taxable income of U.S. manufacturing industry to its economic one. In the same vein the numbers in the rest of columns are the ratios of various income adjustments to the economic income. And in each row of the table, the following identity holds:

$$[\text{Taxable Income}]+[\text{First Stage Income Adjustment}]+[\text{Depreciation Adjustment}]+[\text{Gains from Borrowing}]-[\text{Inventory Adjustment}]=100\%.$$

A comparison of Table 1(a) with 1(b) reveals a very important difference between the construction of the two nations' economic incomes. In the U.S. taxable income was consistently higher than the economic one during the period in which the rate of inflation was high. On the other hand, Table 1(b) shows quite different figures in Japan: taxable income has been lower than the economic one throughout our estimation period, 1970–87. The rates of divergence between the taxable and economic incomes in Japan were most significant at around the two oil shocks, when prices increased most markedly. Thus, we may claim that inflation has two divergent effects on taxable income: in the U.S. it has inflated the taxable income and this supports the findings of Feldstein and his coauthors: however, unlike in the U.S., taxable income has been brought down even below the economic one in Japan.

We would like to detect possible sources of this difference by comparing each component of income adjustments. In both countries first stage adjustments have been positive except for the U.S. in 1985 and 1986; in these years net receipts of dividends were so negative as to overwhelm other adjustments which had contributed to reducing the taxable income. Thus, overall, first stage adjustments may be said to have made the taxable income lower as compared with the economic. Among the second adjustment components, depreciation adjustment has had mixed effects; in the U.S. this element was negative (that is, inflating the taxable income) in the 1970s and the early 1980s, and became positive (even in double-

[2] A good explanation of the effects of inflation on costs of inventory, therefore on taxable income, may be found in Kay and King (1986) and Boadway, Bruce and Mintz (1982). In the U.K. the stock relief act was enacted as a special measure to cope with this problem. However, in either the U.S. or in Japan, no special tax policies have been implemented to lessen the inflated corporate tax burden.

TABLE 1. COMPOSITIONS OF ECONOMIC INCOME

(a) U.S.

%

YEAR	Taxable income	Income adjustments			
		First stage	Second stage		
			Depreciation adjustment	Gains from borrowing	adjustment Inventory
1967	96.3	3.7	2.2	−0.4	1.9
1968	98.6	4.1	2.3	−0.5	4.6
1969	102.0	5.1	1.1	−0.6	7.6
1970	104.8	5.9	−1.3	−0.6	8.8
1971	101.1	4.3	−0.4	−0.4	4.6
1972	98.7	5.8	1.3	−0.3	5.6
1973	106.2	7.9	1.1	0.4	15.6
1974	113.0	13.0	−3.9	6.7	28.8
1975	105.9	3.8	−8.1	4.7	6.3
1976	106.0	5.2	−6.3	1.8	6.8
1977	105.2	5.1	−4.0	1.2	7.4
1978	112.2	2.5	−7.2	1.4	8.9
1979	117.5	2.3	−8.4	4.0	15.4
1980	115.5	4.1	−10.5	4.8	13.8
1981	116.0	1.8	−9.4	−0.4	8.0
1982	103.4	5.1	−4.0	−1.2	3.2
1983	96.1	2.1	4.9	−0.6	2.5
1984	89.9	3.3	9.8	−1.4	1.7
1985	84.6	−1.1	17.0	−0.3	0.3
1986	80.3	−1.1	17.4	2.4	−1.1

(b) Japan

%

YEAR	Taxable income	Income adjustments			
		First stage	Second stage		
			Depreciation adjustment	Gains from borrowing	Inventory adjustment
1970	70.3	10.3	14.8	5.7	1.1
1971	71.5	11.9	18.3	−2.3	−0.7
1972	69.2	10.8	14.0	10.8	4.7
1973	59.5	7.6	7.4	40.9	15.4
1974	62.3	10.3	4.4	38.1	15.2
1975	91.8	18.0	−5.5	9.3	13.6
1076	72.9	8.6	4.3	21.0	6.8
1977	82.1	11.1	4.0	5.6	2.8
1978	86.7	9.5	4.9	−3.1	−2.1
1979	77.9	7.1	3.4	24.7	13.0
1980	77.6	6.7	2.2	27.9	14.2
1981	93.5	8.5	3.0	0.6	5.6
1982	90.4	6.3	4.4	0.6	1.7
1983	86.6	6.8	7.4	−2.5	−1.6
1984	84.9	7.3	6.4	0.5	−0.8
1985	85.2	7.6	7.9	−3.8	−3.2
1986	86.0	9.1	9.6	−14.1	−9.4
1987	82.0	7.4	9.4	−4.1	−5.3

Notes: 1. All numbers in the table are expressed as the proportions to the economic income.
2. In the table, Taxable Income + First Stage Adjustments + Depreciation Adjustment + Gains from Borrowing − Inventory Adjustment = 100%.

digit percentage points) in the last few years of our estimation: in Japan the rates of depreciation permitted by the corporate income tax law were more liberal and except for 1975 depreciation adjustment suppressed the taxable income.

The most important component which made the ratio of taxable to economic incomes so much different in the two nations is the gains from borrowing, the fourth column of Tables 1(a) and (b). This term is expected to be positive when the rate of inflation is high and, indeed this has been the case in both countries. However, the magnitudes of this gain were very different in the 1970s: Japanese manufacturing firms seem to have gained very much from being big borrowers and in certain years the gains from borrowing amounted to more than thirty percent; firms in the U.S. were also gainers from borrowing throughout this period and even for a longer period than Japanese firms, but the gains, when measured as the proportion of the economic income, were much smaller. It is also worth noting here that these gains decreased sharply in Japan in the 1980s due to the stabilization of prices which came earlier than in the U.S.

The last column of each table shows how taxable income has been inflated by inventory accounting. In order to make the interpretation of the tables simpler we listed numbers so that the plus signs indicate the undervaluation of inventory which occurs most typically when the FIFO is used as an accounting method in an inflationary period. Thus, to reach the economic income from the taxable income, we must deduct this adjustment. This adjustment has been consistently positive in the U.S. except for 1986, implying that inventory accounting has always made the taxable income exceed the economic. In Japan this had also been the case in the 1970s, however the wholesale prices became stabilized much sooner than in the U.S. after the second oil shock and the inventory accounting rather suppressed the taxable income.

II.2 Effective Tax Rate and Economic Rate of Return

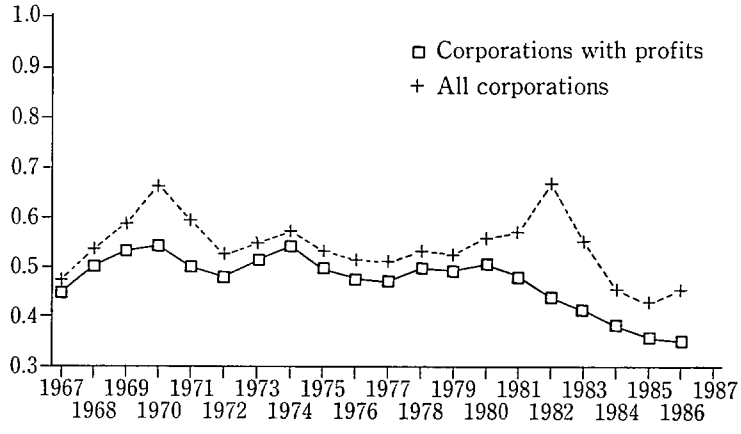
With the estimation of economic incomes of the two nations' manufacturing industries now available, we can present two important indexes to describe the nation's tax policy and the performance of firms: the effective tax rate and the economic rate of return. The effective tax rate is defined as the proportion of taxes paid by corporations to their economic income. A broader notion of the effective tax rate of capital income would be to trace the distribution of corporate income to the households that ultimately receive it and to add taxes paid by them to that already paid by the firms. In this paper we concentrate on the corporate stage and deal only with taxes paid by corporations.

Our estimate of the effective tax rates are shown in Figures 1(a) and (b): the former for the U.S., and the latter for Japanese firms. Before comparing the figures a caveat is due about the aggregation of firms. Since all firms do not raise profits and some firms report negative income, the effective tax rate would be overestimated if we used the income aggregated over all firms. That is, while taxes are paid only by firms with positive income, the negative income is "added" to the total income. Hence, the income deemed to have paid taxes is undervalued, and the effective tax rate will accordingly be overestimated.

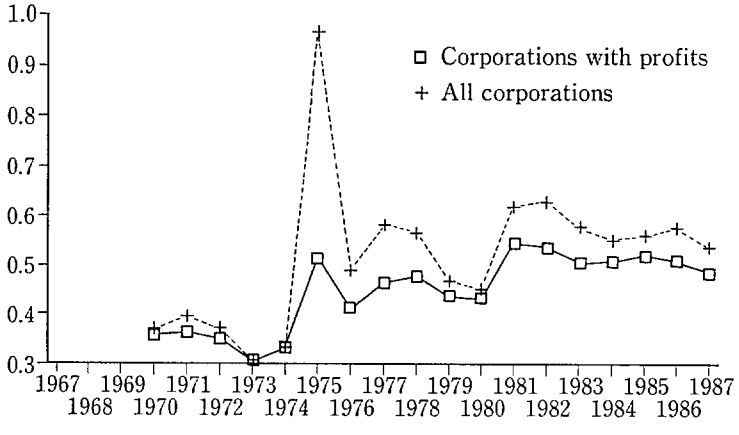
In Figures 1(a) and (b) we have drawn two estimates: in each figure the higher line is the estimate when the income of all firms is used as a basis of the economic income and the lower one is obtained when only the income of firms with positive profits is aggregated. The magnitudes of the two estimates have been widely divergent, especially at recessionary

FIGURE 1. EFFECTIVE TAX RATE

(a) U.S.



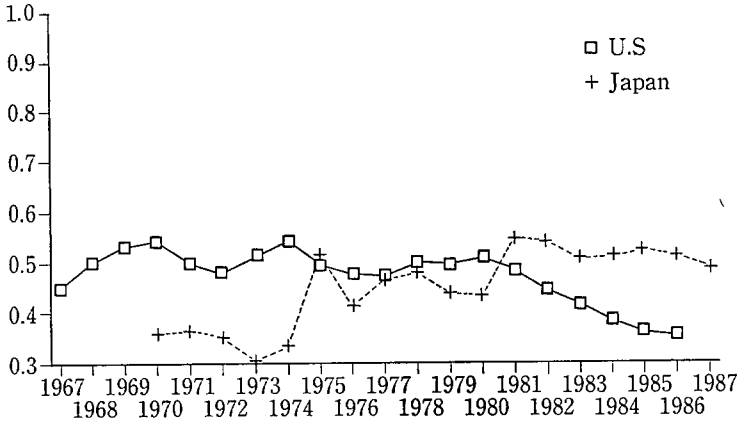
(b) Japan



times when the share of firms with negative profits is high. Thus the results here clearly indicate that aggregation does matter when we estimate the effective tax rate.

With this caution in mind we stay on the estimate aggregating the income of only firms with positive income, and compare the effective tax rates between the U.S. and Japan. Figure 2 shows the results. In the U.S. the effective tax rate had hovered around 50 percent until the beginning of the 1980s and then declined sharply to 35.4 percent in 1986, our latest estimate. On the other hand, the effective tax rate in Japan had an increasing trend over the period from 1970 to 1987: it started at 36.1 percent in 1970 and reached the highest rate of 54.6 percent in 1981 and stayed around 50 percent after that. When the effective tax rates of the two nations are drawn in the same figure, we can notice an important fact: except for 1975 the effective tax rate in Japan had been persistently lower than in the U.S. until 1980, and it jumped 10 percent points in 1981 and passed the rate in the U.S. Since then the gap of the two effective tax rates was widened and in 1986 it amounted to

FIGURE 2. EFFECTIVE TAX RATE: U.S.-JAPAN COMPARISON

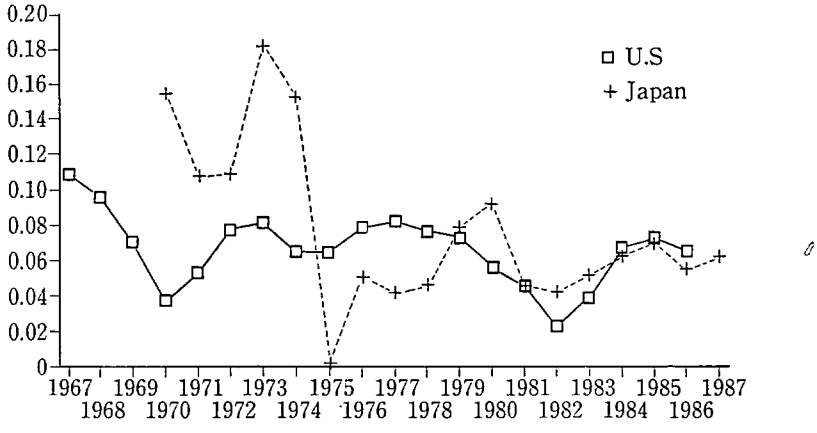


15.1 percent. With the unsettled question of the incidence of corporate income tax aside, our estimate supports the view often claimed by Japanese business community that Japanese firms have borne more tax burden than their U.S. counterparts.

We now turn to the comparison of the economic rate of return which is another index obtained from the economic income. We will define it as the ratio of the economic income to the capital stock. As was mentioned in the introduction of this paper, we have estimated the capital stocks of the two countries' manufacturing industries for ourselves. It would rather be more relevant to say that we cannot avoid this cumbersome part, because we have to have the capital stock data which generate the series of depreciations which are compatible with those reported by tax statistics. In an actual estimation procedure, we started from the Statistics of Income compiled by the Internal Revenue Service for the U.S. manufacturing industry and constructed the series of capital stock, using the tax as well as the balance sheet data reported there. As for Japanese firms, the statistics published by the Japanese Tax Bureau contain only tax data. We have, therefore, to combine corporate survey data with the tax statistics to get the estimate of the capital stock. One of the most difficult parts when estimating the capital stock is how to set the rates of economic depreciation. Here we have employed rather a heroic procedure: the economic rates of depreciation estimated by Hulten and Wykoff have been applied to properly classified assets in both countries. This is because there has, as yet, been no study in Japan comparable to Hulten and Wykoff's on the rates of economic depreciation.

Figure 3 depicts our estimates of economic rates of return of the two nations. In the U.S. the rate of return had been on a long declining trend until 1982 and rebounded sharply after that. In Japan it fluctuated more widely. In 1973 it was at the highest level during our estimation period, 1970 to 1987, due mostly to the gains obtained from borrowing (see Table 1(b)). It then plunged deeply in 1975 when two somewhat contradicting phenomena occurred: while the gains from borrowing were reduced sharply, very significant undervaluation of inventory (therefore, overvaluation of the taxable income) took place. The directions of these two income adjustments are contradictory, since price stabilization after the first oil shock, which reduced the gains from borrowing so drastically, should have also

FIGURE 3. ECONOMIC RATE OF RETURN: U.S.-JAPAN COMPARISON



reduced the inflationary impacts on taxable income caused by inventory accounting. We consider it just plausible that with the stabilization of prices the economic income of Japanese manufacturing industry decreased after 1973, but its drop as was shown in Figure 3 is too sharp.

One of the most convincing explanations of this awkward result seems to be ascribed to the difference of the sources of statistics of corporate finance and inventory adjustment: our estimate of the gains from borrowing was based on the survey of corporate income and that of inventory adjustment was from the national income statistics. This difference in the origins of statistics seems to have given us conflicting numbers in 1975.

After this nosedive in 1975 the economic rate of return of Japanese manufacturing firms regained its momentum and increased until 1980. Then came the post second oil-shock era and it again dropped by about 5 percentage points from 1980 to 1982, and rebounded and stayed on an increasing trend after that.

III. *Economic Rate of Return and Investment*

We would now like to explore how investments of the two countries' manufacturing industries have responded to the economic rate of return. And if they are well explained by investment functions so conceived, we will try two simple simulations: the first is to see how indexing the tax base would have changed investment; and the second, which is restricted to Japan, is to find out how cutting the rate of corporate income tax would induce investment there. In the introduction of this paper we have referred to the two views on the effects of taxation and inflation on investments, i.e., one by Feldstein and his collaborators about the depressing effects of inflation on investment and the other most strongly from the Japanese business community about negative impacts of high corporate income taxes on investment. Two experiments here seek to present our answers to the problems raised from these viewpoints.

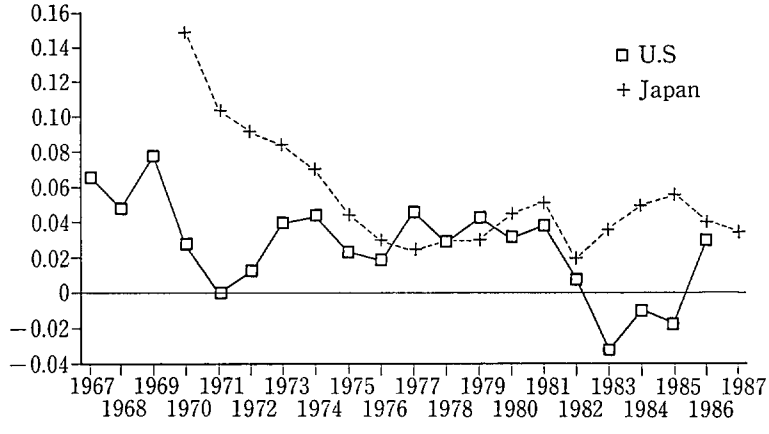
III.1 The Rate of Capital Accumulation

Before jumping into the specification and estimation of investment functions it would be appropriate to examine capital investments of manufacturing firms of the two nations. Using the series of capital stock data which we have constructed and have used for estimating economic rates of return, we can calculate the rate of capital accumulation, which is defined as the ratio of net investment to capital stock. The results of our estimation are shown in Figure 4.

The overall message of the figure is that the rate of capital accumulation in the U.S. has been lower than that in Japan except for a few years in the second oil-shock period when the rate of investment of Japanese manufacturing industry declined and stagnated. In fact, two to three percent rates of capital accumulation continued in Japan from 1976 to 1979. The sharp decline of capital accumulation rate in Japan in the 1970s is also very remarkable: it started at 18 percent in 1970 and went down to almost a tenth of it in 1977. Sharp as this decline of capital investment in Japan may be, now in retrospect of its postwar high growth era this contracting phase of capital accumulation seems to be unavoidable and must have happened in one way or another. And it really happened and was made worse incidentally by the two oil shocks. Let us turn to the investment behavior of U.S. manufacturing firms. Their capital-accumulation rate plunged deeply in 1971. However, it returned to three to five percent growth rates in the latter half of the 1970s and the very early 1980s.

This is an overall picture of investment behavior of the two nations' manufacturing industries. What seems to us to be more important is to compare the capital formation of the two countries in more recent period, say after 1980. In this respect, we can find a very decisive difference between the rate of capital accumulation in Japan and that in the U.S. In the 1980s the rate of capital accumulation in Japan started to rise and reached 5.1 percent in 1981, which is the highest rate since 1977. In 1982 capital growth was very sluggish and in fact the capital accumulation rate went down to the bottom over our entire estimation period. However, it rebounded in 1983 and reached 5.5 percent in 1985, which even surpassed the growth rate in 1981.

FIGURE 4. RATE OF CAPITAL ACCUMULATION: U.S.-JAPAN COMPARISON



Capital investment behavior of U.S. manufacturing firms in the 1980s was quite different from this. After three to four percent growth rates in 1980 and 1981 the capital accumulation rate went down to the all-time lowest, minus 3.2 percent, in 1983. And no net accumulation of capital was made in either 1984 or 1985, and it was not until 1986, the last year of our estimation, that the rate of capital accumulation turned out to be positive. Thus, we may claim that while Japanese manufacturing firms were gradually recovering from their stagnated capital formation during the two oil shocks, their U.S. counterparts were suffering from a deep decline of capital investment, even to the extent of capital decumulation until the middle of the 1980s.

III.2 Investment Functions

So far we have examined the investment behavior of U.S. and Japanese manufacturing industries. We would now like to explain it by means of the economic rate of return we have estimated in the preceding section. Here two remarks on our perception of investment function is in order.

The first is on the choice of the economic rate of return as an explanatory variable of investment. One reason of this specification of investment function is due to unsatisfactory results of the cost-of-capital approach in Japan, which used annual data as we are going to do so here. The problem is that the cost of capital is often dominated by the level of the nation's interest rate.[3] And when investment is not sensitive to it, as seems to be the case in Japan, the investment function of this type fails. Of course, replacing the cost of capital with the economic rate of return does not solve all problems: by using the economic rate of return as an explanatory variable, we will bring in a new problem of simultaneity bias, i.e., explaining investment by a variable whose variations are governed partly by investment itself. A means of avoiding this problem is to use explanatory variables which are lagged a few years behind the current dependent variable. We will follow this route.

The second remark we want to make about our investment function is that the economic rate of return in our specification incorporates only taxes imposed at the corporate stage and does not take personal capital-income taxation into account. We consider that this formulation of investment function is more plausible than the one which appeals to the ultimate economic rate of return, which incorporates taxes on capital income received by households as well. One reason for this is that when corporate ownership and management is separated, it seems to be the rate of return at the corporate stage that corporate managers seek to maximize. Another reason is more straightforward: Japanese firms have been closely associated with each other and their stocks have been held mutually. Most typical situation of Japanese manufacturing firms would be that the bulk of their stocks are kept by banks and closely related firms so that the companies are not taken over by the "outside" shareholders. Undert this circumstance, it would hardly be the case that Japanese corporate managers would take the rate of return at the household stage as the index by which to decide their investment.

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[3] We have derived elsewhere the formulas of the cost of capital and the effective corporate tax rate and estimated them for U.S. and Japanese manufacturing industries [Tajika and Yui (1988)]. The results of our estimation there showed clearly that differences in the levels of interest rates and in the stability of prices determined the differences of the magnitudes of the costs of capital between the two nations, and dwarfed the effects of various tax policies on them.

We are now in the position of reporting the performance of our investment functions. For the U.S. manufacturing industry our specification of the function is as follows:

$$I/K_{-1}=a_0+(a_1+a_2 \cdot DUS) \cdot ERR_{-1}+a_3 \cdot UCAP_{-1}+u,$$

where the symbols used are:

I: the net investment,
K: the capital stock,
Subscirpt minus one, -1: one year lag of the respective variable,
DUS: a dummy variable, 1 for years 1983 through 1986, 0 otherwise,
ERR: the economic rate of return (same as in Figure 3),
UCAP: the capacity utilization rate,
u: the random disturbance term.

The specification itself is straightforward and moreover, the ideas which have come up with it are already discussed. Therefore, it would suffice here to state two new explanatory variables appearing in our investment function: *UCAP* and *DUS*. *UCAP* is an index of capacity utilization and was employed by Feldstein et al. as one of explanatory variables of their investment functions in order to eliminate from the variations of investment those parts which might have come from cyclical fluctuations of economy. We have followed their ideas and used it as an explanatory variable of our investment function.

One of the most important phases of the investment of U.S. manufacturing industry is after 1983, when capital accumulation declined while the economic rate of return increased rather steadily. A dummy variable *DUS* is a device to capture this phase clearly: it is set to unity when years are 1983 through 1986 and to zero in other period, and is inserted into the coefficient of ERR_{-1}. We naturally expect that the response of investment to ERR_{-1} is positive, but that its magnitude is reduced after 1983, i.e., the coefficient a_1 is expected to be positive, while a_2 negative, and the overall response of investment to the economic rate of return, a_1+a_2, positive.

We have estimated the function over the period from 1967 to 1986, and obtained the following result:

$$I/K_{-1}=\underset{(-1.967)}{-0.083}+(\underset{(6.02^*)}{0.853}\underset{(-4.45^*)}{-0.377} \cdot DUS) \cdot ERR_{-1}+\underset{(1.112)}{0.068}\ UCAP_{-1}.$$

$\bar{R}^2=0.863$, $DW=2.74$, and the numbers in the parentheses are t-values with * implying respective variables to be significant at the five percent critical level.

The overall fit of the function is good and the economic rate of return is an important variable that dictates investment. Moreover, the coefficient of the dummy variable, *DUS*, is not only negative, but significant at the five percent level. The overall coefficient of the economic rate of return was estimated to be 0.853 from 1967 to 1982, and 0.478 for the rest of our estimation period. Thus, according to this estimation, the marginal response of investment to the economic rate of return is positive over the entire estimation period, but the sensitivity of this response became much smaller after 1983, which conforms to our expectation on the signs and the significance of the parameters. We will report more specific magnitudes of the response later, e.g., elasticities of investment to the economic

rate of return, when we come up with the simulation part.

We turn to the investment function of Japanese manufacturing industry. In order to facilitate the comparison of investment behavior of the two nations we have endeavored to specify the function as identically as possible with the one for U.S. manufacturing industry. Actually we have used the same specification as above for Japanese firms but for replacing the dummy variable *DUS* with *DJPN*, which takes unity for years 1974 and after, and zero for years 1971 through 1973. The intention of introducing this variable into Japanese investment function is due to our conjecture that the response of investment to the economic rate of return had been stronger before the two oil shocks, when Japanese economy grew much faster and expectation of future economic growth was more optimistic. That is, we expect the coefficient of *DJPN* to be negative.

The outcome of our estimation of Japanese investment function is as follows:

$$I/K_{-1} = \underset{(-1.632)}{-0.093} + \underset{(4.194^*)\,(-4.910^*)}{(0.383 - 0.277 \cdot DJPN)} \cdot ERR_{-1} + \underset{(2.081)}{0.130}\ UCAP_{-1}.$$

$\bar{R}^2=0.899$, $DW=2.33$, Estimation period: 1971–1987.

The results of this estimation are as good as those obtained for U.S. manufacturing industry. As are shown in the previous estimation two explanatory variables, the economic rate of return and the dummy variable, are significant. As in the previous equation the variable, *UCAP*, has been put into the present one to take cyclical investment variations away from total variations of investment. However, this component by itself does not seem to have influenced investment significantly (at least at the five percent level).[4] The results also support our conjecture well: the response of investment to the economic rate of return is not only positive throughout our estimation period, but becomes much smaller when Japanese high growth era came to an end. Thus, the expectations of emergence of more difficult times as (eventually) exemplified by the two oil shocks may be said to have dampened the investment spirits of corporate managers of Japanese manufacturing industry.

These are the specification of investment functions and the results of estimation. Overall, we may claim that the economic rate of return explains both countries' investments well. However, it is also true that a mere introduction of the variable in the investment function has not been enough: there seem to have occurred structural changes in the two countries. In the U.S. the response of investment to the economic rate of return has clearly changed after 1982. And in Japan investment in its high growth era was much more vigorous and responded more sharply to the economic rate of return than after the middle of the 1970s when the nation could no longer expect double-digit economic growth.

IV. *Effects of Inflation and Tax Policies on Investment*

We would now like to take up the two issues posed at the introduction of this paper:

[4] With more careful scrutinity of the results of our estimation we can find that UCAP in Japan is a more important element to determine investment than its counterpart in the U.S. In fact, it is significant at less than 10 percent and its coefficient is much larger than that of UCAP in the U.S.

interactions between inflation and tax policies, and their ultimate effects on investment; and the effects of tax cuts on the investment of Japanese manufacturing industry. We will tackle these problems by simulating investment functions obtained in the preceding section.

Let us start with the first issue. The estimation of economic income in the second section has shown that inflation does not necessarily inflate the taxable income, but it could squeeze the taxable income and make it smaller than the economic. In the former case firms pay more tax when inflation occurs, whereas in the latter they pay less. Since investment responds positively to the economic rate of return, which is defined as the post tax economic income divided by the capital stock, changes in corporate tax liabilities matter.

In order to clarify the problem more clearly, let *YECO* denote the economic income, *YTAX* the taxable income, τ the rate of corporate income tax. After-tax corporate income is, then, given by:

$$YECO - \tau \cdot YTAX = YECO \cdot \left(1 - \tau \cdot \frac{YTAX}{YECO}\right).$$

Hence if the taxable income is inflated by inflation and exceeds the economic one, the economic income will be reduced by more than 100τ percent. In other words, this increase of tax liability comes from an institutional arrangement that nominal income is chosen by the law to constitute the taxable income. Therefore, when we explore the effects of inflation on investment, a relevant question we should pose is how investment would be changed, if the tax base were fully indexed. In the equation above this implies that *YTAX* is replaced by *YECO*.[5]

In the U.S. the taxable income was persistently higher in the 1970s and the early 1980s than the economic. The reverse, however, is the case in Japan and the economic income exceeded the taxable income in every year of our estimation (Tables 1(a) and (b)). This implies that while indexing the taxable income would have encouraged investment in the U.S., it would have rather depressing effects on investment in Japan. Now a remaining issue is how to quantify the impacts of indexation on investments of both nations' manufacturing industries.

Table 2(a) presents the results of our simulation for U.S. manufacturing industry. The numbers in the first column show the changes in the economic rate of return when the taxable income is fully indexed. As is expected from what we have observed above, the economic rate of return is increased by indexation in almost all years except for a few years in the late 1960s and the early 1980s, when the rate of inflation was moderate and the taxable income was smaller than the economic. The second column represents the rate of changes in investment induced by indexation. Here numbers in several years are missing:

[5] To be precise, indexing the taxable income corresponds to the second stage of income adjustments in Section 2: revaluations of depreciation allowances, gains from borrowing and gains/losses from inventory accounting. Various first stage adjustments are mostly aimed at eliminating discretional, sometimes artificial, arrangements sneaked into the taxable income. Therefore, replacing the taxable income with the economic might overshoot the required income adjustments.

TABLE 2. EFFECTS OF INDEXATION ON INVESTMENTS

(a) U.S.

Year	Changes in the rate of return	The rate of change in investment	Elasticities
1968	−0. 002	−0. 050	1. 364
1969	0. 002	−0. 025	1. 438
1970	0. 003	0. 052	1. 748
1971	0. 001	.	.
1972	−0. 001	.	.
1973	0. 006	−0. 026	1. 714
1974	0. 011	0. 116	1. 554
1475	0. 005	0. 328	1. 989
1976	0. 005	0. 187	2. 692
1977	0. 005	0. 128	1. 892
1978	0. 011	0. 100	1. 687
1979	0. 014	0. 240	1. 698
1980	0. 011	0. 330	1. 716
1981	0. 010	0. 525	2. 699
1982	0. 002	.	.
1983	−0. 002	.	.
1984	−0. 007	.	.
1985	−0. 012	.	.
1986	−0. 015	−1. 246	7. 526

(b) Japan

Year	Changes in the rate of return	The rate of change in investment	Elasticities
1971	−0. 027	−0. 135	0. 548
1972	−0. 028	−0. 126	0. 493
1973	−0. 055	−0. 125	0. 477
1974	−0. 047	−0. 088	0. 289
1975	−0. 003	−0. 109	0. 356
1976	−0. 018	−0. 020	0. 008
1977	−0. 012	−0. 059	0. 164
1978	−0. 009	−0. 043	0. 141
1979	−0. 019	−0. 026	0. 128
1980	−0. 022	−0. 044	0. 174
1981	−0. 005	−0. 051	0. 214
1982	−0. 007	−0. 015	0. 134
1983	−0. 010	−0. 026	0. 140
1984	−0. 014	−0. 030	0. 144
1985	−0. 015	−0. 033	0. 153
1986	−0. 011	−0. 037	0. 169
1987	−0. 015	−0. 035	0. 160

Notes: 1. This table shows the effects of indexation on the economic rate of return and the rate of capital accumulation.
2. Column one represents the magnitude of changes in the economic rate of return.
3. Column two represents the rate of change in investment.
4. Column three is the elasticities of investment with respect to the rate of return.
5. In the table 2(a) the numbers in the second and the third columns in 1971, 72 and 82 are missing, because net investments of these years were almost zero.
6. In the table 2(a) the numbers in the second and the third columns in 1983 through 1895 are also missing, because investment responded negatively to the economic rate of return over these years.

the numbers in 1971, 72 and 82 are set blank, for net investments in these years were almost zero or negative (less than one percent of the capital stock) and this makes the estimates of the rates of changes in investment very unreliable; numbers in 1983 through 1985 are set missing, because over this period not only net investments were negative, but investment responded negatively to the economic rate of return. Except for these years our simulation indicates that investment of U.S. manufacturing industry would have been increased sizably, as much as thirty percent, if corporate tax base had been fully indexed.

The last column shows the elasticities of investment with respect to the economic rate of return. But for a few outliers (most notably 1986) the estimated numbers are about one and a half to two, reflecting high values of the coefficient of the economic rate of return in the investment function of U.S. manufacturing firms.[6] Although it seems to us that these responses of investment to the economic rates of return are rather high, this is as much as we can say about the effects of indexation on invetsment in the U.S.

The same experiment has been carried out for Japanese manufacturing firms. And Table 2(b) summarizes the results of this. As in the preceding table the numbers in the first column are the changes in the economic rate of return when the taxable income is fully indexed. Here numbers are all negative, indicating taxable incomes were less than economic ones throughout our estimation period. The second column, then, shows that investment would have been reduced with indexation. The rates of reduction are more than ten percent until the middle of the 1970s, and decline sharply after 1976 and stay around two to five percent. The elasticities of investment of Japanese manufacturing industry to its economic rate of return are not only much smaller than its U.S. counterpart, but more stable: the elasticities in Japan are about a third of those in the U.S. in the early 1970s and even lower in the later years.

Thus, the effects of nonindexing taxable corporate income on investment in both countries may be claimed to be significant enough to call for the attention of policy makers contemplating the nation's capital formation. That indexing would affect investments of the two countries in a diametrically opposite way has been obvious at the outset at least qualitatively. What, however, has not been clear is that the effects of nonindexing on investment would have had more serious effects in the U.S. and that the investment in the U.S. responded more readily and sporadically to changes in the economic rate of return.

We turn to the second simulation which purports to quantify the effects of corporate income tax on Japanese manufacturing investment. Table 3 reports the results of this exercise. Specifically, the question we have posed here is: how much Japanese manufacturing investment would be increased, if the corporate tax rate were cut to the present U.S. statutory rate, thirty four percent? Since this stems from contemporary rather than his-

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[6] The reason for the exceptionally high value of the investment elasticity to the economic rate of return in 1986 is due to the sharp rise in investment in this year.

When we estimate the elasticities, we plug actual and indexed economic rates of return into the investment functions of the U.S. manufacturing industry and obtain the projected investments. The elasticity is then calculated by dividing the change in investments by the difference between the post- and pre-indexed economic rates of return.

The source of the extremely high elasticity in 1986 is the low projected value of I/K_{-1} in 1986. While its actual number is 0.029, the projected one is 0.004. This, in turn, made the changes in investment due to the indexation extremely high. Thus, the abrupt surge in investment in 1986 is the cause of the exceptionally high investment elasticity.

TABLE 3. EFFECTS OF TAX CUT ON INVESTMENT OF JAPANESE MANUFACTURING INDUSTRY

Year	Changes in the rate of return	The rate of change in investment
1980	0.006	0.013
1981	0.008	0.016
1982	0.008	0.024
1983	0.009	0.031
1984	0.011	0.025
1985	0.013	0.027
1986	0.011	0.033
1987	0.010	0.032

Notes: 1. This table shows the effects of a tax cut on investment of Japanese manufacturing industry, where the rate of Japanese corporate income tax is slashed to 34 percent, the present U.S. statutory rate (effective since 1987).
2. Columns one and two correspond to those in Table 2.

toric concerns, we have restricted our simulation period to the 1980s.

The columns of the table are the same as those in Table 2. And the numbers in the second column of the table show clearly economic rates of return would unambiguously be increased when Japanese corporate tax rate were replaced with the one in the U.S., which indicates simply that Japanese effective tax rate are higher than the U.S. statutory rate. The second column shows the rate of increase of investment triggered by this policy change. Except for a few years in the beginning of the early 1980s, investment would be increased by two to three percent.[7] While three-percent surge in investment may hardly be a matter to overlook, what seems to be more important to stress here is that Japanese investment has not been carried out under the tax climate more favorable than its counterpart in the U.S. And from a present Japanese standpoint, concerns of high corporate tax rate are not so much on its depressing effects on investment at large, as on its purging otherwise domestically executed investments to foreign countries.

V. *Conclusion*

In this paper we have attempted to examine the relation between tax policies and investment of U.S. and Japanese manuafcturing industries. An emphasis has been put on circumstances where high and chronic inflation is underway. Comparing our studies of the two industrial nations has yielded some important findings. As for interactions between inflation and tax structure, the most striking difference in the two countries would be that inflation has blown up taxable income in the U.S., whereas it has worked in an opposite way in Japan and in fact, the taxable income has turned out to be smaller than the economic one. The consequences of this deserve out attention, for capital investment seems to have reacted positively to the (after-tax) economic rate of return.

[7] The elasticities of investment to the economic rate of return are skipped in the table, because they are already reported in Table 2(b).

Investment functions have, then, been estimated for the two nations with the economic rate of return as a central explanatory variable. And we have seen these functions indeed capture the variations of investment well and the economic rate of return has affected investment positively. The effects of inflation has been studied by means of simulating investment when taxable income is fully indexed. The results here are as follows: the response of investment to changes in the economic rate of return has been sharper, but less stable in the U.S.; and while the indexation would have rendered a big push to investment in the U.S., in some years as much as thirty percent, it would have realized an opposite outcome in Japan, where as much as ten percent of investment seems to have been slashed.

Besides these findings, a fact which has attracted our interest as much is that the behavior of investments of the two nations' manufacturing industries cannot be explained by the economic rate of return per se. In this regard two observations merit our restatement. The first is about U.S. manufacturing investment. Not only did it plunge after 1981, but, still more importantly, this decline occurred in the phase when the economic rate of return started to soar up. Thus, in the latest period of our estimation U.S. manufacturing investment responded negatively to the economic rate of return. The second remark is about a structural change in Japanese manufacturing investment. Investment behavior of the industry may broadly be separated into before and after oil-shock periods. However, now looking back at the high growth era of Japanese economy in the 1960s and the very early 1970s, the excessively high growth rates of capital accumulation in those days might have been rather exceptional.

These are the summary of this paper. Rather than having concluded our research on capital formation of the two countries, it has ignited our new interest in further research on this issue. First, we would like to extend our observation period as closely as possible to the present, and like to see how recent expansion of capital investments of both nations occurred and how the recovery of economic rate of return has contributed to it. The other agenda of research is to tackle the capital movement across the Pacific. One of our concerns in this respect is to show how the two nations' tax policies have affected Japanese foreign direct investment to the U.S. In this study we would like to explore how our estimates of both nations economic rates of return would influence the capital flows.

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