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Cost of Capital for the United States, Japan, and Canada: An Attempt at Measurement Based on Individual Company Records and Aggregate National Accounts Data

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ABSTRACT

A conceptual basis is laid out for measuring the cost of capital for corporations from data typically available in countries such as the United States, Canada, and Japan. Attempts are made to carry out the measurement based both on the accounting records of individual companies and on the aggregate National Accounts data, supplemented by the market information on the price of equity shares. We find a consistent pattern for the United States from both sets of data, and the real cost of capital after depreciation and before taxes is found to fluctuate around 10 to 11 percent without a persistent trend. For Canada, the individual company data cover too few companies for too short a period to produce reliable estimates. The aggregate National Accounts data for Canada supplemented by some unpublished data supplied by Statistics Canada suggest that the cost of capital in Canada is equal to or somewhat lower than that in the United States. For Japan, the individual company accounts and National Accounts data yield apparently inconsistent results. Attempts are made to identify the sources of inconsistency, although the full clarification of this problem must await the publication by the Economic Planning Agency of a detailed and full explanation of the derivation of its national accounts estimates. Finally, we suggest that the extraordinarily high prices of land and the persistent real capital gains which companies enjoyed on their ownership of land until 1990 were an important cause leading to an underestimation of the cost of capital when the standard procedure is applied to Japanese data, and effects still appear to persist.

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I. Introduction

The cost of capital is an important component of the total cost of producing output for most firms, and therefore its magnitude, both absolute and relative (especially in comparison with the cost of labor) is critical information affecting decisions by management on the choice of technology, on the scale of operations, and on the location of plants. The magnitude and the time pattern of the cost of capital faced by a group of firms, therefore, are an essential part of information needed by analysts wishing to understand the behavior of these firms.

At the same time, the cost of capital is a notoriously difficult concept to measure in practice. First, it is in principle a forward looking concept[1], but we seldom have information on the subjective assessment of future values of variables used by managers. Consequently, most students of the subject measure the ex-post cost of using capital from accounting records and hope such ex-post measurements, if they are taken over many firms and cover a fairly long period of time, would converge to the similarly averaged value of the forward looking concept used in managers' decisions[2].

The second reason why the cost of capital, even ex-post return to capital, is so difficult to assess is that the measurement can be affected by a number of arbitrary accounting conventions and management decisions such as the choice of depreciation rules and inventory accounting methods. To establish some uniformity of these conventions among firms, especially among firms in different countries, can be an exceedingly difficult task.

During the 1980's, there developed a perception among American business executives, especially of those corporations which compete with Japanese corporations, that the cost of capital in Japan was noticeably lower than that in the U.S., and this is one of the reasons why Japanese corporations appeared to outperform their American counterparts. Evidence for this proposition was not fully convincing, and relatively late in this debate, Ando and Auerbach (1988a), (1988b), and (1990) attempted to estimate the cost of capital for corporations in the U.S. and in Japan using data for firms listed on the New York and Tokyo stock exchanges. The idea was that, by using more extensive data and making adjustments to them so that data for Japanese firms and those for the U.S. firms are as compatible as possible, we might come closer to settling the argument one

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[1] It is forward looking in the sense that, since capital goods last for a number of periods, management must look forward to evaluate the cost of using them while they last , especially if the capital is not malleable once it is installed. If it is fully malleable, then it can be adjusted without cost to new relative prices in every period, so the managers need not look beyond the current period in designing the capital structure of the firm.

[2] A little more than hope by analysts is involved here. Presumably, in assessing the future cost involved in maintaining a specific capital good, the manager summarizes his perception of various uncertain elements into a probability distribution and takes the expected value of the cost over this distribution. By averaging the ex-post realization of the cost across firms and over time, analysts would be performing a somewhat similar operation though information on which the expectations are conditioned may not be the same. If the ex-ante estimates of the cost of capital used by managers in their decisions and the ex-post measurement by analysts are substantially different from each other even when they are averaged both across firms and over a fairly long period of time, then the presumption must be either that we are dealing with a very unstable system, or that there is something unusual about the process by which the managers form their anticipations. In order to deal with such problems, we must have direct observations of managers' expectations in addition to ex-post measurements of costs.

way or another, and more importantly, if the cost of capital is different in these two countries, we may gain some insight into the causes of such differences.

They concluded that, while in the U.S., the accounting measure and the market measure of the cost of capital appeared reasonably close to each other when they are averaged over a fairly long period of time, in Japan the market measure appeared to be noticeably higher than the accounting measure. The market measure of the cost of capital appeared similar for these two countries, and therefore the accounting measure of the cost of capital in the U.S. looked noticeably higher than that in Japan. They explored a number of potential causes for this pattern and suggested as a plausible hypothesis a role played by the extraordinarily high price of land and continual real capital gains corporations in Japan enjoyed by their ownership of land. Since such real capital gains are not included in the measurement of earnings by firms, if these gains are in fact recognized by market participants and taken into account in valuing corporate shares, it may explain the discrepancy between the accounting and the market measures of the cost of capital, and hence the difference between the cost of capital in the U.S. and in Japan in terms of its accounting measure.

Since the price of land and the value of equity have both declined sharply in Japan since 1990, the most recent data seem to offer an opportunity to test this hypothesis. There is also an impression that the cost of capital in Canada is somewhat higher than that in the U.S., This seems surprising given the close integration of the capital markets of these two countries, at least for large companies with access to equity and bond markets in both countries.

In this paper, we will take another look at the cost of capital in the U.S., Japan, and Canada. Since we will rely heavily on the accounting measure of earnings by firms, and these earnings may include the contribution of physical capital to the total value added of the firm as well as oligopoly rent, in the next section, we will first attempt to clarify the relationship between the accounting measure of earnings and the user cost of capital as usually understood in the literature on investment. We will then report our empirical investigation using both aggregate data and individual firm data and conclude the paper with a discussion of remaining puzzles and their potential explanations.

II. Some Conceptual Issues

II.1. Corporate Profit Tax, Oligopoly Rent, and the Term Structure of Interest Rates

The user cost of capital is the amount of money that a firm pays in order to use one dollar's worth of capital for a period of time (one year). In the absence of taxes and under the assumption of perfect markets, this cost must be equal to the real required rate of return in the market plus the economic rate of depreciation. We are, however, embarking on an empirical measurement of the cost of capital actually incurred by firms, so that we must allow for corporate taxes, the presence of market imperfections, and other issues. In order to arrive at an operational formulation in which a measurable quantity can be interpreted as an approximation to the cost of capital, we posit the following two equations.

$$T^c = \tau^c [P_x X - WE - z(\rho+\delta)P_k K] \tag{1}$$

$$(1-\tau^c)P_x X = \mu[(1-\tau^c)WE + (1-z\tau^c)(\rho+\delta)P_k K] \qquad (2)$$

where

T^c:	corporate profit tax
τ^c:	corporate profit tax rate
P_x:	price of output (value added)
X:	value added measure of output
W:	gross compensation per man-hour, including all fringe benefits
E:	employment in man-hours
ρ:	the real rate of interest per year prevailing in the capital market
δ:	the economic rate of depreciation per year
P_k:	reproduction price of capital
K:	net stock of capital used in production
z:	the rate of the depreciation allowed under the corporate profit tax law on K as a fraction of the total cost of capital, i.e., $Z=z(\rho+\delta)P_kK$ where Z is depreciation allowed under the corporate profit tax
μ:	the mark-up factor; that is, the pricing policy of the firm is assumed to require that the net of the tax value added is μ times the net of the tax cost of labor and the net of the tax cost of capital used.

Equation (1) is a grossly simplified description of the corporate profit tax system imbedded in the U.S. tax law. We assume that the tax rate is proportional and ignore many fine points of the law. We also assume that the corporate tax applies to profits net of other taxes such as real estate taxes and sales tax, so that in our empirical work we define the value added of the firm as net of these indirect taxes. Employment taxes are included in the rate of compensation, W.

Equation (2) is the mark-up pricing rule applied to net of tax prices. That is, it requires that net of tax revenue (value added) should be μ times net of tax cost[3]. For this equation to make sense, we must have a homogeneous production function of degree one underlying the whole process, and we assume that this is true in the range of production activities actually observed. We suppose that the mark-up factor, μ, may vary from one firm to another and over time, but that it is not a function of the corporate tax rate, τ^c, or the rate of gross return, $\rho+\delta$. It is instructive to rewrite (2) by dividing both sides of equation by $\mu(1-\tau^c)$:

$$\frac{P_x X}{\mu} = WE + \frac{1-\tau^c z}{1-\tau^c}(\rho+\delta)P_x K \qquad (2')$$

[3] At the conference, it was suggested that the mark-up factor should apply to the labor cost and capital cost net of depreciation. The mark-up rule is, in a sense, arbitrary and does not result from a rational optimization process, so that what is reasonable is, in the final analysis, an empirical question. It may be pointed out, however, that a mark-up rule which excludes depreciation from the base is considerably more complex than (2). Furthermore, if the production function explains the value added gross of depreciation and it is approximately Cobb-Douglas, then it is the mark-up on cost gross of depreciation that would be close to a constant fraction of the value added measure of output.

In (2'), the left-hand side is the total value added before it is marked up. On the right-hand side, the first term is the gross wage bill, and the second term is the gross return on capital which the firm must earn in order to pay the corporate profit tax and the return required on funds obtained in the market, and to cover economic depreciation. It is perhaps helpful to note that this term can be split as follows:

$$\frac{1-\tau^c z}{1-\tau^c}(\rho+\delta)P_k K = (\rho+\delta)P_k K + \frac{\tau^c(1-z)}{1-\tau^c}(\rho+\delta)P_k K \tag{3}$$

The first term on the right-side is, of course, the market required return and economic depreciation, and the second term is the tax payment. We may also note the identity

$$P_x X = \frac{P_x X}{\mu} + \frac{\mu-1}{\mu}P_x X \tag{4}$$

The first term on the right-hand side is gross value added, and the second term is the oligopoly rent earned by the firm. Substituting (2') into (4) and then inserting the resulting expression into (1) and simplifying, we obtain

$$T^c = \tau^c \frac{\mu-1}{\mu}P_x X + \frac{(1-z)\tau^c}{1-\tau^c}(\rho+\delta)P_k K \tag{1'}$$

(1') says that the total corporate profit tax payment is the sum of the oligopoly rent times the full tax rate and the gross cost of capital net of tax times the factor $(1\text{-}z)\tau^c/(1\text{-}\tau^c)$. When z is unity, that is, when the full cost of capital is deductible for corporate income tax purposes, the only corporate profit tax paid is on the oligopoly rent. The corporate profit tax therefore does not have any impact on input decisions by corporations, and in this sense, it is neutral (Samuelson Theorem). When z is zero, that is, when none of the cost of capital is deductible for corporate profit tax purposes, then corporations must earn $1/(1\text{-}\tau^c)$ times the cost of capital and pay $\tau^c/(1\text{-}\tau^c)$ times the cost of capital as well as τ^c times oligopoly rent as the corporate profit tax. We can now decompose total sales net of intermediate inputs and rearrange it so that the decomposed parts can be interpreted as corresponding to familiar concepts appearing in the corporate sector of the national income and product accounts:

$$\begin{aligned} &P_x X - WE - \delta P_k K \\ &= (1-\tau^c)\frac{\mu-1}{\mu}P_x X + \rho P_k K + \tau^c \frac{\mu-1}{\mu}P_x X + \frac{\tau^c(1-z)}{1-\tau^c}(\rho+\delta)P_k K \end{aligned} \tag{5}$$

The left-hand side of equation (5) above represents, for the corporate sector, before tax corporate profits with inventory valuation adjustment and capital consumption

adjustment plus interest payments[4]. On the right-hand side, the first term is the oligopoly rent after taxes, the second term is the market required return on capital used, and the third and fourth terms are corporate profit taxes on oligopoly rent and the cost of capital, respectively. The important point here is that, on the basis of national income and product account data or on the basis of standard accounting data such as those reported in the COMPUSTAT tape or its equivalent in other countries, we can at best compute only the left-hand side of (5), and not individual items on its right-hand side. That is, we cannot directly measure separately the required return in the market, $\rho P_k K$ and the oligopoly rent after the corporate profit tax, $(1-\tau^c)\frac{\mu-1}{\mu}P_k K$, although we can obtain data for the total profit tax paid, that is, the sum of the last two terms on the right-hand side of (5)[5], and therefore the sum of $\rho P_k K$ and $(1-\tau^c)\frac{\mu-1}{\mu}P_k K$.

We have set out to estimate the rate of return on capital by computing the ratio of income accruing to capital to the market value of capital. We have argued above that, relying on the standard accounting records for firms or on national income and product accounts, we can measure the sum of oligopoly rents and income accruing to capital, before or after corporate profit taxes, but not each of them separately. Let us now turn our attention to the measurement of the market value of capital.

Since there is no direct estimate of the market value of physical assets, the best we can do is to rely on the indirect estimate, namely, the total market value of the firm defined as the sum of the market value of equity outstanding and the market value of the

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[4] This is so because we have interpreted the term $\delta P_k K$ as the economic depreciation on all capital at replacement cost. This means that the depreciation of capital goods is based on their replacement costs, and the cost of inventory sold is also valued at its replacement cost.

[5] This assertion is not quite true. We may observe that, under our assumption, the total corporate profit tax collected by the authority is given by

$$\tau^c \frac{\mu-1}{\mu}P_x X + \frac{\tau^c(1-z)}{1-\tau^c}(\rho+\delta)P_k K = T^c \qquad \text{(a)}$$

while the total profit after tax plus the depreciation allowance is given by

$$(1-\tau^c)\frac{\mu-1}{\mu}P_x X + (\rho+\delta)P_x X = B + Dep \qquad \text{(b)}$$

where B and *Dep* are profits after tax and the depreciation allowance reported to the tax authority. T^c, B, and Dep are available from the tax data, and τ^c and z are computable from the tax codes. Hence, (a) and (b) above may be considered as two equations in two unknowns, $\frac{\mu-1}{\mu}P_x X$ and $(\rho+\delta)P_k K$, and may be solved for these two quantities. In practice, however, this is an extraordinary complex task because many detailed provisions of the corporate profit tax codes must be taken account of and data adjusted accordingly, and cyclical deviations of variables from their normal level must be reduced as much as possible. I may note that, whatever it may be worth, my attempt to carry out this program in the mid 1970's for the United States suggested that the value of μ is between 1.02 and 1.04. This does not mean, of course, that we can say anything about the value of μ for other countries. (This note is by Ando).

debt of the firm[6]. There are two basic problems with this measure. First, it is very likely that the amount of debt reported in the accounting records of the firm is the face value of debt, not the market value. When the long term rate of interest fluctuates significantly, the market value can deviate markedly from the face value of debt, and thus our estimate of the total value of the firm may be subject to serious errors. The same observation applies to the aggregate value of the debt of corporations reported in the Flow of Funds accounts in the U.S. and in the National Accounts in Japan. Second, as we have discussed above, the total capital income of a firm includes oligopoly rent, and this means that the total market value of a firm must include the capitalized value of expected future oligopoly rent. In order to clarify the implications of the presence of oligopoly rent, consider a case in which the market value of physical capital is precisely equal to its reproduction cost, and debt is also reported at its market value. Since economic depreciation is subtracted from the income accruing to capital, the existing capital can be perpetually replaced so that current income may be viewed as a perpetuity. Under these assumptions and defining the ratio m by

$$m = \frac{(1-\tau^c)\frac{\mu-1}{\mu}P_x X}{\rho P_k K},$$

the ratio of net of tax income from capital to the market value of the firm is given by

$$\frac{(m+1)\rho P_k K}{(m\frac{\rho}{\rho+q}+1)P_k K} = \rho\frac{m+1}{m\frac{\rho}{\rho+q}+1} \tag{6}$$

where q is the risk premium demanded by the market for capitalizing oligopoly rent. It is clear from this expression that, if q is zero, then the presence of oligopoly rent will not create any distortion when we measure the cost of capital by the ratio of total income accruing to capital as defined by the left-hand side of (5) to the total market value of the firm.

A parallel line of analysis applies to the effects of the ownership of natural resources by the firm. To see this, it is helpful to write down an alternative version of equation (5) in which it is assumed that there is no oligopoly rent, but that the firm can produce and sell (as a part of its product) N units of a natural resource, whose price is given to the firm as P_n. The government requires that a fraction d of $P_n N$ be included in the corporate profit tax base. Equation (5) then becomes

[6] If all capital is "malleable", we may rely on the reproduction cost of capital for its value since the "putty" content of capital is well defined, and it can be fully utilized as a component of a new capital good. Since, however, we believe that the nature of capital, especially of capital equipment, is "putty-clay", the reproduction cost of capital is not well defined. We therefore believe that the only sensible measure of the value of capital to be used as the denominator of the rate of return must be the market value of capital. Note, however, that we have no alternative but to use a measure of depreciation on a reproduction cost basis (usually computed by adjusting the standard accounting records of depreciation for changes in capital goods prices) on the left-hand side of equation (5)

$$P_x X - WE - \delta P_k K$$

$$= \rho P_k K + (1 - \tau^c d) P_n N + \frac{\tau^c (1 - z)}{1 - \tau^c} (\rho + \delta) P_k K + \tau^c d P_n N \qquad (5a)$$

The value of the firm must now include the present value of the future stream of natural resources after tax, that is, the future value of $(1-\tau^c d)P_n N$. In light of our discussion of oligopoly rent above, we know that the condition under which the cost of capital computed as the ratio of the left-hand side of (5a) to the total market value of the firm will be unbiased by the presence of natural resources ownership is that the value of natural resources included in the market value of the firm is $(1-\tau^c d)P_n N/\rho$.

We would venture a guess that this condition is more likely to be violated in the case of natural resources than in the case of oligopoly rent. The reason for our conjecture is that natural resources may be exhausted fairly quickly at the current rate of exploitation, or alternatively, the stock of natural resources owned by the firm is much greater than the amount needed to enable its current rate of exploitation indefinitely. Since we have no information on the amount of natural resources owned by firms, we must proceed by ignoring its presence, having noted the nature of biases created due to our inability to deal with it explicitly.

We must now review another, rather complex question. For a firm faced with a decision of whether or not to invest in capital equipment that may last for a fairly long time, where the nature of the equipment is basically putty-clay, the relevant rate of return is the real, long term rate of return whose maturity is coincidental with the expected life of the equipment. On the other hand, for investors purchasing equities and the debt of the firm, presumably the most relevant measure of the profitability of such an investment is the one-period holding rate. The relationship between the one-period holding rate and the long term real interest rate is a rather messy expression except in the limiting case of a perpetuity, whose rate of return we shall refer to as the capitalization rate. In that case, we have the relationship:

$$R_t^* = \rho_t^* - \left(\frac{\dot{\rho}_t^*}{\rho_t^*} \right)^e \qquad (7)$$

where ρ^*_t is the capitalization rate for the perpetuity, $(\dot{\rho}^* / \rho^*)^e$ is the expected rate of change of ρ^*_t, and R^*_t the one period holding rate associated with the security whose capitalization rate is ρ^*_t. It is the one-period holding rate which would be equilibrated in the market, and since the expected rate of change of the capitalization rate is not necessarily uniform among market participants, the capitalization rate itself is not necessarily equilibrated in the market. Since the cost of capital, ρ, is closer to the capitalization rate rather than to the one-period holding rate, this is another reason why the cost of capital may not be fully equalized among markets in several countries.

II.2 Special Problems in Comparing the Cost of Capital Across Countries

In addition to all the problems that we have raised above, the costs of capital in two or more countries have an additional reason for remaining differentiated, namely, exchange

rate risk. Let us recall the standard uncovered arbitrage equation involving the expected rate of change of the exchange rate and the differential of the short term interest rate between two countries, given by

$$(R_t^d - R_t^f) - \left(\frac{\dot{e}_t}{e_t}\right)^e = \eta_t \tag{8}$$

where R^d and R^f are the real one period interest rate in domestic and foreign countries and e_t is the real exchange rate, $(\dot{e}_t / e_t)^e$ is the expected rate of change of the real exchange rate, and η_t is the risk premium plus random residual noise[7].

Even assuming that the variation of η is relatively small, movements of the expected rate of change of the exchange rate are bound to be quite significant. Consider, for example, a case in which the exchange rate is expected to rise by one-half of one percent in a three month period. This is equivalent to a two percent rise in the exchange rate at an annual rate, so that it will create a gap of two percentage points in the interest rates with three month maturity in the two countries in question measured at an annual rate. This is clearly a very significant difference between the two real interest rates. In Figure 1, we exhibit the three month commercial paper rate for Japan and for the United States in the upper panel. Between 1987 and 1994, we happen to have a direct measure of the expected rate of change of the exchange rates among several currencies including the exchange rate between U.S. dollars and the Yen[8]. Taking advantage of this availability, we exhibit in the lower panel what American residents should have expected to receive in dollars by holding three month commercial paper in Japan, in one case assuming that the directly observed expectation data in fact represented the expectation of the person in question, and in the second case assuming perfect foresight. It is easy to see not only that the realized rate of return on such an operation is very different from holding a domestic commercial paper of similar quality, but the expectation and the realization can be very different from each other.

We have now outlined the more important reasons why the cost of capital in two countries may not equalize even when the mobility of capital between the two countries in question is nearly complete. First, there may be a significant difference between the shortterm real rate of interest in two countries due to the expected rate of change of the exchange rate, and this difference may be quite volatile over time. Second, even if the short term interest rates in the two countries are the same, when this is translated into long term rates through an equation like (7), the expected rate of change of the capitalization rate must be taken into account, and there is no reason why the expected rate of change of the capitalization rate must be identical in two countries. Third, there are a number of measurement problems discussed in Section II.1 above, and the order of magnitude of these measurement biases may not be the same between two countries.

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[7] The relationship (8) is often expressed in nominal terms rather than in real terms. Provided that the expectation of the inflation rate incorporated into interest rates and the one underlying the exchange rate expectation are the same, the formulations of (8) in real terms and in nominal terms are equivalent to each other.

[8] Currency Forecasters' Digest, published monthly, P.O. Box 139, Gedney Station, White Plains, NY., 10605. Fax # 914-949-0303.

These are reasons for the deviation of the cost of capital between two countries even before the more commonly cited reasons, different risk premiums and different fiscal systems, are introduced. These factors, moreover, are capable of creating quite large differences in the cost of capital among countries, and market forces would not necessarily operate to eliminate the differences so long as the underlying causes persist. It is also the case that it would be extremely difficult to attribute a specific magnitude of the difference in the cost of capital in two countries to a particular cause, unless we have a direct measurement on such quantities as the expected rate of change of the capitalization rate and the expected rate of change of the exchange rate.

Under the circumstances, in this paper, as we did in the earlier papers of Ando and Auerbach, we will concentrate on reporting the observed differences in the cost of capital in three countries, and leave our speculation as to their causes to a brief section at the end.

II.3. Marginal versus Average Cost of Capital

It is often argued that the average rate of return on capital has little to do with the marginal rate, and it is the marginal rate that must be used in the construction of the gross rent for the use of capital which in turn must be equated to the marginal value product of capital. Professor Jack Mintz makes the point again in his written comment on an earlier version of this paper.

We have no quarrel with the observation that, in making a decision on whether or not to acquire a specific capital good, the manager must compare the present value of the future net income stream associated with this capital good with the cost of acquiring it, and the discount rate used to compute the present value here is closely related to the cost of capital we seek, and that in principle it may not be the same rate used to acquire capital goods in preceding periods. In this sense the distinction between the marginal and average costs of capital appears to be well established.

For the purpose of measurement, however, we are prepared to make a case that errors introduced by approximating the marginal cost of capital by the average cost, computed using the market value of the firm as the denominator, is much smaller than potential errors of measurement involved in constructing directly the cost of capital from relevant interest rates, the depreciation rate, tax structure, and even the mark-up factor to capture the oligopoly rent. Anyone who has attempted to estimate an investment equation can testify to the difficulty of carrying out the latter program, and one of us, having struggled with the problem of constructing a direct estimate of the cost for many years, wanted to try an alternative approach. Since he has written on the cost of capital variable needed in the investment equation[9], we present below an argument why the average cost of capital may be a reasonable approximation of the marginal cost if our aim is simply to measure it.

The argument basically rests on the observation that, in period t, any capital goods acquired earlier by the firm must now have an economic value equal to the present value of the future stream of net revenues associated with the capital good in question by using the relative prices and price expectations held in period t, not those held in period t-1 or earlier. One of the relative prices is the appropriate discount factor for converting expected future receipts to the present value in period t.

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[9] Ando, Modigliani, Rasche and Turnovsky (1974) and Ando (1976)

For example, suppose that the long term interest rate increases significantly and unexpectedly in period t, other relative prices remaining stable. In such a case, it is clear that the market value of the equipment purchased in period t-1 must decline to reflect the changes in the long term interest rate, and the new long term interest that must be used in period t is the same as the long term rate used to make decisions on capital purchases in period t.

A perpetual inventory procedure for generating the depreciation of capital goods and the net stock of capital goods, however sophisticated it may be, would not be capable of reflecting many of these changes. In this sense, if we use the stock of capital generated by an accounting procedure involving a pre-fixed pattern of depreciation as the denominator of our estimate of the cost of capital, then the average rate of the cost of capital generated in this way may be significantly different from the marginal cost. The market value of equity, on the other hand, provided that the equity market functions well and all relevant information about the firm's operations and the relative prices it faces are made available to important market participants, must reflect all of these changes, including changes in relative prices that may be caused by unexpected new technological improvements[10].

This line of consideration leads us to expect that the average cost of capital estimated using the market value of equity as the denominator must approximate the marginal cost of capital as well as any measure can, and the objection that such a measure reflects the average rather than the marginal cost of capital is not strictly justified.

III. Data

Our original intention was to supplement earlier estimates by Ando and Auerbach (1988b), (1990) for the U.S. and Japan by adding data for the years 1988-94, and to perform a parallel analysis for Canada. For the U.S., the historical component of the COMPUSTAT file has become more easily accessible, and we have been able to revise our estimates using data for a somewhat longer period. For Japan, we have decided to use the Nikkei data set of consolidated accounts rather than the standard Nikkei-Needs data file, since the former appears to be more compatible with the American accounts in the COMPUSTAT file[11].

It turned out that, for Canada, COMPUSTAT starts reporting individual company accounts only in 1976, and not until 1983 does the number of companies exceed 100. Even after 1984, the number of companies hovers around 200, and we know from our

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[10] Most factors that may make estimation of the net income stream and discount factor complex are such that they can be introduced to affect either the income stream or the discount factor, and for most purposes, the results are equivalent. Here, however, we must make sure that we introduce them into our calculations in such a way that the discount factor applicable to the income generated by older capital is the same as the one applicable to the income generated by new capital.

[11] Another reason for our choice was that, given the results reported in Ando and Auerbach, the fact that the Nikkei Consolidated data file did not go back much earlier than 1980 did not seem important. Unfortunately, we found that the number of firms reported in the consolidated accounts file was quite small until 1984, and we had to start our analysis in 1985. Furthermore, some information is available in the standard Nikkei-Needs data file but not in the consolidated accounts file, forcing us to make some additional approximations. Ideally, we should have obtained both the standard data file and the consolidated accounts file, but the price charged by Nikkei for them and our budgets were not compatible with such an arrangement.

experience with the American and Japanese cases that this is not a large enough sample to generate reliable estimates.

These problems which we encountered in dealing with micro data led us to consider the possibility of constructing an alternative estimate of the cost of capital for all three countries based on their aggregate national accounts data. Since the nature of the micro data and the number of adjustments we have undertaken to bring the accounting data as close as possible to the concepts needed to estimate the cost of capital have already been discussed in Ando and Auerbach (1988a) and (1988b), (1990), we comment primarily on the nature of the aggregate data and the potential problems in using them.

For the United States, on the flow side, Table 1.16, Gross Domestic Product of Non-financial Corporate Business in Current and Constant Dollars, National Income and Product Accounts, contains the records of corporate profits with an inventory valuation adjustment and a capital consumption adjustment. These two adjustments are in principle the same as those adjustments we have undertaken to correct the earnings of individual firms for their biases due to inflation in our dealing with the micro data. This table contains only "net interest" while we need "gross interest paid," but the latter is separately reported in Table 8.17, Interest Paid and Received by Sector and Legal Form of Organization. Thus, all necessary data on the flow side are available in the National Income and Product Accounts subject to the normal measurement problems.

On the stock side, the most convenient source of data is the nonfinancial corporate sector of the Balance Sheets for the U.S. Economy, Flow of Funds Accounts, prepared by the Board of Governors of the Federal Reserve System. The basic problem of these balance sheets is that the basis of valuation is different for different groups of items, and hence they contain a sizable residual called "market valuation discrepancy". It is useful to be clear about these valuation problems, and for this purpose, we find it convenient to introduce a few simple notations:

ARR: Reproducible tangible assets valued at reproduction cost; equipment, structure and inventories.

ARN: Non-reproducible tangible assets, primarily land, valued in principle at market value.

AF: Financial assets other than equities. Its components are in principle valued at their market value but in practice often reported at their face value.

LF: Financial liability. Components of this item, too, are in principle valued at their market value, but they are often reported at their face value.

NWM: Equity outstanding at market value. Here it is netted against equity owned by these corporations.

NWR: Net worth at "reproduction cost," to be defined below.

DMV: Market valuation discrepancy.

LF*: LF less trade debts.

AF*: AF less trade credit

NWR is defined by the identity

$$ARR+ARN+AF=LF+NWR \tag{9}$$

and DMV is defined by another identity

$$DMV=NWR-NWM \tag{10}$$

As in our work with micro data, we propose to use the sum NWM+LF* as the denominator in our estimate of the cost of capital. This definition seems natural enough especially if DMV is relatively small. Unfortunately, DMV can be quite large, and it can fluctuate substantially over time, although its sign has remained positive until very recently[12]. The short-run fluctuation of DMV is largely due to cyclical fluctuations of the price of equity shares, and the recognition of this problem implies that, to obtain a meaningful estimate of the cost of capital, we should confine ourselves to averages over a relatively long period so that our estimate will not be affected by short run fluctuations of the stock market[13]. The persistently large value of DMV indicates the presence of significant biases in estimates of some components of net worth reported in the balance sheet provided by the Flow of Funds accounts.

The market value of equity itself, NWM, is well known to be fairly accurate for large, public corporations whose shares are listed on stock exchanges. Here, therefore, the source of error is the valuation of private, unlisted companies, especially small ones. For the United States, however, the equity of large, public corporations is a large enough fraction of the total value of equities of all corporations so that any bias in our estimates of the total value of equities of all corporations cannot be large enough to account for the average value of DMV over the past 40 years[14].

Among financial assets and liabilities, we believe that the value of financial instruments with relatively short maturity is reasonably accurately reported. The same cannot be said, however, for financial instruments with longer maturities, since the market value of these instruments depends not only on the relationship between the coupon rate and the market rate of interest given the length of the remaining period to maturity, but also on many complex provisions such as callability and convertibility. Because of these difficulties, the Flow of Funds section often resorts to reporting the value of long-term financial instruments at their face value. The consequent bias in the estimate of the market value of a firm can be significant, and since corporations on average have much more long term financial liabilities compared to long term financial assets, one would expect that, by and large, when the long term interest rate is high, we underestimate their net market value, while when the long term interest rate is low, we

[12] The unusual movement of DMV for the Flow of Funds accounts in the U.S. since 1989 is largely due to the reported movement of the value of land, which declined from $940 billion in 1989 to a mere $ 90 billion in 1993. This dramatic movement of the value of land has nothing to do with reality, but it is simply due to the disappearance of the data source on which the Flow of Funds section at the Federal Reserve Board depended, and to the decision by the section to follow a specific procedure to deal with this problem which turned out to generate an unreasonable result after the fact. I believe that letting the value of land increase in proportion to, for example, the nominal value added measure of output of the nonfinancial corporate sector since 1989 would at least avoid the major distortion of the accounts and is preferable to the current procedure until an alternative source of the required information is found.

[13] This is especially true when we work with the market measure of the rate of return rather than with the accounting measure. See section IV below.

[14] This may not be true of the Japanese case, as discussed below.

overestimate their net market value. Thus, biases in the Flow of Funds estimate of financial assets and liabilities cannot explain the persistent positive value of DMV[15].

These considerations leave the overvaluation of ARR as the most likely source of the persistent positive and large value of DMV. We believe that there are two possible mechanisms that can lead to the overvaluation of ARR. First, it may be that the depreciation rate used to carry out the perpetual inventory procedure is simply too small. Second, in attributing the reproduction cost to existing capital stock, those responsible for the procedure may be underestimating the technical changes involved so that they are imputing too high a level of productivity to older capital. This possibility would lead to two consequences. First, we may attribute to the older capital a market value that is too high. Second, we may underestimate the amount of capital which must be abandoned for economic reasons, because its productivity has become too low compared to that of new capital, so much so that the marginal cost of producing output using them has become larger than the total cost of producing the same output using new capital. Both of these situations could be mechanically described by saying that the rate of depreciation is too small. Let us therefore look at the consequence of using a depreciation rate smaller than the rate at which the value of capital declines in the market.

For the aggregate data, gross investment must be assumed to be accurately measured, so we will take gross investment, I, as given, and let us consider an economy in which output is increasing at a constant rate, g, and the capital stock requirement is proportional to output, and therefore also growing at the rate g. Let us designate the "true" depreciation rate and the "true" stock of capital by δ^* and K^* respectively. On the steady growth path, we must have the relationship

$$I_t = gK^*_{t-1} + \delta^* K^*_{t-1}$$

implying

$$K^*_{t-1} = \frac{I_t}{g+\delta^*} \qquad \text{for all t.} \tag{11}$$

On the other hand, suppose that an analyst adopted another depreciation rate δ, $\delta<\delta^*$, and kept the perpetual inventory according to

$$K_t = I_{t-1} + (1-\delta)K_{t-1}$$

starting from some K_0, presumably not too far from K_0^*, and using the same I_t as in (11). He will find then that his estimate of capital stock will eventually converge to

$$K_{t-1} = \frac{I_t}{g+\delta} \qquad \text{for all t} \tag{11a}$$

[15] The size of DVM, which can be as large as 40% of NWM in some periods, cannot be accounted for by potential biases in the estimate of the value of financial instruments. Suppose that 50% of NWM is in long term liabilities subject to the bias, and it is underestimated by as much as 50% due to the past movement of the long term interest rate. This very extreme assumption would create DMV of some 25% of NWM.

To obtain a sense of the order of magnitude involved, suppose that g is .02 and δ^* is .15, while the analyst assumed that δ is .10. Then K^* is 5.88 x I, while K is 8.33 x I, making the analyst's estimate of the capital stock more than 40% too large relative to the true value. Somewhat surprisingly, however, the estimate of the amount of depreciation generated by the analyst is not very far from the true amount. We have

$$\delta K_{t-1} = \delta \frac{I_t}{g+\delta} = \frac{.1}{.12} = .83 I_t$$

$$\delta K^*_{t-1} = \delta^* \frac{I_t}{g+\delta^*} = \frac{.15}{.17} = .88 I_t$$

Indeed, if g is zero, then the estimate of the depreciation amount prepared by the analyst is unbiased.

To summarize, in reviewing the aggregate balance sheet of nonfinancial corporations for the U.S. prepared by the Federal Reserve Board as a part of the Flow of Funds Accounts, we found the large and persistently positive value of the market valuation discrepancy to be the most disturbing feature of the data contained in the balance sheet. While it is possible that the discrepancy may be due to errors of measurement of the value of equity or of financial assets and liabilities, the most likely cause of the discrepancy is that the depreciation rate used in the perpetual inventory procedure by which capital stock was estimated from gross investment is too small as a measure of economic depreciation. However, even if this is so, the estimate of depreciation itself would not be seriously biased on the steady state growth path so long as the accounting identities are consistently observed. In a sense, this is good news for working with the data for the United States, because for the ratio used to estimate the cost of capital, the numerator is importantly affected by the amount of depreciation which is not badly biased, while for the denominator, we utilize NWM+LF*, which appears to be estimated with less severe biases involved than NWR. Basically the same comments apply to micro data, and in the next section we will show that, for the United States, the cost of capital estimated using micro data and the one estimated from aggregate data are almost identical. (Figure 2.1).

We now come to a review of Canadian data. As we have mentioned earlier, micro data for Canada appear to be quite erratic, presumably because the sample size is too small, making it necessary for us to rely heavily on aggregate data to estimate the cost of capital in Canada. At the beginning, it looked as though the necessary aggregate data did not exist either, but Statistics Canada in the end was willing to make some unpublished data available to us so that we could carry out for Canada a computation very similar to the estimation procedure based on aggregate data for the U.S[16].

There are however, some problems.

Most importantly, financial data for Canada do not explicitly contain the value of equity outstanding for any group of corporations. It turns out, however, that Statistics Canada can generate dividends paid by nonfinancial corporations, while we can obtain

[16] We are very much indebted to Mr. Patric O'Hagan of the National Accounts and Environmental Division, Statistics Canada, for not only preparing special tabulations for us but also providing us with a great deal of additional information on the nature of the data.

the dividend-price ratios applicable to nonfinancial corporations listed on the Toronto Stock Exchange. Dividing dividends by the dividend-price ratio, we should be able to generate an estimate of the value of equity outstanding under the assumption that the dividend-price ratio for nonfinancial corporations that are not listed on the Toronto Stock Exchange is the same as the dividend-price ratio reported by the TSE. This is largely what we did, except that there is a large break in the time series on dividends from 1987 ($12,517 million) to 1988 ($26, 274 million). Such a jump did not seem reasonable, and Statistics Canada informed us that this was partly due to a change in the method of the survey on which the dividend series is based. We have estimated an equation explaining dividends in terms of cash flow after taxes and previous years' dividends based on data up to 1987, and then used this equation to extrapolate the dividend series to the 1988-1994 period. We also had from Statistics Canada an alternative estimate of dividends for 1988 and 1989 based on the older survey method, and we eventually scaled our predictions up to match this additional information for 1988 and 1989. A detailed description of the procedure is given in the Appendix.

Liabilities of nonfinancial corporations were directly taken from the balance sheets of these corporations provided by Statistics Canada, except that we have excluded trade payable, corporate claims, shares, and other liabilities. The sum of our estimated value of equity outstanding and total liabilities described above constitutes the denominator of our estimate for the cost of capital for Canada.

The numerator of the ratio is the profits of nonfinancial corporations before tax with capital consumption adjustments and inventory valuation adjustments as in the case of the United States, and these data are directly provided to us by Statistics Canada. As in the case of the U.S., we make the final adjustment to the numerator by subtracting the real capital loss on the nominal financial assets of these corporations. The resulting ratio is reported in Column XII , Table 6a, of the Appendix, and is discussed in the next section. Comparison of the results from the National Accounts data and from individual company data for Canada is provided in Figure 2.2.

We now have to make a few comments on the Japanese data, though the conclusion here is quite negative. We find that the Japanese National Accounts data contain some critical defects for the purpose of estimating the cost of capital, and the result of going through the motion of estimating it based on this data is not meaningful. On the other hand, a comparison of the National Accounts data and corresponding estimates generated from individual company data provided by the Nikkei data files casts doubt on both sets of data, making our results for the Japanese case subject to serious doubts. We will present below a brief description of the difficulties as we perceive them. A set of information which puts in focus differences between the National Accounts data and the individual company data provided by Nikkei are shown in Table 3, supplemented by standard indicators compiled by the Tokyo Stock Exchange.

In the Japanese National Accounts, we have three basic tables for nonfinancial corporate enterprises. One shows "income" and "outlays"[17]; the second indicates investment in capital goods, inventory and in land, and how these acquisitions are financed. The third is the balance sheet. With information provided in these three tables,

[17] These words are used in very specific senses. Total receipts here consist of operating surplus (not sales) plus income from properties not used in production and the benefits from casualty insurance policies. This is clearly different from the value added by enterprises. Outlays are the distribution of this concept of receipts among various items.

it appears that we can carry out the same procedure as we have described for computing the cost of capital in the U.S. case. Unfortunately, this is not the case.

First, it turns out that the depreciation of the capital stock reported in the first two tables of flow quantities is based on the original cost of investment, while the stock of capital reported in the balance sheet is based on their replacement costs. We have tried to reconcile the two, but we could not do so by using information reported in the National Accounts. In other words, in terms of the argument leading to equations (11) and (11a), not only is the depreciation rate used to compute depreciation in the flow tables an incorrect rate and presumably too low, but the quantity of depreciation reported in the flow table is inconsistent with the stock of capital reported in the balance sheets and does not satisfy the accounting identity.

As we have shown in the discussion following equations (11) and (11a), this is a crucial issue because, if depreciation and the stock are consistently generated, the quantity of depreciation may be reasonably close to the true quantity even if the depreciation rate used is significantly different from the true rate. Since we do not know exactly how depreciation and the stock of capital are calculated in the Japanese National Accounts, we do not know what depreciation rate is used. If we simply compute the ratio of reported depreciation to depreciable real assets for nonfinancial corporations, we obtain a number a little below 0.1 for most years. On the other hand, if we perform similar calculations using data from the Nikkei consolidated accounts file, we obtain a number above 0.2.(See Table 3, row (1)). For the U.S., the corresponding number is between 0.06 and 0.08 computed both from individual company data supplied by COMPUSTAT and from the National Income and Product Accounts. For equipment it may be between 0.1 and 0.2, but for structures, it must be much below 0.1, so that the figure of 0.2 for the average which emerges from the individual company data in Japan seems implausible.

Second, it is generally believed that the debt-equity ratio of Japanese corporations is much higher on average than the corresponding ratio in the U.S. This ratio can move significantly even when the level of debt is fairly stable due to changes in the market value of equities. The average ratio for companies included in the Nikkei Consolidated Account File is 1.22 in 1985, declines to 0.56 at the peak of the bubble in 1990, and increases again to 1.22 in 1993 as the bubble bursts. Computed from the nonfinancial corporation accounts in the National Accounts, we have 2.07 in 1985, 0.81 in 1989, and 2.23 in 1993. Either smaller companies not listed on Tokyo Stock Exchanges have much higher debt-equity ratios, or we have some serious problems in the measurement of debt and/or equity. We find it hard to believe that the difference is due to a much larger debt-equity ratio of unlisted companies, since their debt-equity ratio must be extremely large in order to account for the difference.

Third, the standard measures of the rate of return on equity, the dividend-price ratio and the earnings-price ratio as reported by the Tokyo Stock Exchange without any manipulation on our part, is on average only a half the magnitude of the ratio computed from the National Accounts data[18]. Here again, we know that the National Accounts data cover, besides those corporations listed on the Tokyo Stock Exchanges, many smaller firms that are not listed. Since the proportion of output generated by these smaller firms is

[18] While the ratios calculated from the Nikkei file of consolidated accounts are quite similar to the ones reported by the Tokyo Stock Exchange, this cannot be considered independent information since companies in the Nikkei file are all listed on the Tokyo Stock Exchange.

quite large in Japan, if their behavior is radically different from large corporations, then the larger difference between the earning-price ratio for those firms listed on the Tokyo Stock Exchange and the ratio reported in the National Accounts is theoretically possible. Such a large difference, however, does not seem plausible, and since the measurement of dividend payments by corporations are unlikely to be badly biased, this observation raises the possibility that the value of equity reported in the National Accounts is underestimated.

The fourth and last observation on the Japanese data is related to the market valuation discrepancy[19]. In the National Accounts, this item is always positive as in the case of the U.S., but the ratio of this item to the total value of equity shares is extremely large in the case of Japan. The surprising finding is that, when the parallel concept is computed based on the Nikkei file of consolidated accounts, DMV is negative, and its ratio to the market value of equity is quite large. (Table 3, row (6). Figures reported in this row are after the adjustment described in footnote 20 below). There is an obvious bias in the estimate of this ratio from individual company accounts. In these accounts, it is most likely that the value of land is recorded at its original cost, and this in Japan is, of course, nonsense. Since we do not have any information on when the land was purchased nor where it is located in the consolidated version of the accounts in the Nikkei files, we have made a very gross adjustment to the value of land just to see if such an adjustment would make a material difference in our estimate of DMV[20]. This adjustment made a sizable difference. Prior to this adjustment, the ratio DMV/(NWM+LF*) averaged over all companies in the Nikkei file of consolidated accounts and over the years 1985 to 1993 is -0.53, while it becomes -0.36 after the adjustment. However, this contrasts with the corresponding figure computed from the National Accounts of 0.44.

We know that the market value of equity reported in the consolidated accounts of the Nikkei file is accurate, because we know precisely how many shares of these companies are outstanding, and we also know the market price of shares precisely. Unfortunately, we do not know the value of the equities of the corporations which are not listed on the Tokyo Stock Exchanges, so that we cannot fully judge whether or not the market value of equity reported in the National Accounts is too small or not, though we suspect that it is. On the other hand, we believe that the stock of reproducible tangible assets reported in individual company accounts in the Nikkei files is probably undervalued because of the unreasonably high rate of depreciation discussed earlier. Though we are not sure of either of these observations, we must keep them in mind as we proceed to review the results of our calculations to arrive at our estimate of the cost of capital. In any event, the comparison of result from the National Accounts data and from individual company data for Japan is provided in Figure 2.4. The difference is quite striking.

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[19] In the balance sheets in the National Accounts of Japan, the market valuation discrepancy is designated as "Shomi Shisan", which can be literally translated as "True Net Assets". While definitions and names are arbitrary, in this instance, the designation used suggests that the original designers of these balance sheets had a serious misconception of what this item represented.

[20] In the process of estimating the net earnings of companies in their individual accounts, we have estimated the value of the net stock of reproducible tangible capital at its reproduction cost as a part of estimating depreciation at its reproduction cost. We then computed the ratio of the value of land to the value of reproducible tangible assets at reproduction cost for all companies in the Nikkei file of consolidated accounts and increased the value of land so that this ratio matched the corresponding ratios in the National Accounts.

IV. Results.

We report several measures of the cost of capital: (i) the total rate of return on capital before tax (total income received by equity owners and bond holders before corporate profit tax and before personal taxes but after depreciation designated as R/K); (ii) the total rate of return on capital after tax, untaxed bonds (same as R/K except that the corporate profit tax paid is subtracted from the numerator); and (iii) the total rate of return on capital after tax, taxed bonds (same as (ii) above except that we compute the corporate profit tax liability as though the interest paid is not deductible for tax purposes). We will also report in some cases the basic earnings-price ratio defined in the usual way except it is adjusted for the real capital gains earned by owners of equity due to inflation by being indebted to bond holders.

In this section, our primary focus is on the total rate of return on capital before taxes. In most countries, certainly the U.S., Canada, and Japan, the interest paid to bond holders is deductible for tax purposes. This means that any net of tax measure of the rate of return is dependent on the debt-equity ratio, and the debt-equity ratio may be heavily affected by the tradition of a country. We have noted earlier that the debt-equity ratio in Japan is on average much higher than the debt-equity ratio in the U.S. or Canada. Thus, international comparisons of the rate of return may depend on the historical tradition of the country, making the comparison of the rate of return among them much more difficult.

One way to get around this problem is to construct a hypothetical rate of return carrying out the computations under the assumption that interest payments to bond holders are not deductible for tax purposes, and then calculate the rate of return on capital after taxes. This is the reason why concept (iii) was introduced above. By following this strategy, we avoid the problem that the rate of return depends on the historical accident of the size of the debt-equity ratio. But it is subject to the objection that the concept in terms of which we are conducting the comparison is significantly different from any of the commonly used ones. Thus, the total return on capital before tax appears to be the most reasonable measure on which we can focus our attention.

The results of our calculations are summarized in Table 1, and the time pattern is given in various figures. One striking feature is that, for the United States, averaged over the longest possible period, 1956-1994, the adjusted accounting measure of the total return on capital before taxes (Table 1.B.) based on individual company data is identical to the market measure (Table 1.C.), and they are in turn virtually the same as the parallel concept computed from the aggregate National Income and Product Accounts data (Table 1.B). They are all reported to be 0.109. They ought to be quite close to each other once they are averaged over a long period of time, but it is gratifying that they in fact become closer and closer as the period over which they are averaged becomes longer and longer. Thus, provided that we average over a long period of time and the quality of data is satisfactory, then any one of these three measures can provide a reasonable estimate of the order of magnitude of the average cost of capital for a country for the period covered.

Even when the period over which the averaging takes place is relatively short the ratio computed from the National Income and Product Accounts and the average ratio computed from individual company accounts included in the COMPUSTAT file are quite close for the U.S. case. This is evident from Figure 2.1., in which we graph each of these

two ratios. The only periods in which the difference between them exceeds two percentage points are 1974 and 1978-81.

For Canada, we originally produced estimates based on individual corporations but not ones based on the aggregate National Accounts data, because we understood from our colleagues at Industry Canada that it is not possible to locate the information necessary to adjust published data so that we can come close to the concept that we laid out earlier in this paper. Somewhat to our surprise, our estimated cost of capital based on individual company data reported in the COMPUSTAT file turned out to be considerably higher than its counterpart for the U.S. Furthermore, when we prepared the estimated cost of capital for broad classes of industries, we encountered the further surprise that for the industry in which the cost of capital is expected to be relatively low, namely, the transportation and public utility industry, the cost of capital by far is the highest. (Table 2).

We believe that these results are most likely due to the erratic variation of means of fairly small samples. We also observe, as a possible confirmation of this unreliability of the Canadian results based on individual company data, that the market rate of return for Canadian firms is dramatically lower than the adjusted accounting rate of return, 0.084 against 0.147. Confronted with these results, we appealed to Statistics Canada and very fortunately were supplied with a set of unpublished data on which we can base our estimate of the cost of capital for Canada. This set of data is not without problems, as discussed in Section III above and exhibited in detail in the Appendix.

The adjusted accounting rate of return before tax based on the aggregate National Accounts data for Canada for the years 1962 to 1994 turns out to be 0.092. This is only one percentage point over the market rate of return computed from individual company data, 0.084 for the period for which individual company data are available, 1976 to 1993. For comparison purposes, we have computed the ratio based on the aggregate National Accounts for the period 1976-1993, and we obtain the figure 0.097.

This estimate of the cost of capital for Canada is somewhat lower than that for the U.S. For the U.S., the corresponding figure computed from individual company data for the period 1976-93 is 0.124 in terms of the adjusted accounting return, while it is 0.126 in terms of the market return. This contrasts with the Canadian corresponding figures of 0.147 and 0.084. As we have noted earlier, the very large difference between the two Canadian figures makes our Canadian estimates subject to some suspicion. Based on the aggregate National Accounts data, as we have noted above, the Canadian figure is 0.092 for the longest period available, namely, 1962-1994, while the corresponding figure for the U.S. for the same period is 0.114.

Figure 2.3 exhibits the comparison of the total rate of return on capital before tax for the U.S. and for Canada, based on aggregate National Accounts data. The U.S. rate is almost uniformly higher than the Canadian rate by some 2 percentage points, so that the average figures for the entire period in this case is a good representative of the difference. We know that the U.S. pattern presented here is also very close to the U.S. pattern based on individual company data (Figure 2.1.), while the Canadian figure is considerably lower than the pattern we would obtain using individual company data (see Figures 2.2).

Given this somewhat mixed pattern that emerges in comparing the cost of capital between the U.S. and Canada, we are forced to speculate which of these figures is more reliable, and how such considerations will affect our inference on whether or not the cost of capital in these two countries is the same, and if it is different, then what our best estimate of the difference is?

We believe that the U.S figures are a little more reliable than the Canadian ones, for two reasons. First, the U.S. data cover a longer period. Second, for the U.S., individual company data and the aggregate National Accounts data give roughly the same results. Of the Canadian data, we believe that the National Accounts data are somewhat more believable than individual company data, although we have no systematic and compelling evidence leading to such a conclusion. We simply find that individual company data for Canada seem more erratic in their pattern, and cover relatively few firms over a very short period. Of the National Accounts data, the most suspicious feature is the very large break in the pattern for cash dividends series between 1987 and 1988. While this break is quite startling and makes the time series on cash dividends subject to serious doubt[21], we believe that this does not affect our estimate of the cost of capital very much. This is because for Canada, we do not have direct estimates of the value of equity shares outstanding, and we estimate the value of equity by dividing the dividend series by the dividend-price ratio supplied by the Toronto Stock Exchange. In the end, we also add the same dividends to retained earnings, corporate profit tax, and interest paid, and then divide them by the sum of the value of equity outstanding generated by the procedure just described and the value of financial liabilities less trade debt and a few other things. Thus, it is the dividend-price ratio that was the critical variable, and the absolute size of dividends was used as a weight in this calculation. There is, of course, a possibility that retained earnings are underestimated, but we do not have any reason to suspect it[22]. We believe we were reasonably careful to select items among financial liabilities so that the definition of financial liabilities should be very close to the one that we have used for the U.S.

There is one other indirect evidence that the cost of capital for Canada is quite close to that for the U.S. Some Canadian companies are listed both in the Toronto Stock Exchange, and for these companies, the cost of capital must be very close to that for the U.S. Corporations. If the cost of capital for these cross listed companies must be distinctly lower than the cost of capital for those Canadian firms which are not cross listed. In Figure 4, we report the comparison between these two groups. There does not seem to be any systematic difference in the cost of capital between these two groups of companies.

Given the data that we have had at our disposal, we believe that the only conclusion we can arrive at in comparing the cost of capital in Canada and that for the U.S. is that they are quite close, and if anything, the cost appears to be marginally lower for Canada than for the U.S., but we cannot be sure. We can say that we have found no evidence supporting the proposition that the cost of capital is especially high in Canada.

For the case of Japan, we must regrettably report that the current study confounds rather than resolves the difficulties of understanding Japanese data discussed in Ando and Auerbach. We have already outlined in Section III above serious contradictions in the pattern of variables between the aggregate National Accounts data and individual company data included in the Nikkei data files. As a consequence of differences noted in

[21] For most countries, dividends are a very stable quantity over time.

[22] We wonder if very accurate estimates of these quantities, retained earnings, dividends, interest payments, corporate profit tax liabilities, etc., could not be directly available from tax records. For the U.S., records at the IRS are the most important source of data for the income side of the corporate sector in the national accounts.

Section III, if we proceed to calculate the rate of return based on the National Accounts data, we obtain a radically different result compared to individual company data.

In Figure 2.4., we exhibit the adjusted accounting measure of the total return on capital before tax based on individual company data, and the rate of return before tax that we have calculated from the National Accounts data. We may note that the rate of return based on individual company data, represented by triangles and covers the period from 1970 to 1987, is taken from the earlier study of Ando and Auerbach and computed from the standard Nikkei file, while the figures for the later period, 1984 to 1993, represented by large squares, have been computed for this study using consolidated accounts from the Nikkei file. The latter covers a somewhat smaller number of companies, but the behavior of these two series for 1984 -1987 when they overlap is close enough for us to suppose that there is no obvious selection bias. Results summarized by this graph imply a very low level of return to capital before tax. On the other hand, the graph representing the result obtained using National Accounts data indicates that the return to capital in Japan was exceptionally high until about 1982, and then it is approximately at the same level as that for the U.S.

For the rate of return based on the National Accounts data, we are unable to correct for inflation bias. Thus, the graph of the rate of return based on the National Accounts data in Figure 2.4. is more like the unadjusted accounting measure rather than the adjusted accounting measure. Since the rate of inflation for Japan in the 1970's was quite high, this may make a significant difference. We have, based on individual company accounts data, a very rough indication of the quantitative effects of adjusting for inflation biases, since we have both unadjusted and adjusted accounting rates of return for Japan recorded in our tables. For example, in terms of the total return on capital, the unadjusted measure is 0.093 for the relatively high inflation period of 1967-83 and 0.050 for the low inflation period of 1985-94, while their adjusted counterparts are 0.064 and 0.044, respectively. Thus, the adjustment reduces the rate by 0.029 during the strong inflation period, and only by 0.006 during the period when inflation was low. This order of magnitude seems quite low to us, but since we have no other estimate, let us think through the consequence of the assumption that these adjustments are the right order of magnitude and that they can be transferred to estimates based on the National Accounts data.

Deducting 3 percentage points from the estimate based on the National Accounts data for the 1970's brings the average rate for this period down to a little over 10%, the number roughly comparable to the U.S. estimate based on the National Accounts data for the same period. For the period 1985-1993, our estimate for Japan based on the National Accounts data does not change much as the result of the adjustment and remains around 8%, which is noticeably lower than its counterpart for the U.S. Compared with the corresponding estimates based on the individual company data for Japan, the difference has been narrowed, especially for the 1970-1983 period as we can see from Figure 2.4., but estimates based on the National Accounts data remain uniformly higher than those based on individual company data.

The fact that our estimate of the total rate of return on capital based on the National Accounts data for Japan turns out to be of the same order of magnitude as their U.S. counterparts for a fairly long period of time does not necessarily make the estimates believable. In Section III above, we have listed circumstantial evidence suggesting that the market value of net worth is substantially underestimated in the National Accounts, leading to a probable overestimation of the rate of return on capital. On the other hand,

we will argue later that the unusually high price of land in Japan and the way it is handled in Japanese accounting practice would probably lead to a significant underestimation of the rate of return on capital. Before we come to these points, however, let us comment briefly on our estimates of the rate of return on capital based on individual company accounts.

The longest period for which we have an estimate of the rate of return on capital for Japan based on individual company data is from 1967 to 1994, and the adjusted accounting rate of return before tax for this period is reported to be 0.057. This contrasts with the rate of 0.115 for the same measure in the U.S. for the same period (see Table 1.B.), making it appear that the Japanese rate is only a half of its U.S. counterpart. In terms of the market measure, the pattern is basically the same. For the period 1967-1994, the Japanese figure is 0.053, while the figure for the U.S. is 0.105.

This pattern contradicts earlier findings of Ando and Auerbach who reported that the market measure of the rate of return for Japan was significantly higher than the adjusted accounting measure. The difference is due to the inclusion of the 1990-1994 period, when the market rate of return was strongly negative reflecting the burst of the bubble market in Japan of 1985-89. Thus, on the surface, it seems difficult to deny that the cost of capital is lower in Japan than in the United States. We believe that there are several features of the data that cast doubt on this conclusion.

Since nonfinancial corporations listed on the Tokyo Stock Exchange constitute a substantial fraction of all nonfinancial corporations in Japan, we should expect that the behavior reported in the nonfinancial corporate sector of the National Accounts and that represented by nonfinancial firms in the Nikkei data file should exhibit largely similar patterns. The parallel expectation was largely fulfilled by the data in the case of the United States, making our task of describing some aspects of the behavior of American nonfinancial corporations relatively straightforward. The difficulty we encounter in the case of Japan can be easily appreciated by referring back to Table 3, in which several critical ratios for these corporations are calculated according to both macro data from the National Accounts and the individual firms data reported by the Nikkei files. The difference between the two sets of ratios are quite striking, and yet we must attempt at least a partial reconciliation of these two sets of ratios if we are to say anything about the cost of capital faced by Japanese corporations.

Let us begin our review of potential biases in these ratios by focusing our attention on the question of land.. Row (5) of Table 3 shows that the value of land is reported to be 0.52 of the reproduction cost of reproducible tangible assets and financial assets (excluding trade credits), while the parallel ratio computed from the Nikkei data is only 0.12. We believe that the figure from the National Accounts is clearly closer to the truth in this case, since almost surely the value of land reported in individual company records is based on its original purchase cost many years earlier, and the relative price of land has risen dramatically in Japan since the 1950's[23].[24]

Since individual company records in the Nikkei file do not report either the location or the physical size of land, there is no possibility of applying any reasonable

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[23] One of us studied the value of land belonging to households and concluded that the aggregate estimate reported by the national Accounts seems reasonably accurate. See Hayashi, Ando, and Ferris (1989).

[24] By way of contrast, for the United States, the balance sheet for nonfinancial corporations records the ratio of the market value of land to the reproduction cost of reproducible tangible assets plus financial assets less trade credits to be roughly 15 percent in 1989, the last year for which a reasonably reliable estimate of the value of land is available.

correction to the value of land reported in these accounts. We have decided, for our discussion here, to adjust the value of land in individual company records uniformly so that the ratio Land/(ARR+AF*) on average is equal to the ratio obtained from the National Accounts data. We believe that this procedure is biased in the direction of underadjustment, since the value of ARR+AF* itself is probably underestimated in the Nikkei individual company records.

Second, the depreciation rate reported in row (1) indicates that it is more than twice as high for the Nikkei file compared with the one estimated from the National Accounts. We have never been able to understand the procedure followed by the National Accounts of Japan in handling depreciation. The description of the Accounts imply that the flow of depreciation is computed on an original cost basis, while the net stock reported in the balance sheet is on a reproduction cost basis. Although this statement has never made sense to us and we have not been able to duplicate the calculations generating the net stock of capital and its depreciation. Given this statement, our figure reported in Table 3, 0.092, is presumably not the rate used to construct the accounts, because we are dividing the original cost flow by the reproduction cost stock. Nevertheless, we believe that the true depreciation rate must be closer to 10 percent than to 20 percent, since we are here dealing with both equipment and structures, and the weight of the structures appears to be more than a half[25]. Indeed, even the figure of 10% is considerably higher than the normal rate observed in most industrialized countries. Thus, the depreciation rate of 0.206 computed from the individual company records and reported in row (1) of Table 3 is clearly unreasonable, and it must lead to a serious underestimation of the net stock of capital. What happens to depreciation is not clear. If the net stock and depreciation are consistently generated from gross investment, then depreciation will be overestimated if the rate used is too high, and the degree of overestimation will depend not only on the rate used and true rate but also on the rate of growth of gross investment[26] If depreciation and net stock are not generated consistently, as seems likely with such an exceptionally high rate, then anything is possible.

Pursuing further the question of the underestimation of the net stock of capital, we observe that, according to figures reported in row (6) of Table 3, the total value of firms valued at their reproduction cost is only 64 percent of the total market value of these firms according to the Nikkei data. In this data set, we are reasonably sure that the market value of the firm is accurately measured, because we have the exact price and the number of equity shares outstanding. We can be reasonably sure, then, that in these accounting records of individual firms, the value of reproducible tangible assets is significantly undervalued even after its valuation is converted from an original cost basis to a reproduction cost basis[27].

In terms of the National Accounts data, on the other hand, the total value of the firm at its reproduction cost is 1.44 times the market value of the firm. Unfortunately, in this case we have no way of directly judging whether the market value is underestimated or the reproduction cost is overestimated. We suspect, however, that in this case both the

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[25] We do not seem to know the division of the total stock of reproducible tangible capital into equipment and structures for nonfinancial corporations, but for the country as a whole and excluding residential structures, the division is roughly 70% structures and 30% equipment. This is probably too much weighted to structures when it is applied to the private sector, since I assume that most government capital is structures. Economic Planning Agency, Annual Report on National Accounts, 1994, p.410.

[26] See equations (11) and (11a) above and the analysis following them.

[27] Note that the value of land has also been adjusted up as described in footnote 5 in Table 3.

market value of firms is underestimated, and their value at the reproduction cost somewhat overestimated. To support this suspicion, we offer an observation reported in rows (3) and (4) of Table 3, that both the dividend-price ratio and the earnings-price ratio computed from the Nikkei individual company data are approximately the same as the ones recorded and published by Tokyo Stock Exchange, while the corresponding ratios computed from the National Accounts data are almost twice as large. Since it is unlikely that dividends are badly overestimated in the National Accounts, we believe this observation strongly suggests that the market value of firms in the National Accounts is underestimated. The relative size of the debt-equity ratio, shown in row (2) of Table 3, also hints at the underestimation of the market value in the National Accounts, though this is by no means strong evidence.

To summarize, in terms of relevant features of Table 3 in evaluating our estimates of the rate of return from these sets of data, we believe that in the National Accounts, the market value of the firm is underestimated by as much as 20 or 30 percent, so that the estimate of the rate of return after the very rough inflation adjustment that we have cited at the beginning of this discussion, namely, 9 to 10 percent, is probably an overestimate and should be amended to around 8 percent. On the other hand, the estimate based on individual company records provided by Nikkei and reported in Table 1, Parts B and C, of around 5 percent is significantly underestimated because of the overestimation of depreciation, and should be amended to 6.5 to 7 percent.

This is not, however the final story in the case of the Japanese cost of capital. We must take account of the role played by the extraordinarily high price of land and steady rise of its price until 1990. We have discussed this question already in Ando and Auerbach (1990), but to appreciate the issue, consider a firm whose market value is $1 million and is operating on a piece of land purchased at $100,000.The purchase cost of land is a part of the value of the firm, and therefore, if the firm earns a return of 10 percent or $100,000 per year, then it includes the rent on the land of $10,000. Suppose now that the price of land, for reasons little to do with the firm, suddenly goes up to $500,000. If the firm is unable to raise the price of output and earn the appropriate rent on the land of $500,000, it must move to a new location, realize the capital gain and distribute it to the firm's owners. Otherwise, the new market price of the firm, namely $1.5 million, is not sustainable, unless the price of land continues to rise at approximately 10 percent per year so that the market value of the firm rises just enough to supplement the earnings of the firm and makes the total return to shareholders 10 percent on average.

If this process goes on for a long enough period of time, then the conventional adjusted accounting measure of the rate of return will underestimate the full return earned by shareholders because real capital gains on land would not be included in such a measure, while the market for shares would recognize it and price the firm accordingly. It can be sustained only if the relative price of land is expected to rise continually, and actually did so. We believe that this is the process that operated in Japan from the 1960's to 1985, accelerated dramatically in the second half of the 1980's and then crashed at the beginning of the 1990's[28].

[28] Ando and Auerbach estimated that the adjusted accounting rate of return for Japanese firms may be biased down due to the implicit real appreciation of the land value by as much as 4 percent or more between 1976 and 1988 (see Ando and Auerbach (1990), Table XI). This is probably an exaggeration because the period covered had a very strong upward trend in the real price of land. As a working hypothesis, we suggest that the bias involved may be of the order of magnitude of 2 percentage points. Although the market measure of the rate of return should reflect the unrealized capital gains on land and

Looking at the pattern of prices and rate of return in Japan immediately following the return of stability in prices in 1994 and 1995, the price of land and other associated prices do not seem to be low enough to be sustainable unless at least a moderate and steady real capital gain in land resumes, but we see no logical reasons why such steady capital gain should resume in Japan. We may hasten to add that the period after the bubble and its burst has been quite short, and the market for land and the market for equity do not seem to have recovered their equilibria, so that it is extremely difficult to interpret the pattern of prices at this time.

We must conclude this long inquiry with less than a fully satisfactory assessment of the cost of capital in the United States, Japan and Canada. In the United States, the cost of capital measured as the total return on capital before tax and after depreciation has been a little more than 10 percent during most of the period since 1955. Though it does fluctuate substantially over time, it does not show any tendency to move up or down persistently. The order of magnitude cited above emerges whether we use individual company data collected in the COMPUSTAT tapes or macro data from the National Income and Product Accounts, and whether we use the adjusted accounting measure or the market measure.

For Canada, we are unable to use individual company data, since the number of companies for which data are available is too small and the period covered by the data is too short to generate reliable estimates. Based on National Accounts data supplemented by unpublished information supplied by Statistics Canada, we estimate that the cost of capital in Canada appears to be a little lower than that for the United States. Given that we had to make a number of approximations as discussed in the Appendix, it is probably best to conclude that there is no ground to believe the cost of capital in Canada is significantly higher than that in the United States.

The Japanese case is the most complicated, primarily because the pattern of results generated by individual company data and the pattern generated by National Accounts data are apparently inconsistent. After a lengthy review and reasoning which rely on a number of pieces of indirect evidence and on assumptions that are somewhat stronger than we would prefer to use, we have concluded that the cost of capital in Japan is somewhat lower than that in the United States, although not by a very large margin. Furthermore, we have argued that this lower cost of capital was probably generated by a very high and continually rising price of land. If we are right in this hypothesis, only those firms which acquired land before the rapid rise in the real price of land had began were able take advantage of the lower cost of capital. Finally, again if we are right in this hypothesis, the current price of land, and hence the current level of equity value, do not appear to be sustainable unless a moderate but persistently rising trend in the real price of land resumes in Japan.

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therefore should not be biased due to this problem, it is hard to design a reasonable way to handle the dramatic large negative returns suffered by equity shareholders in early 1990's, and we will leave the analysis of this problem for a later occasion when we will have seen the final outcome for the pattern of the Japanese land price and of the equity value after the bubble and its burst.

To complete our presentation, in Figures 3.1 through 3.4, we exhibit comparison of the rate of return in terms of various measures for the three countries, all based on individual company data. All reservations concerning the reliability of these estimates discussed above apply to these graphs. The adjusted accounting measures before and after tax show the similar pattern, in which the Canadian rate of return is slightly higher than that for the U.S., while the Japanese rate of return is much lower than the other two countries. We should recall, however, that in terms of these measures computed form the aggregate National Accounts data, the U.S. rate remains unchanged, while the Canadian rate becomes slightly less than the U.S. rate, and the Japanese rate becomes significantly higher than the U.S. rate.

The market rate of return is too volatile to allow us to make a detailed comparison even when they are smoothed by moving averaging. For the market rate, we believe that the only comparison possible is in terms of the averages over the entire period, as reported in Table 1.C.

We believe that these alternative measures of the rate of return do not change our main conclusion based on the adjusted accounting rate of return before tax, namely, that the Canadian Rate of return has been about the same as that for the U.S. between 1962 to 1994, while not much can be concluded about the Japanese rate of return until the rate of return based on individual company data and the one based on aggregate National Account data are reconciled for Japan.

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Table 1.
Average Rate of Return
A.
Accounting Returns,
Unadjusted

USA

Based on Individual Company Data

Period	E/P	R/K After Tax, Taxed Bonds	R/K Before Tax
(1) 1956~94	0.083	0.070	0.125
(2) 1967~94	0.091	0.076	0.135
(3) 1976~93	0.099	0.083	0.146

JAPAN

Based on Individual Company Data

(2)* 1967~94	0.051	0.042	0.077
(2a) 1967~83	0.065	0.053	0.093
(2b) 1985~94	0.028	0.024	0.050
(4a) 1985~89	0.032	0.027	0.057
(4b) 1990~94	0.024	0.021	0.044

CANADA

Based on Individual Company Data

(3) 1976~93	0.167	0.124	0.179

* 1984 is missing from averages reported in this row

Table 1.
Average Rate of Return
B.
Accounting Returns,
Adjusted

USA

Based on Individual Company Data

Period	E/P	R/K After Tax, Taxed Bonds	R/K Before Tax
(1) 1956~94	0.085	0.054	0.109
(2) 1967~94	0.095	0.056	0.115
(3) 1976~93	0.104	0.061	0.124

Based on Aggregate National Accounts Data

(1a) 1956~93			0.109
(3a) 1976~93			0.118
(4a) 1961~93			0.114

JAPAN

Based on Individual Company Data

(2)* 1967~94	0.068	0.023	0.057
(2a) 1967~83	0.092	0.025	0.064
(2b) 1985~94	0.028	0.018	0.044
(4a) 1985~89	0.032	0.022	0.052
(4b) 1990~94	0.023	0.013	0.036

CANADA

Based on Individual Company Data

(3) 1976~93	0.163	0.093	0.147

Based on Aggregate National Accounts Data

(3a) 1976~93			0.097
(4a) 1962~94			0.092

* 1984 is missing from averages reported in this row

Table 1.
Average Rate of Return
C.
Market Return

USA

Based on Individual Company Data

Period	E/P	R/K After Tax, Taxed Bonds	R/K Before Tax
(1) 1956~94	0.080	0.053	0.109
(2) 1967~94	0.076	0.044	0.105
(3) 1976~93	0.102	0.061	0.126

JAPAN

Based on Individual Company Data

(2)* 1967~94	0.072	0.018	0.053
(2a) 1967~83	0.075	0.016	0.057
(2b) 1985~94	0.066	0.020	0.045
(4a) 1985~89	0.249	0.113	0.141
(4b) 1990~94	-0.116	-0.072	-0.051

CANADA

Based on Individual Company Data

(3) 1976~93	0.065	0.025	0.084

* 1984 is missing from averages reported in this row

Table 2.

Adjusted Accounting Rate of Return to Capital

Before Tax

Industry Breakdown

	USA		CANADA
Period / Industry	1955~94	1967~93	1967~93
Agriculture and Primary Industries	0.102	0.101	0.118
Manufacturing and Construction	0.118	0.137	0.119
Transportation and Public Utilities	0.091	0.101	0.212
Trade	0.111	0.126	0.150
Services and Public Administration	0.108	0.122	0.042

Table 3

Some Critical Ratios for Japanese Data Computed from National Accounts and Individual Company Data, Nikkei, Averaged over period 1985-1993

	National Accounts	Nikkei	TSE\1st Division
(1) Depreciation Rate[29]	.092	.206	
(2) Debt/Equity[30]	1.541	.918	
(3) Dividend/Price	.013	.008	.007
(4) Earnings/Price[31]	.043	.023	.021
(5) Land/ARR+AF*[32]	.520	.120	
(6) (NWR*+LF*)/(NWM+LF*)[33]	1.440	.640	

[29] For the National Accounts, it is computed as a simple ratio of depreciation to the net stock. For Nikkei, it is computed with adjustments to correct for the inflation biases. Note however that the inflation adjustments correct the net stock and depreciation of capital of the same vintage by the same proportion, so that the depreciation rate is not much affected, though the amount of depreciation is.

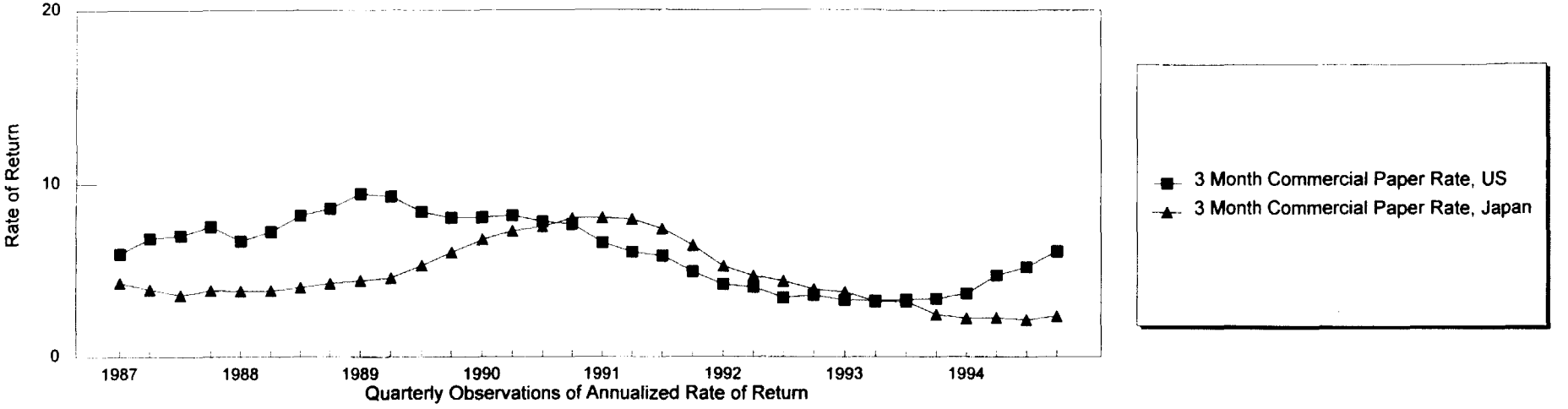
[30] In both cases, debts exclude trade debts

[31] For the National Accounts, earnings are computed as the sum of dividends and retained earnings after tax ("saving"). For Nikkei, it is adjusted for inflation biases.

[32] ARR and AF* are defined just above equation (9) in the text. Note that this sum excludes the value of land.

[33] NWM is the market value of equity, LF* is total financial liability excluding trade debts, and NWR is net worth at "reproduction cost" defined by equation (9). NWR* is equal to NWR for the National Accounts. For Nikkei, NWR* is equal to NWR except that the value of land is adjusted so that the ratio of its value to ARR is equal to the ratio found in the National Accounts

Figure 1: Three Month Commercial Paper Rates in US and Japan



Three Month Commercial Paper Rates in Japan

With Exchange Rate Effects (Expected and Actual)

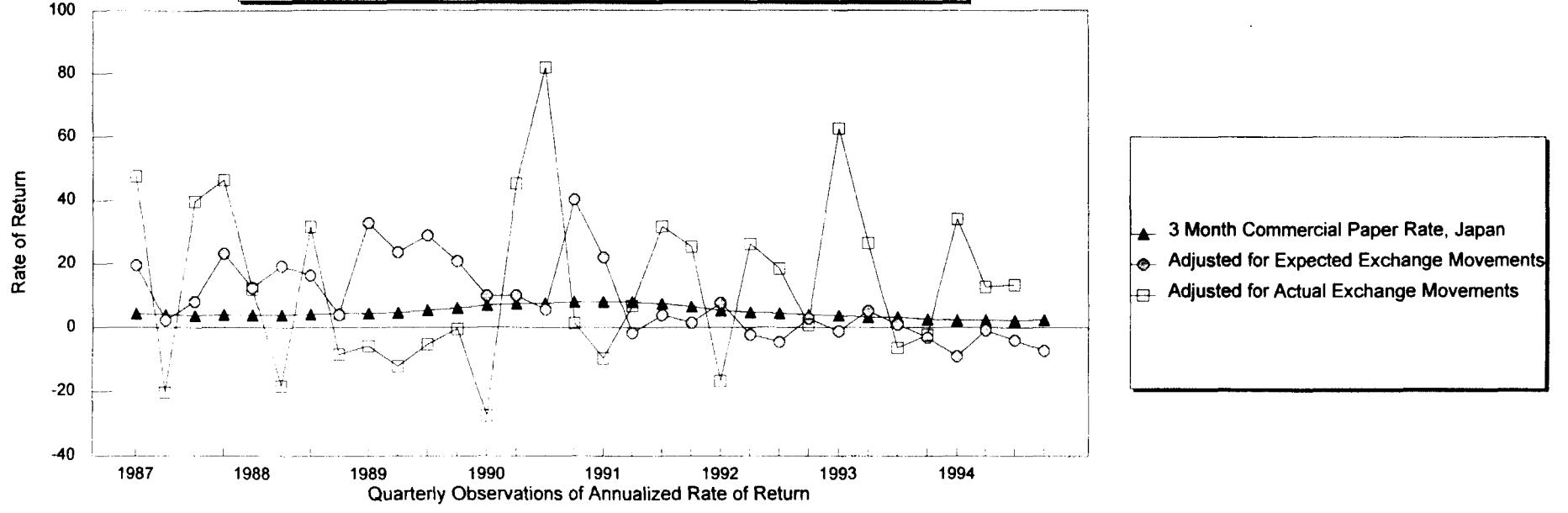


Figure 2.1: Adjusted Accounting R/K Before Tax, US

Comparison of National Accounts and Individual Company Data

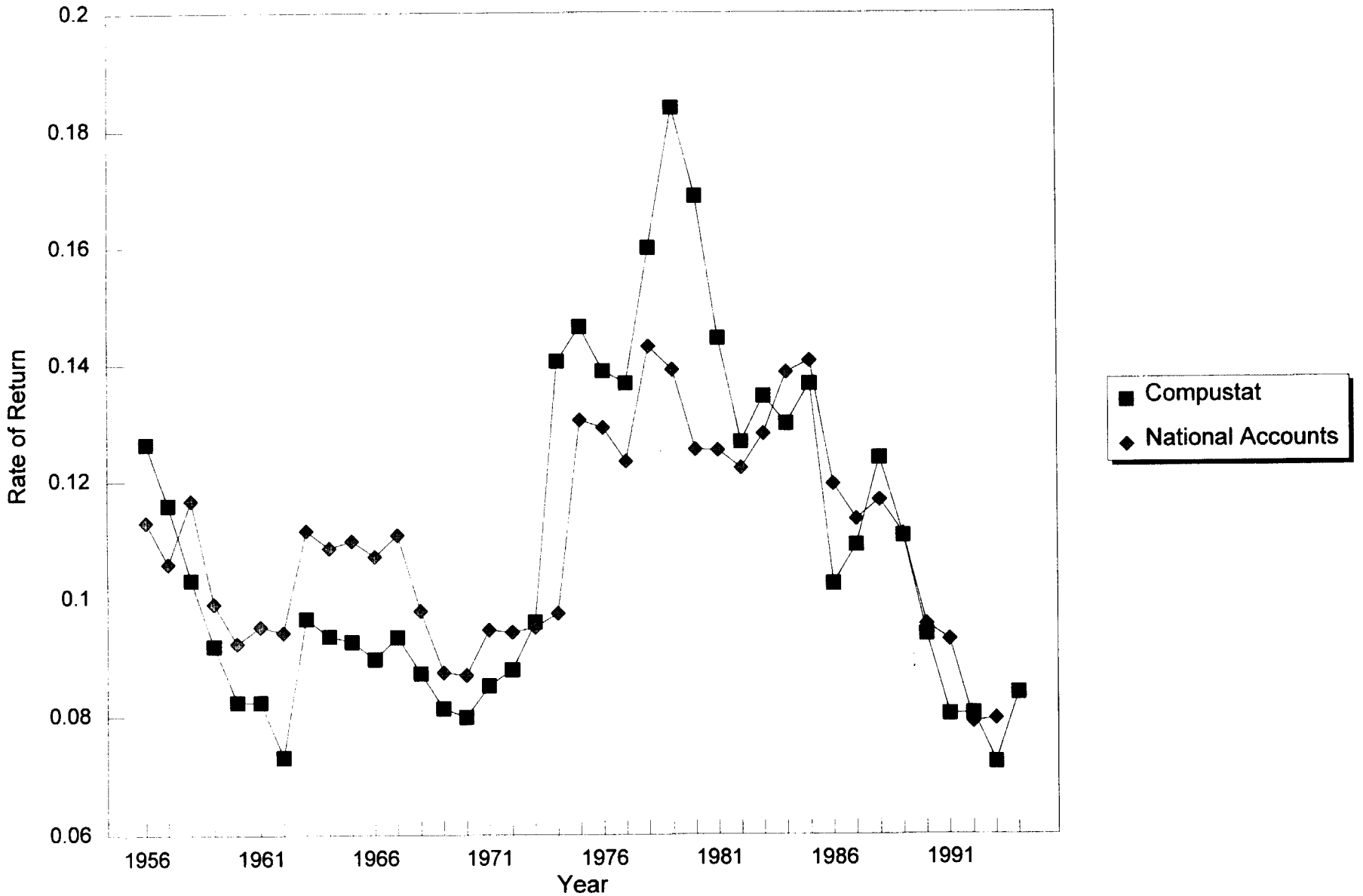


Figure 2.2: Before Tax Accounting R/K,Canada

Comparison of National Accounts and Individual Company Data

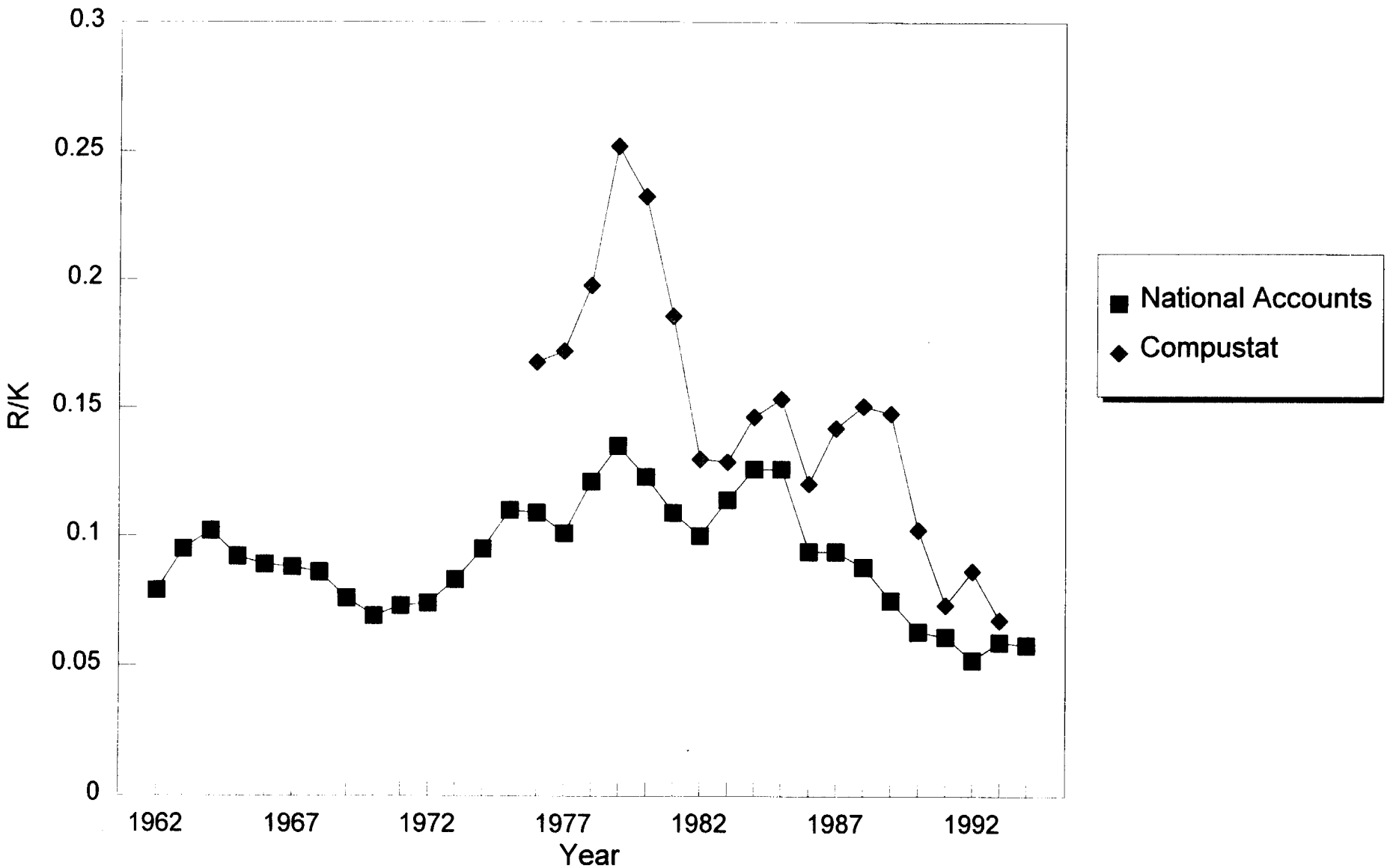


Figure 2.3: Before Tax Accounting R/K

Calculated from National Accounts Data

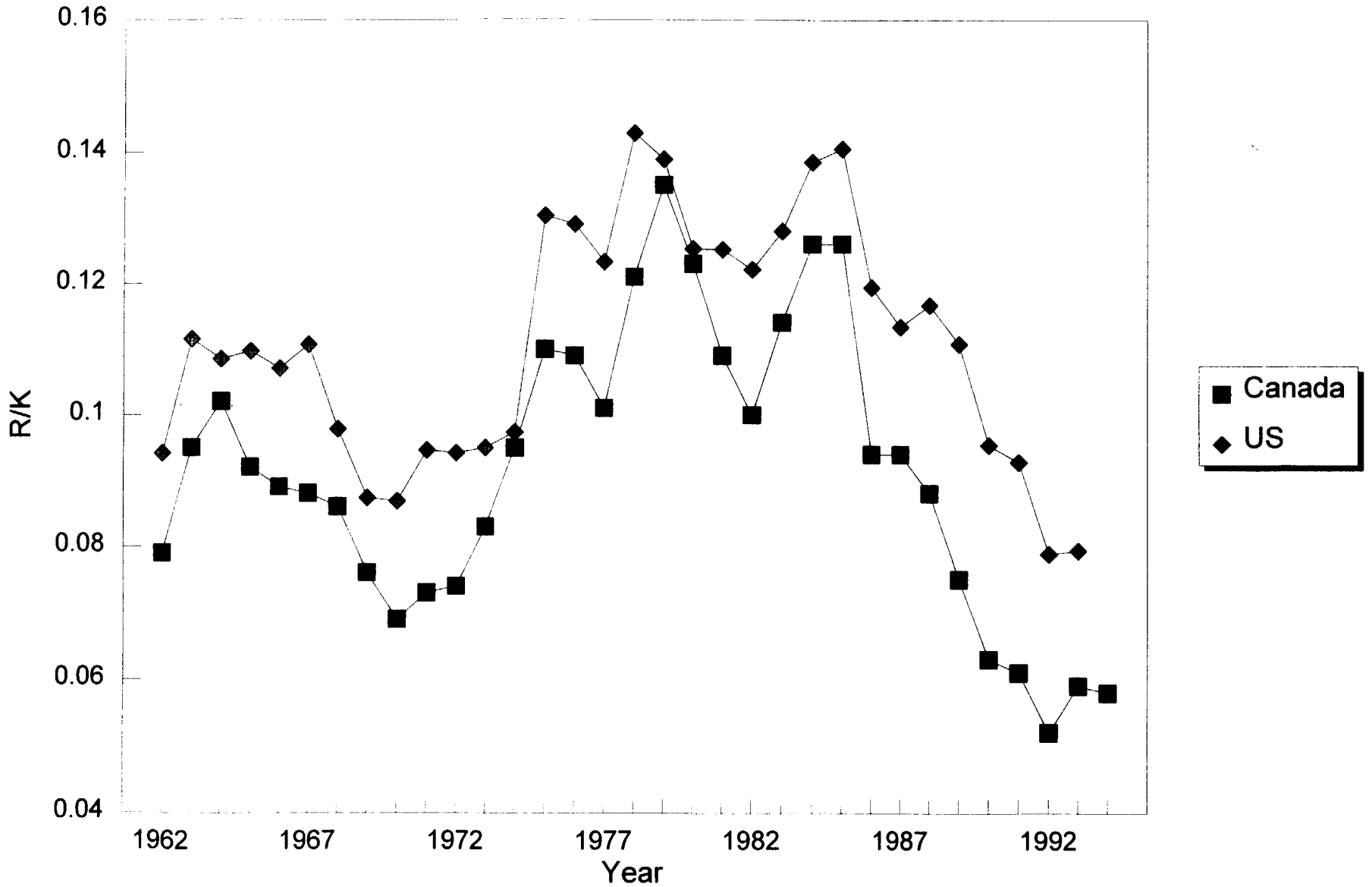


Figure 2.4: Adjusted Accounting R/K Before Tax, Japan

Comparison of National Accounts and Individual Company Data

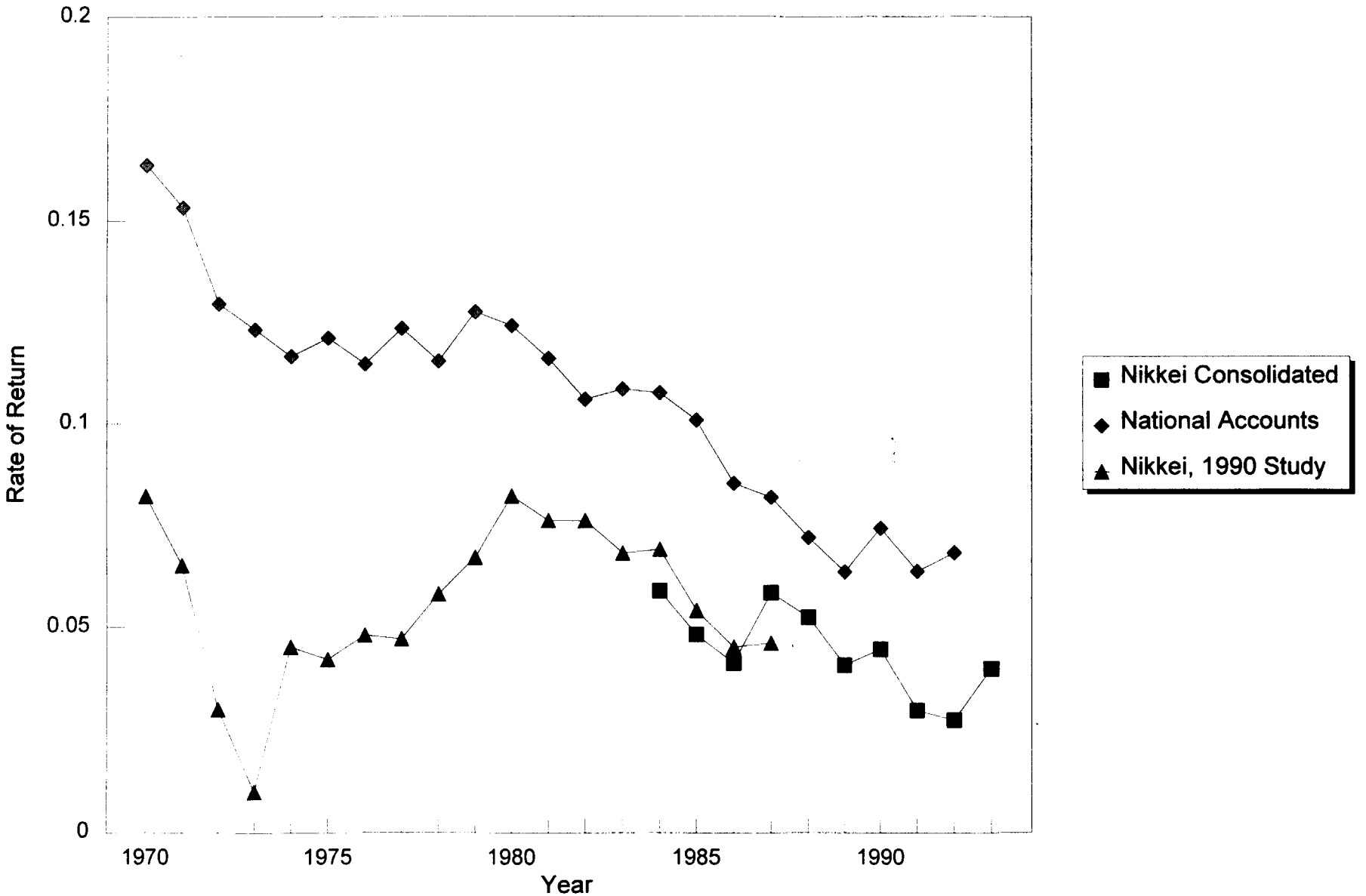


Figure 3.1: Adjusted Accounting R/K Before Tax

Individual Company Data

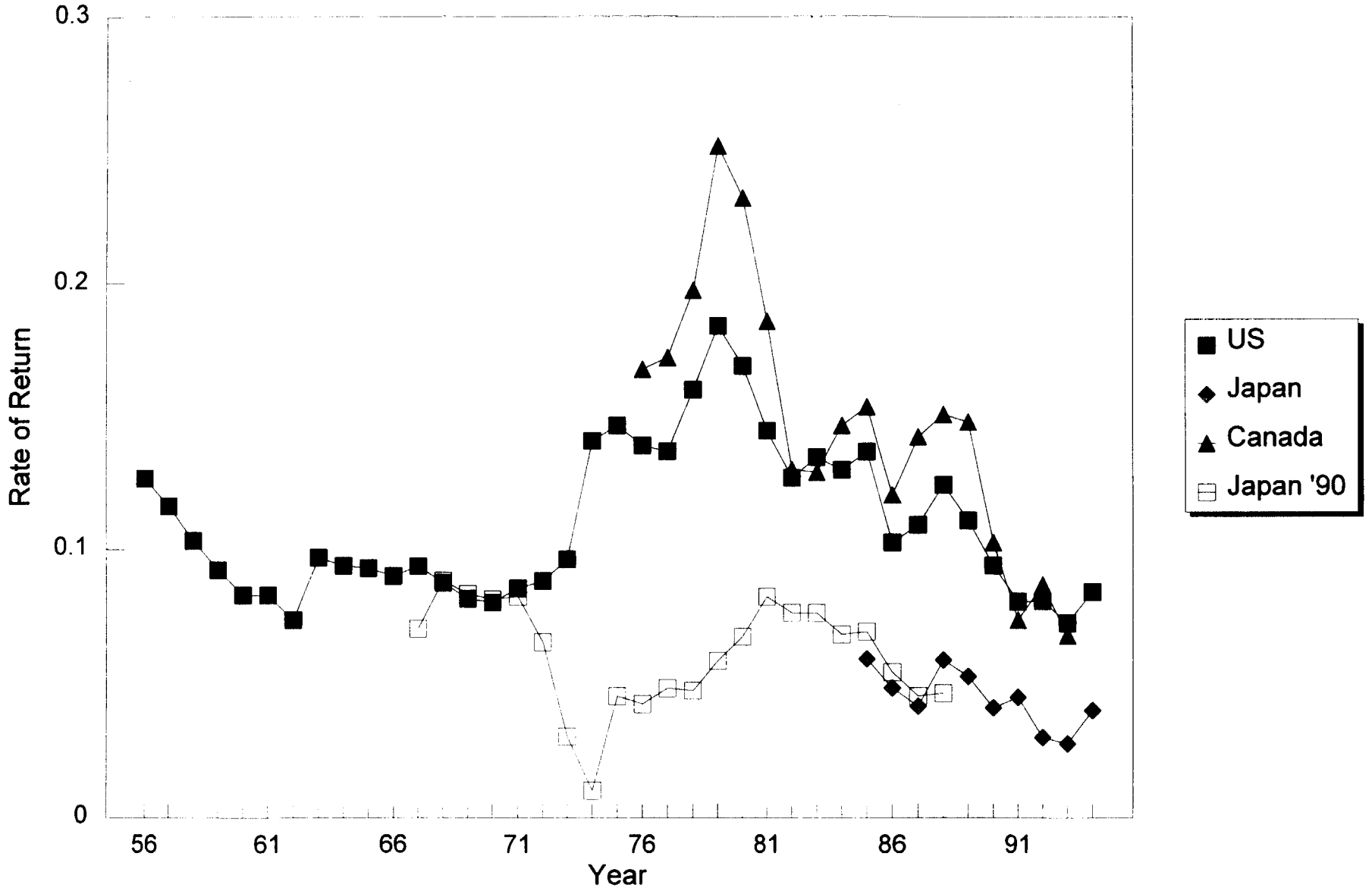


Figure 3.2: Adjusted Accounting R/K After Tax

Taxed Bond, Individual Company Data

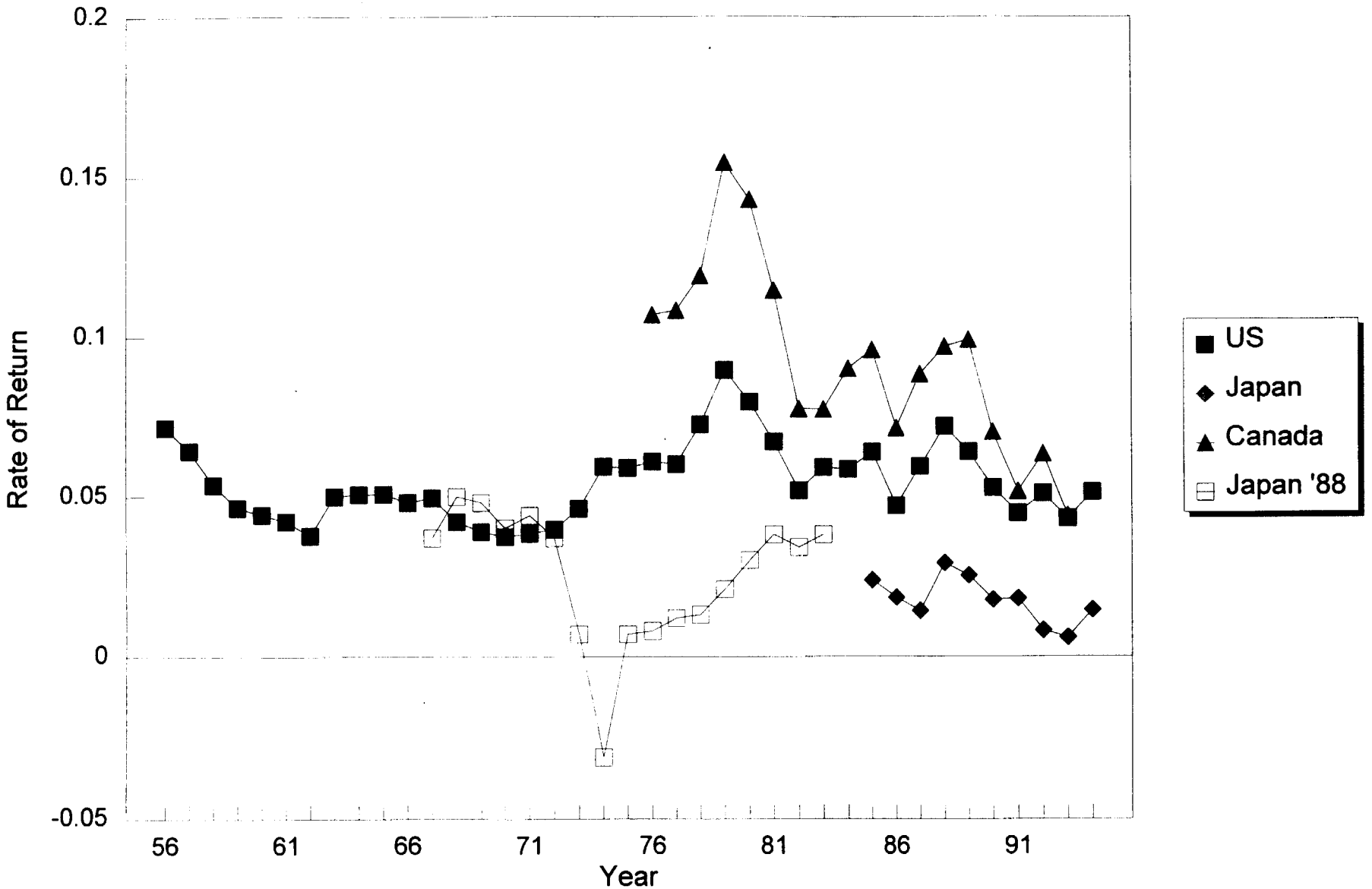


Figure 3.3: Market R/K Before Tax

5 Year Moving Average, Individual Company Data

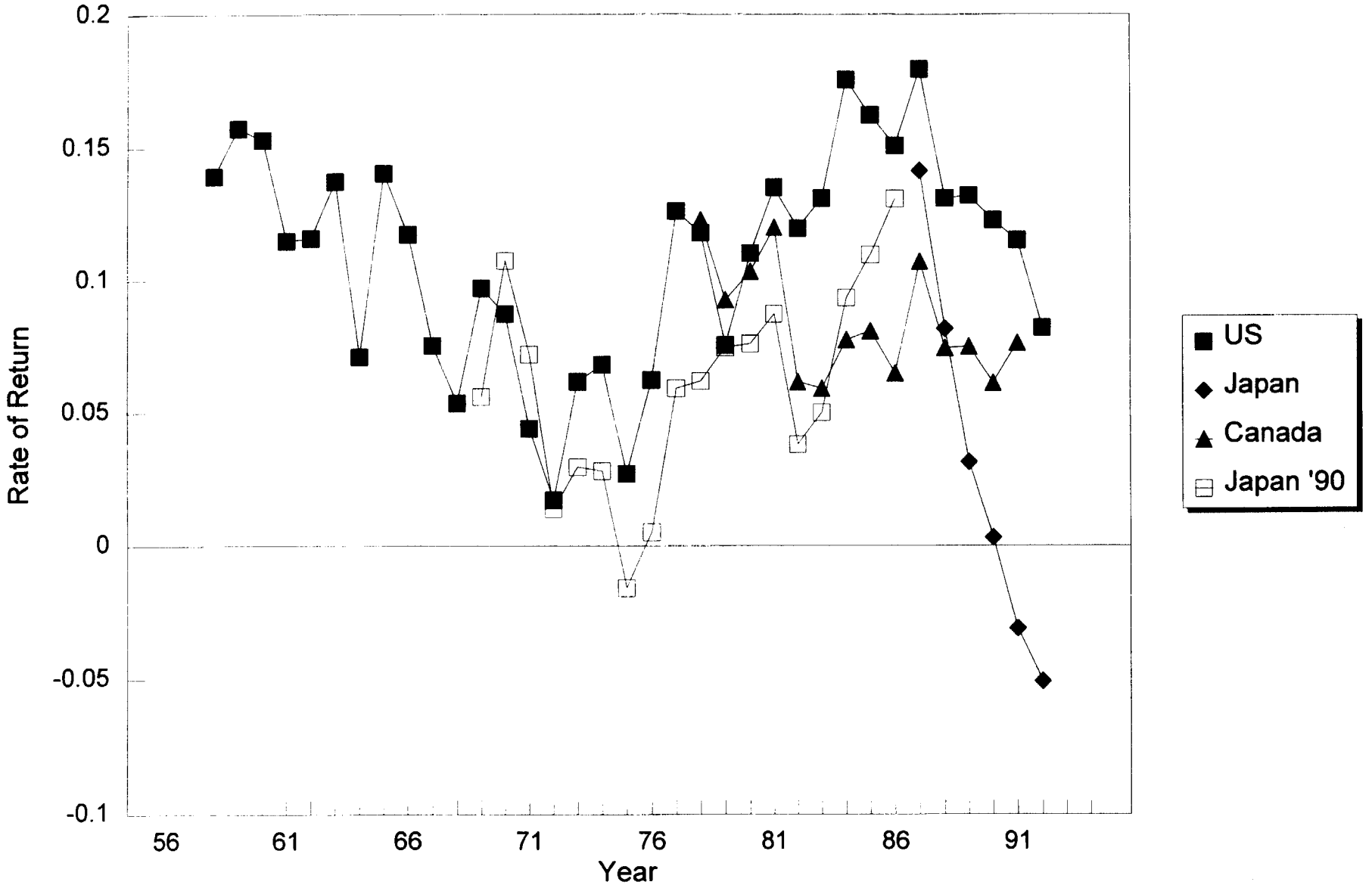


Figure 3.4: Market R/K After Tax

Taxed Bond - 5 Year Moving Average, Individual Company Data

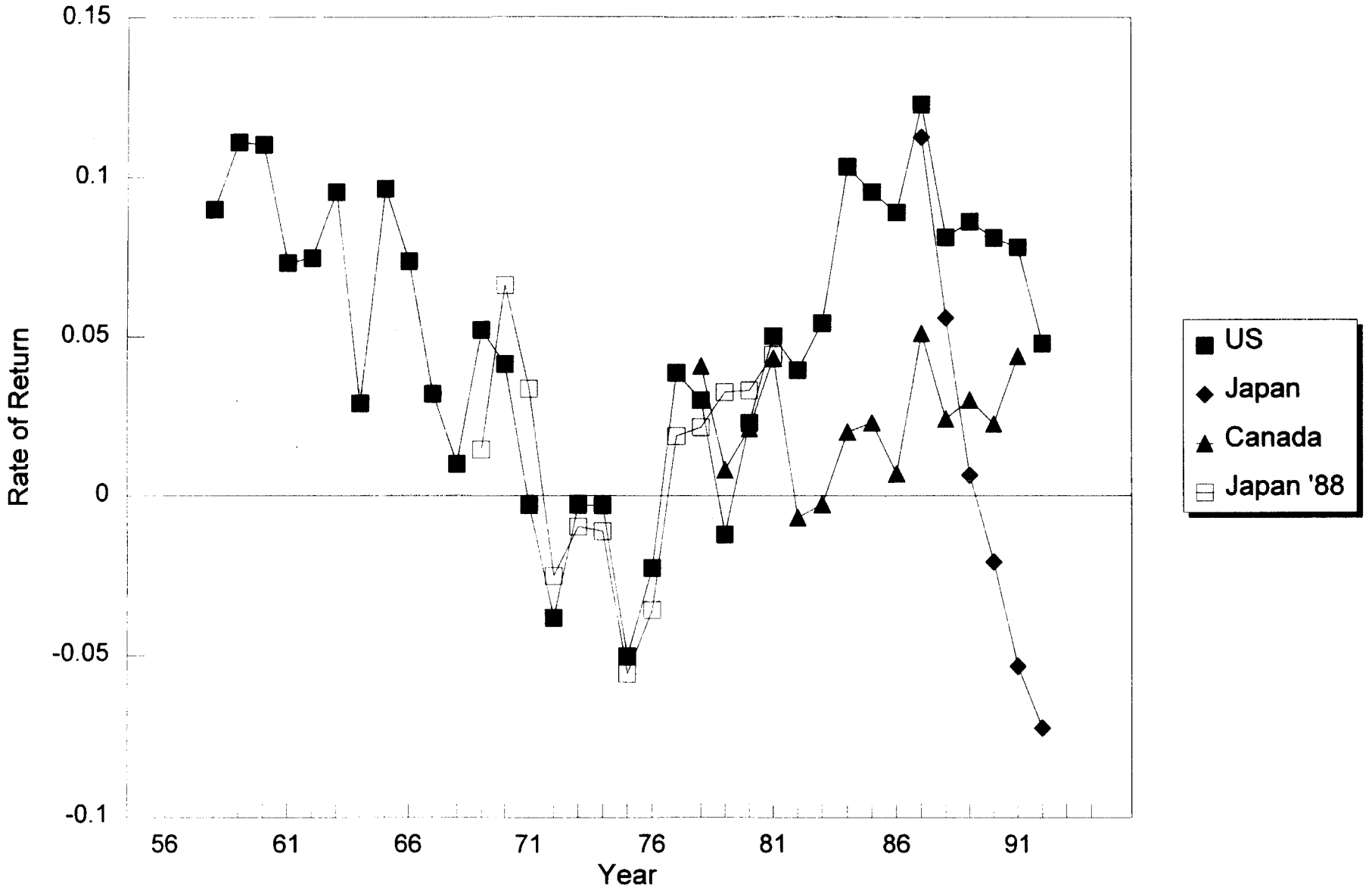


Figure 4: Adjusted Accounting R/K Before Tax, Canada

Cross Listed vs. Not Cross Listed