The Erosion of GIC Returns by Income Taxes and Inflation

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PRÉCIS

Les investisseurs canadiens détiennent actuellement environ 247 milliards de dollars en certificats de placement garantis (CPG), et un peu plus des deux tiers des CPG personnels sont détenus à l'extérieur de comptes d'impôt différé. Une récente étude conclut que le taux de rendement réel (après inflation) des CPG a été constamment positif pendant plus de vingt ans et que, par conséquent, les CPG offrent aux investisseurs une plus grande certitude quant à leur pouvoir d'achat futur que les produits de placement soumis aux aléas du marché boursier. L'étude ne tient cependant pas compte de l'imposition annuelle du revenu d'intérêt couru sur les CPG détenus à l'extérieur de comptes enregistrés.

L'étude utilise un algorithme pour calculer les rendements réels (après inflation) après impôt de CPG d'une durée d'un an, de trois ans et de cinq ans pour la période 1974-2003. Dans notre analyse, nous avons supposé qu'à l'échéance, ces CPG étaient renouvelés dans de nouveaux CPG d'une durée identique et portant intérêt à un taux fondé sur le taux moyen (historique) du marché pratiqué par les grandes banques et sociétés de fiducie dans l'année du transfert. Nous montrons que les rendements réels annualisés après impôt ont été négatifs pour les investisseurs ontariens se situant dans la fourchette d'impôt marginal le plus élevé des particuliers pour la majeure partie de la période couverte par l'étude. Par exemple, un investisseur dont le taux marginal d'impôt des particuliers dépassait 35,5 % tirait, en moyenne, un rendement réel après impôt annuel négatif de CPG d'une durée d'un an renouvelé de façon continue entre 1974 et 2003. Pour les CPG d'une durée de trois et à cinq ans, le taux d'impôt critique était légèrement supérieur, à savoir 42,06 %. Même lorsqu'il était positif, le rendement réel après impôt dépassait rarement 1 %. Du point de vue des investisseurs individuels, ces résultats montrent l'importance de regarder au-delà des taux officiels offerts pour les CPG pour voir comment le sacrifice consenti actuellement par l'investisseur en terme de consommation est récompensé en dollars consommables futurs.

ABSTRACT

Canadian investors currently hold approximately $247 billion in guaranteed investment certificates (GICs) , and a little over two-thirds of personal GICs are held outside tax-deferral

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accounts. A widely held perception exists that the real (after-inflation) rate of return on GICs has been consistently positive over a two-decade period, and therefore GICs provide investors with more assurance of future purchasing power than investment products subject to the uncertainties of the stock market. However, common wisdom fails to take into account the annual taxation of accrued interest income on GICs held outside registered accounts.

This study computes the real (after-inflation) after-tax returns (RATs) on one-year, three-year, and five-year GICs during the period 1974-2003. In our analysis, we assume that on maturity these GICs were rolled over into new GICs with an identical term and an interest rate based on the (historical) average market rate quoted by the major banks and trust companies in the year of the rollover. We show that annualized RATs have been negative for Ontario investors in the top marginal personal tax bracket for most of the study period. For example, any investor whose marginal personal tax rate exceeded 35.5 percent earned, on average, a negative annual RAT from one-year GICs rolled over continuously from 1974-2003. For three-year and five-year GICs, the breakeven tax rate was slightly higher at 42.06 percent. Even when positive, RATs rarely exceeded 1 percent. From the viewpoint of individual investors, these results demonstrate the importance of looking beyond the quoted rates for GICs to determine the reward in future consumable dollars for the investor's current consumption sacrifice.

KEYWORDS: INFLATION ■ INDEXING ■ INTEREST INCOME

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INTRODUCTION

Guaranteed investment certificates (GICs) have long been, and are expected to remain, a sizable component of Canadian investment in fixed-income instruments.[1] GICs and other fixed-term deposits are held both within and outside tax-deferral

1 Fixed-income investment accounted for $494 billion (31 percent) of the total asset pool of $1,594 billion in 2000. It is expected to double to $988 billion in 2010 (though that figure represents only 23 percent of an estimated total asset pool of $4,295 billion in that year). See the presentation by Gerry McCaughey at the CIBC Wealth Management Luncheon, Toronto, June 27, 2001, 2-3 (available online at http://www2.cibc.com/download/WM_June_Lunch_HO.pdf).

accounts such as registered retirement savings plans (RRSPs) and registered education savings plans (RESPs). As of March 31, 2004, investors held $247 billion in personal GICs, of which $164.2 billion (or 66.5 percent) was held in non-registered accounts.[2] Therefore, the taxation of interest income from GICs and the effects of inflation on the future purchasing power of the invested funds are of interest to a majority of GIC investors.

A recent study by O'Neill[3] computed the real (after-inflation) rates of return on term deposits and GICs of one financial institution since 1971 and concluded that fixed-term investments have produced positive real returns since 1979. O'Neill argues that GICs preserve purchasing power over long horizons and are therefore safe, relative to mutual funds and similar products that are exposed to the vagaries of the stock market. However, O'Neill's study fails to take into account the annual taxation of accrued interest income earned on GICs held outside tax shelters.

Mintz[4] has pointed out that even at an inflation rate of 2 percent, a taxpayer in a 30 percent tax bracket earning 4 percent on a GIC ends up paying double that rate on the real or inflation-adjusted return. As Mintz explains, the tax liability is 1.2 percentage points (30%*4%) and the real return is 2 percent (4% - 2%), thereby making the effective tax rate equal to 60 percent (1.2%/2%).[5]

Investors in mutual funds are also susceptible to erosion of the nominal return on their investment through taxation of distributions from the fund. In a study documenting the impact of taxes on returns and rankings of Canadian mutual funds, Mawani, Milevsky, and Panyagometh[6] show that an investor at the highest marginal personal tax rate lost approximately 135 basis points to taxes on fund distributions from the average annual pre-tax return of 9.01 percent. However, by varying distribution policies, fund management could influence (the present value of) the tax liability, and thus the after-tax return, of the unitholder.[7] Thus, mutual funds have a competitive advantage over GICs, which have no means of offsetting the investor's tax cost and must compete solely on the basis of pre-tax nominal returns.

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2 See "Total All Banks, Consolidated Monthly Balance Sheet as at March 31, 2004," published on the Office of the Superintendent of Financial Institutions Web site at http://www.osfi-bsif.gc.ca/eng/institutions/banks/financial/index.asp.

3 Tim O'Neill, "BMO Term Investments Have Consistently Beat Inflation in the Last Two Decades," *BMO Financial Group Commentary*, December 10, 2003.

4 Jack Mintz, "When Bigger's Not Better," *National Post*, February 21, 2004.

5 Lochan has addressed a similar concern about the erosion of income through capital gains taxation of the inflation component of gains. Frank Lochan, "Should Inflation Be a Factor in Computing Taxable Capital Gains in Canada?" (2002) vol. 50, no. 5 *Canadian Tax Journal* 1833-67.

6 Amin Mawani, Moshe Milevsky, and Kamphol Panyagometh, "The Impact of Personal Income Taxes on Returns and Rankings of Canadian Equity Mutual Funds" (2003) vol. 51, no. 2 *Canadian Tax Journal* 863-901.

7 The average absolute value of the difference between pre-tax rankings and pre-liquidation after-tax rankings caused by mutual fund distributions was 28. In other words, the average fund moved 28 places higher or lower in a ranked list of the 343 funds in the study.

As we show in this article, the combined effects of annual taxation of accrued interest and annual inflation can erode most of the pre-tax nominal returns from GICs. Income taxes are imposed on accrued nominal interest income, and the entire impact of inflation is borne by the after-tax return. For example, if a one-year GIC offered a nominal return of 5 percent, an investor with a 40 percent marginal personal tax rate would earn an after-tax return of 3 percent ((1 - 0.40)*5%). If inflation was 1.2 percent during that year, the net return would be 1.8 percent (3% - 1.2%). In our study, we refer to this amount as the real after-tax return (RAT). The calculation of RAT is more complex when the investment has a longer time horizon and the GIC is rolled over for one or more successive terms on maturity. We illustrate the detailed mechanics of this calculation in a later section of the article.

The objective of this study is twofold. First, we develop and explain the algorithm for computing the RAT from a GIC of any maturity based on the assumption (consistent with current Canadian tax law) that accrued interest is taxed annually. Our algorithm illustrates the importance of first deducting income taxes from nominal returns and only afterward adjusting for inflation. Second, using historical data on GIC rates, income tax rates, and inflation, we apply this algorithm to a hypothetical case in which an investor purchases, and then rolls over, one-year, three-year, and five-year GICs over a 30-year period (1974-2003). We assume that the three-year and five-year GICs are "compounding" or "compound interest" GICs—that is, all interest income earned in the year is reinvested in the GIC and is paid out only on maturity or ultimate liquidation of the investment. In our hypothetical case, on the rollover of the GIC, the investor reinvests both the principal amount and all interest accrued to maturity. Our calculations demonstrate that a surprisingly large number of returns on these so-called risk-free investments are actually negative when measured properly. Our results contradict the positive and reassuring message conveyed by the O'Neill study. We show that, on the contrary, nominal safety can produce real erosion once returns are computed to account for both income taxes and the effects of inflation.

The article is organized as follows. In the next section, we review changes in the legislation governing the taxation of interest income over the study period, indicating how those changes affect our analysis. After briefly describing our sources for historical data on GIC returns, tax rates, and inflation, we illustrate the mechanics of computing a RAT for any fixed-income product that is taxed annually on its accrued interest. Then we present and discuss the results of applying the algorithm to the hypothetical case described above. The article concludes with a summary of our findings.

EFFECT OF CHANGES IN THE TAX RULES

As indicated above, the rules for taxing interest income earned on compound interest GICs changed over the study period. This section summarizes these changes and explains how we take them into account in calculating the effects of taxation on GIC returns.

Before November 12, 1981, interest income earned on GICs could be reported on a cash,[8] a receivable,[9] or an accrual[10] basis, as long as the reporting method was applied consistently for all debt instruments from a particular source. The cash reporting option offered taxpayers a deferral opportunity. The November 1981 federal budget introduced a new rule requiring interest income to be reported every three years, effective January 1, 1983, thereby reducing (though not eliminating) the deferral previously available. This three-year rule was intended to restore equity and neutrality, and to curtail certain abuses, such as stripped bonds.[11] Taxpayers were required to include in income any unreported interest income accrued after December 31, 1981 on each third anniversary of the debt contract.[12] Generally, the third anniversary for the first reporting period was deemed to be December 31 of the third taxation year following the year in which the debt obligation was acquired;[13] however, for debt instruments acquired before 1982, it was deemed to be December 31, 1987.[14] An exception to the three-year rule was provided for interest income earned on specific debt instruments, which could be reported on an accrual basis provided that the taxpayer filed an irrevocable election applicable to all subsequent years.[15]

The new reporting requirement resulted in a number of disadvantages for tax-paying GIC investors. For example, recognizing interest income every three years for GICs with a five-year term could be detrimental to the extent that a portion of the aggregate income could be taxed at a higher marginal rate. In addition, the $1,000 deduction against investment income,[16] which could be claimed annually, might not be fully used if interest income was reported only every three years. However, there were also offsetting benefits, including a three-year deferral of tax and potential preservation of the annual personal exemption in the intervening two

8 Paragraph 12(1)(c) of the Income Tax Act, RSC 1985, c. 1 (5th Supp.), as amended (herein referred to as "the Act"). Unless otherwise stated, statutory references in this article are to the Act.

9 Ibid. To use the receivable basis for reporting of interest income, the investor must have the right to require payment of that income. In the tax context, "receivable" means legally receivable; "receivable" in the accounting sense is much more broadly defined.

10 *Interpretation Bulletin* IT-396R, "Interest Income," May 29, 1984, paragraphs 1 and 5.

11 A stripped bond does not have periodic coupon payments over the term of the bond; instead, both principal and interest are paid at the maturity date.

12 Subsection 12(4), as it applied for taxation years commencing after 1982; subsequently amended for investments acquired after 1989.

13 Paragraph 12(11)(b), as it applied for taxation years commencing after 1982; subsequently amended for investments acquired after 1989.

14 Ibid.

15 Subsection 12(8), as it applied for 1985 and subsequent years, until its repeal in 1990.

16 This deduction, provided in former section 110.1, was available from 1975 until its repeal in 1987. For further discussion, see Lawrence I. Gould and Stanley N. Laiken, "Effects of the Investment Income Deduction on Investment Returns" (1982) vol. 30, no. 2 *Canadian Tax Journal* 228-39.

years for low-income taxpayers (who could include children under family income-splitting arrangements, for example).[17] The net costs and benefits are difficult to generalize, since individual taxpayers could reduce their tax liability through various tax-planning schemes, such as spreading income over several years or concentrating income in a specific year (to utilize tax credits or to offset low employment income, for example).[18]

In our analysis below, we assume that interest income earned on compound interest GICs held on December 31, 1982 is first taxed on December 31, 1987, and every three years thereafter. We also show the effects of reporting accrued interest income annually for GICs of all maturities (as required under current law, discussed immediately below). Annual reporting may be more realistic for small investors and (until 1987) advantageous for investors who did not otherwise fully utilize the $1,000 annual investment income deduction. In our analysis, we assume that the investor has in fact claimed the deduction against other investment income in all taxation years from 1975 to 1987, so that his GIC interest income is fully taxable.

The rules were changed again in the April 26, 1989 federal budget to require accrued interest income to be reported annually instead of every three years. Taxpayers were given until December 31, 1989 to invest in compound interest GICs that would continue to be subject to the three-year accrual rules rather than annual taxation. Apart from that exception, since January 1, 1990, accrued interest income on compound interest instruments such as GICs has been taxed annually, and issuers have been required to report the annual accrued interest on T5 information slips.

In our study, both the three-year and the five-year GICs held in 1989 mature at the end of that year; therefore, interest income on GICs purchased or rolled over on or after January 1, 1990 is considered to be taxed on December 31, 1990 and every December 31 thereafter.

Generally, in respect of rollovers of GICs of all maturities, we assume that our hypothetical taxpayer defers the tax reporting of interest income until the latest possible date for that particular product under the tax rules in effect at the time.

Accrual-based taxation has also been experimented with for other types of economic income. In 1984, Canada introduced elective accrual-based taxation of capital gains and losses earned on publicly listed common shares of Canadian corporations. These indexed security investment plans (ISIPs) required taxpayers to report annually the accrued appreciation or decline in value, net of an adjustment for inflation, of the security's cost basis.[19] The implementation was not entirely smooth, and ISIPs were revoked in 1985 with the introduction of the lifetime capital gains exemption.

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17 Annual recognition of interest income could have led to loss of the personal exemption in all three years.

18 The implications of the three-year reporting rule and the related planning opportunities are discussed in Robert E. Beam and Karen Wensley, "Recognition of Interest Income by Individuals—The New Complexity," Personal Tax Planning feature (1985) vol. 33, no. 1 *Canadian Tax Journal* 134-49.

19 Deloitte Haskins & Sells, *Indexed Security Investment Plans* (Toronto: Deloitte Haskins & Sells, 1984).

DATA SOURCES

For this study, we required historical data on GIC, income tax, and inflation rates from 1974 to 2003. Our sources are described below, with a brief explanation of how we use the data.

GIC Rates

We obtained rates for GICs with one-year, three-year, and five-year terms from Statistics Canada.[20] Arithmetic averages of the corresponding one-year and five-year rates were used to estimate three-year GIC rates for years in which the three-year numbers were missing.

For rollovers of three-year and five-year GICs, we use the rate for the rollover year. For example, if a five-year GIC is initially purchased in early January 1984 and rolled over in early January 1989, we use the 1989 market average rate for the next five-year term. All investments are assumed to begin in 1974, thereby allowing the final rolled-over GIC to mature in 2003 for all three categories (one-year, three-year, and five-year term).

In order to demonstrate the eroding effect of taxes and inflation for investments with an extended time horizon, rollovers of one-year and five-year GICs are simulated over 10-, 20-, and 30-year periods. For the three-year GIC, rollovers are simulated over 9-, 21-, and 30-year periods. (Time horizons must be evenly divisible by the term of the investment.)

Income Tax Rates

Historical combined (federal and Ontario) top marginal personal tax rates and the historical upper and lower bounds of income tax brackets were obtained from annual issues of *The National Finances* (1974-1994)[21] and *Finances of the Nation* (1995-2002).[22] We use the top marginal tax rates (confirmed with a study by Saez and Veall)[23] to calculate the annual erosion of accrued interest income by income taxes. Data on the percentage of taxpayers in the relevant tax brackets were taken from the Canada Revenue Agency's annual income statistics reports.[24]

The choice of the top marginal statutory rate could be considered unrepresentative if GICs are likely to be held disproportionately by investors in lower tax brackets, or if the top rate applied to relatively few investors before 1981 (owing to

20 Statistics Canada, CANSIM database, table 176-0043, "Financial Market Statistics."

21 *The National Finances* (Toronto: Canadian Tax Foundation, annually 1974-1994).

22 *Finances of the Nation* (Toronto: Canadian Tax Foundation, annually 1995-2002).

23 Emmanuel Saez and Michael R. Veall, *The Evolution of High Incomes in Canada, 1920-2000*, NBER Working Paper no. 9607 (Cambridge, MA: National Bureau of Economic Research, April 2003).

24 Canada Revenue Agency, *Income Statistics*, "Interim Basic Table 2A—Taxable Returns by Total Income Class" (available online at http://www.cra-arc.gc.ca/agency/stats/menu-e.html).

the more generous deferral rules in that earlier period). An alternative measure suggested by Kesselman[25] is the "mean marginal tax rate," computed by dividing the aggregate revenue from tax on interest income by the aggregate interest income reported in individual tax returns.[26] However, taxpayers in the top bracket are likely to invest at least a small component of their portfolio in GICs, for reasons of diversification alone. Furthermore, the main results of this study include the computation of a breakeven tax rate at which RATs equal zero, allowing us to report analysis that does not depend on an arbitrary choice of tax rates.

Inflation Rates

For inflation rates during the 1974-2003 period, we used federal consumer price index (CPI) data obtained from Statistics Canada[27] (also confirmed with Saez and Veall). The CPI is one of many indexes available to adjust for inflation. It tracks the change in price of a basket of goods and services that is representatively consumed on a weighted basis by Canadians. While updates are readily available with only a one-month time lag, the CPI contains some inherent biases.[28]

For example, the CPI may not fully reflect the ability of consumers to substitute cheaper goods or to switch brands, quality, or point of purchase in an inflationary environment. There is also some evidence that the CPI does not accurately represent the inflation experiences of specific demographic groups.[29] For example, the Federal Reserve Bank of New York has reported that the elderly in the United States face an inflation rate 0.2 to 0.4 percentage points per year higher than the average because of higher inflation in the health-care sector and the heavier use of health care by the elderly.[30] However, a corresponding British study found that the elderly experience below-average inflation because Britain's health-care system is funded by the state.[31] Owing to the absence of publicly available Canadian data on GIC investment by various demographic groups, we concluded that the CPI was the most appropriate index for the inflation variable in this study.

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25 Jonathan R. Kesselman, "Non-Business Deductions and Tax Expenditures in Canada: Aggregates and Distributions" (1977) vol. 25, no. 2 *Canadian Tax Journal* 160-79.

26 Available in annual issues of the Canada Revenue Agency's *Income Statistics* (formerly *Taxation Statistics*) in hard copy until 1997 and online (supra note 24) for subsequent years.

27 Available online at http://www.statcan.ca/english/Subjects/Cpi/cpi-en.htm (click on series 326-0002).

28 For a discussion of the extent of bias in the CPI, see Allan Crawford, "Measurement Biases in the Canadian CPI: An Update" [Spring 1998] *Bank of Canada Review* 39-56.

29 For some examples, see Rob Carrick, "Consumer Price Index Doesn't Reflect the World We Live In," *Globe and Mail*, May 18, 2004.

30 Bart Hobjin and David Lagakos, *Inflation Inequality in the United States*, Staff Report no. 173 (New York: Federal Reserve Bank of New York, October 2003) (available online at http://www.newyorkfed.org/research/staff_reports/sr173.pdf).

31 "Costs of Living," *The Economist*, June 5, 2004, 72.

Our choice of the federal CPI may be criticized as being inconsistent with our inclusion of Ontario tax rates in the marginal tax rate variable. However, our results do not change qualitatively when we replace the federal CPI with the Ontario CPI (available since 1978) or the Toronto CPI (available since 1974).

Another possible criticism of our use of the CPI is that an individual's decision to invest in GICs is based on anticipated inflation rates rather than actual inflation, and therefore the proper measure of net income from the investment is the *expected* real after-tax return. In our analysis, we assume that the investor's expectations are identical to the actual rate of inflation for the relevant period. This assumption avoids the necessity of adjusting for complicating factors such as the increased uncertainty about future inflation rates that occurs at higher levels of inflation.[32]

CALCULATION OF REAL AFTER-TAX RETURN

Formula

The calculation of the RAT for a fixed-income product that is taxed annually on its accrued interest is relatively straightforward. This section explains the algebraic formula for the calculation.[33] The next section presents an example of how the formula is applied, using historical data from the sources described above.

We arbitrarily start on January 1 of a particular year, i, and assume that an individual invests $1 in a GIC with a maturity of m, where m is the length of the investment period—that is, m = 1, 3, or 5 years. We denote the inflation variable by p_i, representing the value of the CPI for the particular year. We denote the highest combined marginal tax rate (federal and Ontario) for the particular year by t_i, and the quoted (nominal) interest rate on the GIC by R. Note that we allow tax rates to change from year to year, but the interest rate remains fixed since it applies for the full term of the GIC. Accrued interest is assumed to be taxed annually; hence, earned interest retained within the GIC grows at the rate $R(1 - t_i)$. *RAT* is computed using the three input variables as follows (with the symbol P denoting the multiplication operator):

$$RAT = \left(\frac{p_1}{p_{m+1}} \right) \left(\prod_{i=1}^{m} \left(1 + R(1 - t_i)\right) \right)^{1/m} - 1. \qquad (1)$$

The internal part of the expression calculates the after-tax value of the funds within the GIC to obtain the net after-tax return. The formula then adjusts this

32 See Allan Crawford and Marcel Kasumovich, *Does Inflation Uncertainty Vary with the Level of Inflation?* Working Paper 96-9 (Ottawa: Bank of Canada, August 1996).

33 The equivalence of after-tax rates of return for different forms of investment income (interest, dividends, and capital gains) across different holding periods is explained in Lawrence I. Gould and Stanley N. Laiken, "An Analysis of Multiperiod After-Tax Rates of Return on Investment" (1982) vol. 30, no. 5 *Canadian Tax Journal* 682-94.

value by the cumulative change in the CPI over the period, resulting in the amount of after-tax interest income earned net of inflation. Finally, the formula computes the mth root and subtracts 1 to arrive at the annualized rate of return.

Note that for subperiods during which interest income could be taxed on a cash or receivable basis, the variable R in equation 1 would represent a cumulative return as opposed to an annualized return.

Also note that equation 1 computes the RAT for one particular product maturity—for example, $m = 5$ years. Since, in our study, we assume that on maturity the funds are reinvested in another GIC with an identical term, the calculation is repeated and a separate RAT is computed for each successive term. For example, in the period January 1984 to December 31, 2003, there are four five-year terms; therefore, the above methodology produces four separate RATs for a rolled-over five-year GIC. The reported RAT for the period—the compound annualized RAT—would be the geometric mean of these four numbers.[34]

Equation 1 demonstrates the risk in committing to a long-term GIC. At the time a particular interest rate is locked in, future income tax and inflation rates are unknown. This uncertainty creates the potential for loss in future purchasing power if either inflation or income taxes are higher than anticipated. One way to interpret our results is that investors are compensated for this risk—albeit minimally—as evidenced by the higher RATs for longer-term GICs, which we document below (see "Real After-Tax Returns on GICs, 1974-2003").

In computing the RAT for a one-year GIC, equation 1 is reduced to the simpler

$$RAT = \frac{1 + R(1 - t)}{1 + p} - 1, \qquad (2)$$

where p denotes the inflation rate for that particular year.

Application of the Formula: An Example

The following example illustrates how the RAT is calculated using the historical data shown in table 1 and based on annual taxation of accrued interest income.

Assume that on January 1, year 1, the average annual interest rate on a five-year GIC is 11 percent. A taxable individual who invests $1 in the GIC on that date accumulates a nominal return (before taxes and inflation) of $\$1(1 + 0.11)^5 = \$1.685$ by the end of the day on December 31, year 5. Note that this amount reflects compounding interest over the five years; that is, the interest income that accrues each year remains within the GIC, and interest is earned on that income each year until maturity. However, as discussed earlier, under current tax rules the annual accrual of income in the GIC triggers an annual tax liability. In this study, we assume

34 Computing the geometric mean of a sequence of historical rates of return is akin to computing the compound annualized return for a multiperiod investment.

TABLE 1 GIC Rate, Tax Rates, and CPI for Five-Year Investment Period

Year	Average 5-year GIC rate	Top marginal tax rate[a]	CPI value[b]
		percent	
1	11	50.3	63.524
2		52.0	
3		54.9	
4		52.5	
5		46.1	
6			78.414

[a] Combined federal and Ontario rate.
[b] At January 1.

that, while the interest income remains within the GIC, the tax on that income must be paid annually, from other sources.[35] Therefore, the next step is to include this annual tax cost in the calculation of the real return on the investment .

In this example, the top marginal tax rate changes each year. Therefore, the impact of the investor's annual tax liability in respect of the interest income must be calculated separately for each of the five years.[36] Beginning with year 1 and a top marginal tax rate of 50.3 percent, we find that after-tax interest income of ($1 - 0.503)*11% = $0.05468 accrues to the investor by the end of the first year; ($1 - 0.52)*11% = $0.0528 accrues by the end of the second year, and so on. At the end of December 31, year 5, the after-tax (pre-inflation) value accumulated in the GIC will be the product of (1.05468)(1.0528)(1.04959)(1.05221)(1.05929) or $1.299. Thus, although it initially appears that the original $1 investment increases by $0.685 by the time the GIC matures, the cumulative tax liability reduces the amount of that return by $0.386 ($1.685 - $1.299), or more than half.

Rational investors sacrifice current consumption (by investing rather than spending funds) on the expectation of enjoying higher purchasing power (more consumable dollars) in the future. At this stage of our calculations, the after-tax amount of $1.299 reflects nominal—that is, pre-inflation—purchasing power. Therefore, this amount must be adjusted to take into account the compound inflation rate, based on the change in the CPI over the five-year period. Using the values in table 1, the rate is calculated as 78.414/63.524 = 1.2344, or 23.44%. This leads to a cumulative RAT value of $1.05233 at the end of five years. The annualized RAT is the fifth root of this quantity minus 1, or 1.025 percent.[37]

35 Mawani, Milevsky, and Panyagometh, supra note 6, make a similar realistic assumption for annual taxes paid on distributions from mutual funds in their study comparing pre-tax and after-tax rankings of mutual funds.

36 If the tax rates remained constant over the five-year period, the computation would be much simpler: $(1 + (0.11(1 - t))^5$.

37 $(1.05233)^{0.2} - 1 = 1.025\%$.

Therefore, the real annual economic return (the increase in purchasing power) from the five-year 11 percent GIC purchased on January 1, year 1 and redeemed on January 1, year 6 is just over 1 percent after taxes and inflation, assuming annual taxation of accrued interest income. This drastic reduction in the quoted return on the investment results from the erosion of more than half of the nominal return owing to taxes and the additional impact of a cumulative 23 percent inflation rate over the five-year period. The RAT becomes negative if the cumulative inflation rate exceeds the after-tax rate of return from the GIC. As we show in the next section of this article, this occurred in many years during the 1974-2003 period.

If income taxes were ignored altogether, as in O'Neill's study, and only the cumulative inflation rate of 23.44 percent were taken into account, the real annualized rate of return would be calculated by applying the inflation rate to the nominal return on maturity, as follows: $(1.685/1.2344)^{0.2} - 1 = 6.421\%$. While inflation still erodes 4.579 percentage points from the nominal return of 11 percent, the rate of return is much higher than the RAT of 1.025 percent calculated above. However, it is theoretically and technically incorrect to compute the after-tax return to the investor by applying the tax rate to the after-inflation value of 6.421 percent. As our algorithm demonstrates, the proper way to compute the true return to the investor is to subtract income taxes annually from the interest income accruing in the year, and then to adjust the after-tax return for inflation. This method avoids the artificial increase in the rate of return resulting from the compounding of pre-tax interest income over the entire term of the investment.[38]

We noted earlier that our choice of the top marginal tax rate to compute after-tax returns may be criticized on the grounds that investors in the highest tax bracket may not be the principal clientele for GICs. We therefore augment our study with additional analysis that sets *RAT* in equation 1 as equal to zero and solves for the implied breakeven tax rate ***t***. Investors with a marginal tax rate above the implied

38 Under the three-year reporting rule in effect between 1982 and 1989, the after-tax cumulative amount would be computed as follows:

Year	Average annual 5-year GIC rate	Pre-tax value	After-tax value[a]
	%	$	$
0	14	100.00	
1		114.00	
2		129.96	
3		148.15	125.04
4		142.54	
5		162.50	144.52

[a] Assuming a 48 percent tax rate.

Taxes on interest income are paid at the end of the third year and again at the end of the fifth year, on maturity. The after-tax return in this case is 3.204 percent.

breakeven rate would realize a negative RAT, while those with a marginal rate below the implied breakeven rate would realize a positive RAT. We report our results on the frequency of positive and negative RATs in the next section. We also report the estimated proportion of Canadian taxpayers who fall into the marginal tax bracket that yields a negative RAT.

REAL AFTER-TAX RETURNS ON GICs, 1974-2003

This section presents the results obtained when we apply our algorithm to the hypothetical case described earlier. The assumed facts are as follows:

- The investor is an individual who is resident in Ontario and taxable at the top marginal personal rate.
- In 1974, the investor purchases one-year, three-year, and five-year GICs with an interest rate corresponding to the average market rate for GICs of the same term in that year.
- On maturity, the GICs are rolled over continuously to December 31, 2003. The interest rate is the average market rate for GICs of the same term in the rollover year.

The investor's income tax liability is calculated on two bases: first, according to the tax rules in effect during the relevant period; and second, for purposes of comparison, according to the current rules requiring annual reporting of accrued interest income. For the taxation years 1975-1987 inclusive, it is assumed that the investor has already fully used the $1,000 investment income deduction; therefore, tax is payable on the full amount of interest income from the GIC investment. Tables 2 through 5 present the estimated RATs for the investments and the income tax rates and income levels at which the investor would break even on GICs of varying terms at the prevailing interest rates in the investment period.

Table 2 shows the compound annualized RAT rate for investments in one-year, three-year, and five-year GICs, purchased on January 1, 1974 and rolled over continuously into GICs of identical maturities until December 31, 2003. Two sets of results are provided for an investment where the tax rules in effect at the time differed from the current requirement of annual taxation of interest income (that is, for three-year GICs purchased in 1974 and 1983, and for five-year GICs purchased in 1974 and 1984). The first figure represents the result under the applicable rules for that period; the second, the hypothetical result had annual taxation applied.

Table 2 shows that an Ontario investor in the highest marginal tax bracket who purchased a one-year GIC on January 1, 1974 and rolled over the maturing value at the end of every year until December 31, 2003 earned a compound annualized return of - 1.2964 percent after taxes and after inflation. If the same taxpayer invested in a sequence of three-year GICs over the 30-year period, he earned a compound annualized return of - 0.609 percent under the tax rules in effect during

TABLE 2 Real After-Tax Return on GICs: Compound Annualized Rate, 1974-2003

	Year of purchase				
Investment term	1974	1983	1984	1994	1995
1 year	- 1.2964		0.2140	- 0.2904	
3 years[a]	- 0.6090 - 0.8571	1.1145 0.9714			0.6559
5 years[a]	- 0.4916 - 0.8898		1.2432 1.0004	0.2355	

Note: Results are based on Statistics Canada historical returns from series 326-0002 (available online at http://www.statcan.ca/english/Subjects/Cpi/cpi-en.htm), adjusted for inflation and taxes, and compounded annually. The use of the federal CPI as a measure of inflation was tested by substituting Ontario and Toronto CPI data. Although, as expected, the slightly higher inflation rates in Ontario and Toronto, as compared with the rest of Canada, did yield lower RATs, these differences did not change our results qualitatively. That is, positive RATs remained positive.

[a] Where there are two numbers in a cell, the first number is derived on the assumption that accrued interest income was taxed according to the rules in effect at various times during the investment period, and the second number is derived on the assumption that the income was taxed annually, in accordance with the current law. Single entries indicate that the tax rules in effect in that subperiod required annual reporting and taxation of interest income.

the investment period,[39] as compared with a return of - 0.8571 percent if annual taxation had applied. Similarly, investment in a sequence of five-year GICs yielded a return of - 0.4916 percent under the tax rules in effect at the time, or - 0.8898 percent under an annual taxation rule.

In other words, all GIC investments purchased in 1974 yielded negative RATs, regardless of the applicable tax regime. This jarring result is attributable to high inflation in the early to mid-1970s and the high marginal tax rates that were imposed at high income levels.

RATs improved over time as inflation was brought under control and marginal tax rates started to come down. For example, the purchase and rollover of a sequence of three-year GICs beginning in 1983 produced a return of 1.1145 percent under prevailing tax rules, or 0.9714 percent assuming annual taxation. Results were slightly better for five-year GICs purchased in 1984. However, over the 30-year period, RATs rarely exceeded 1 percent, and they did not even attain this level for GICs purchased in 1994/1995.

Table 2 shows that in all cases, and consistent with theory,[40] three-year and five-year GICs yielded higher RATs than one-year GICs, reflecting the higher returns demanded by investors for the risk of locking in funds for a longer period. However,

39 Under those rules, interest income was taxable on receipt until December 31, 1981, on accrual every three years from 1982 to 1989, and annually thereafter.

40 The positive relationship between expected risk and expected return is espoused by the capital asset pricing model (CAPM).

our results reveal a component of risk that may not be recognized by investors, or by issuers of GICs in their pricing structure, and that is the eroding effect of unexpected tax increases. An investor who buys a long-term GIC generally understands that inflation may reduce the purchasing power of the invested funds, or that interest rates on other instruments may increase during the holding period; thus, he demands, and the issuer is generally willing to pay, a compensating risk premium. However, as our comparison data show, changes in the tax rules that increase the tax on accrued interest income can further undercut the return that may otherwise be expected.

Based on the analysis performed for table 2, and applying the same assumptions, table 3 shows the percentage of the study period in which an investment generated a positive RAT. For example, a one-year GIC purchased in 1974 earned a positive annual RAT in 40 percent, or 12, of the 30 years during which the investment was held. Again, three-year and five-year GICs generally produced a better result, as might be expected in view of the risk-return relationship. However, except for investments purchased in 1983/1984, even longer-term investors realized a negative RAT for at least 50 percent of the holding period, and three-year GICs purchased in 1995 performed the worst of all categories over the entire three decades.

Although calculations were performed separately under the tax rule assumptions discussed above, the results in table 3 were the same regardless of the tax regime.

Table 4 shows the marginal tax rates at which the investor broke even—that is, the RAT was zero—for the three GIC maturities over the study period.[41] If an investor's marginal tax rate is higher than the breakeven rate, the RAT is negative; if the tax rate is lower than the breakeven rate, the RAT is positive. In table 4, for example, where the investor purchased a one-year GIC in 1974 and rolled over the funds until the end of 2003, the RAT was negative if the investor's marginal tax rate was above 35.55 percent. For longer-term GICs, the breakeven tax rate was higher. For example, for a five-year GIC purchased in 1974, the RAT was negative if the investor's tax rate was 45.87 percent or higher under the tax rules in effect during the period and 42.06 percent or higher under the annual taxation assumption.

For all maturities, the breakeven threshold rose at the later purchase dates, reflecting the combination of lower tax rates and lower inflation rates over the last two decades of the study period. In addition, the pattern of higher rates for three-year and five-year GICs is partly accounted for by the higher nominal return paid on these investments.

Finally, table 5 presents an overview of breakeven income levels over the study period for Canadian taxpayers generally and indicates the corresponding value of that income in 2003 dollars. The breakeven level indicates that the taxpayer earned sufficient income in the year to be placed in a marginal tax bracket of 35.55 percent

41 There is nothing sacred about a RAT benchmark of zero. However, it does denote the boundary at which sacrifice of current consumption is penalized by lower future purchasing power. The choice of zero as benchmark is consistent with the behavioural finance literature that emphasizes the discontinuity between losses and gains.

TABLE 3 Positive Real After-Tax Returns on GICs, 1974-2003

Investment term	Year of purchase				
	1974	1983	1984	1994	1995
			percent		
1 year	40		60	40	
3 years[a]	50	71			33.33
5 years[a]	50		75	50	

Note: Results are based on the analysis performed for table 2. The use of the federal CPI as a measure of inflation was tested by substituting Ontario and Toronto CPI data. Although, as expected, the slightly higher inflation rates in Ontario and Toronto, as compared with the rest of Canada, did yield lower RATs, these differences did not change our results qualitatively. That is, positive RATs remained positive.

[a] The analysis included separate calculations for the different tax assumptions applied in table 2 (tax rules in effect at the time and the current requirement of annual taxation), but both assumptions yielded the same result, as indicated by the single entries shown here for all subperiods.

TABLE 4 Breakeven Tax Rates for GIC Investments,[a] 1974-2003

Investment term	Year of purchase				
	1974	1983	1984	1994	1995
			percent		
1 year	35.55		53.52	41.15	
3 years[b]	44.33 42.67	64.15 62.86			61.75
5 years[b]	45.87 42.06		66.64 63.33	54.41	

Note: Results are based on the analysis performed for table 2.

[a] The breakeven tax rate is the marginal tax rate at which the compound annualized RAT for the investment is equal to zero. A marginal tax rate below the breakeven rate yields a positive RAT; a rate above the breakeven rate yields a negative RAT.

[b] Where there are two numbers in a cell, the first number is derived on the assumption that accrued interest income was taxed according to the rules in effect at various times during the investment period, and the second number is derived on the assumption that the income was taxed annually, in accordance with the current law. Single entries indicate that the tax rules in effect in that subperiod required annual reporting and taxation of interest income.

(the level calculated for a one-year GIC purchased in 1974). These historical income data are shown in column 1 for every year of the study period. For example, in 1974, a taxpayer earning more than $11,727 would realize a negative annual RAT for a 30-year investment of a one-year GIC; a taxpayer earning less than this amount would realize a positive annual RAT. Note that the income threshold rose almost every year, reflecting the partial indexation of basic personal tax credits and exemptions to offset inflation.

TABLE 5 Breakeven Income Levels for GIC Investors,[a] 1974-2003

Year	Breakeven income (dollars)	Equivalent income in 2003 dollars	Percentage of taxpayers above breakeven level[b]
1974	11,727	46,259	14.69
1975	12,915	45,925	22.43
1976	14,377	47,541	30.20
1977	15,610	47,876	17.83
1978	13,690	38,520	43.25
1979	18,239	47,007	27.37
1980	19,867	46,513	34.13
1981	21,814	45,435	26.10
1982	20,017	37,606	31.92
1983	21,223	37,679	35.18
1984	22,285	37,918	37.52
1985	23,311	38,130	39.38
1986	23,497	36,909	38.12
1987	23,755	35,758	40.19
1988	27,501	39,785	34.34
1989	27,803	38,324	37.17
1990	28,276	37,180	39.38
1991	28,784	35,850	41.15
1992	25,591	31,395	43.37
1993	29,591	35,660	43.74
1994	30,000	36,082	46.39
1995	30,000	35,320	45.32
1996	30,000	34,753	46.15
1997	30,000	34,204	47.40
1998	30,000	33,889	48.88
1999	40,000	44,409	33.55
2000	51,944	56,145	19.94
2001	61,510	64,843	17.37
2002	63,355	65,161	16.73
2003	64,871	64,871	16.21

[a] The breakeven income level is the level of income that triggers a tax rate equal to the one-year GIC breakeven rate of 35.55 percent shown in table 4 (as an illustration).

[b] Taxpayers above the breakeven level would receive a negative compound annualized RAT on a one-year GIC purchased in 1974.

Sources: Breakeven income levels are calculated from historical tax brackets published in *The National Finances* (Toronto: Canadian Tax Foundation, annually 1974-1994) and *Finances of the Nation* (Toronto: Canadian Tax Foundation, annually 1995-2002). Percentages of the taxpaying population are generally derived from Canada Revenue Agency, *Income Statistics* (available online at http://www.cra-arc.gc.ca/agency/stats/menu-e.html); percentages for 2000-2002 are interpolated from income levels in *Income Statistics*; and percentages for 2002 and 2003 are based on 2001 income distribution data and 2002-3 marginal tax rates.

Since the income data are expressed in current dollars for the year, for comparison purposes, column 2 shows the equivalent purchasing power in 2003 dollars. For example, for the 1974 breakeven income, the 2003 equivalent is $46,259. The gap between actual income and the equivalent narrowed as inflation rates dropped in the 1980s.

Column 3 of the table indicates the percentage of tax-paying Canadians with income above the breakeven level in each year. Thus, in 1974, 14.69 percent of taxpayers earned more than $11,727 and hence would have realized a negative annual RAT on a one-year GIC. While year-to-year fluctuations are evident throughout the study period, a marked change occurred between 1999 and 2000, when personal income tax rates for Ontario taxpayers were reduced and inflation remained at low levels. In 2003, for example, at a breakeven income level of $64,871, approximately 16 percent of taxpayers would have earned a negative annual RAT from an investment in a one-year GIC. The lower incidence of negative annual RATs since 1999 has persisted despite lower rates of return on GICs.

CONCLUSION

This study has developed and explained the correct method for calculating the real economic return, after taxes and after inflation, on investments in GICs. Using historical data for the period 1974-2003, we have demonstrated that the real return is far below that indicated by calculations based on nominal rates of return, even when adjusted for inflation. Specifically, our main results can be summarized as follows:

1. During the last 30 years, investors who paid personal income tax at a marginal rate higher than 35.55 percent earned a negative after-tax and after-inflation rate of return from investing in and continuously rolling over short-term (one-year) GICs.
2. Investors who invested in and rolled over three-year and five-year GICs realized a negative return if their marginal tax rate was higher than approximately 42 percent (assuming annual taxation of interest income).
3. Based on aggregate statistics, close to one-third of the tax-paying population during the 1974-2003 period paid tax at higher than breakeven rates and therefore would have earned a negative return on GIC investments held outside tax-deferral accounts (which currently account for about two-thirds of personal GIC investments).
4. We find support for the conclusion that longer-term GICs compensate investors for bearing both inflation risk and taxation risk (relative to shorter-term GICs).
5. RAT in the early 1980s—a period in which nominal interest rates quoted on GICs were quite high—was actually lower than RAT in the early 2000s, even though quoted nominal rates on GICs were much lower.
6. On a positive note, RAT has been increasing steadily over time since 1980, illustrating that the positive effects of lower inflation and lower marginal tax rates outweigh the negative effects of lower nominal rates offered on GICs.

Our results show that individual investors should look beyond the quoted rates on fixed-term investments in assessing the reward in future consumable dollars for the sacrifice of current consumption. While future tax rates and inflation rates cannot be determined with any certainty, their significance should be recognized in the determination and pricing of risk associated with a particular investment. This issue will likely become more prominent if inflation rates edge upward from their recent low level.