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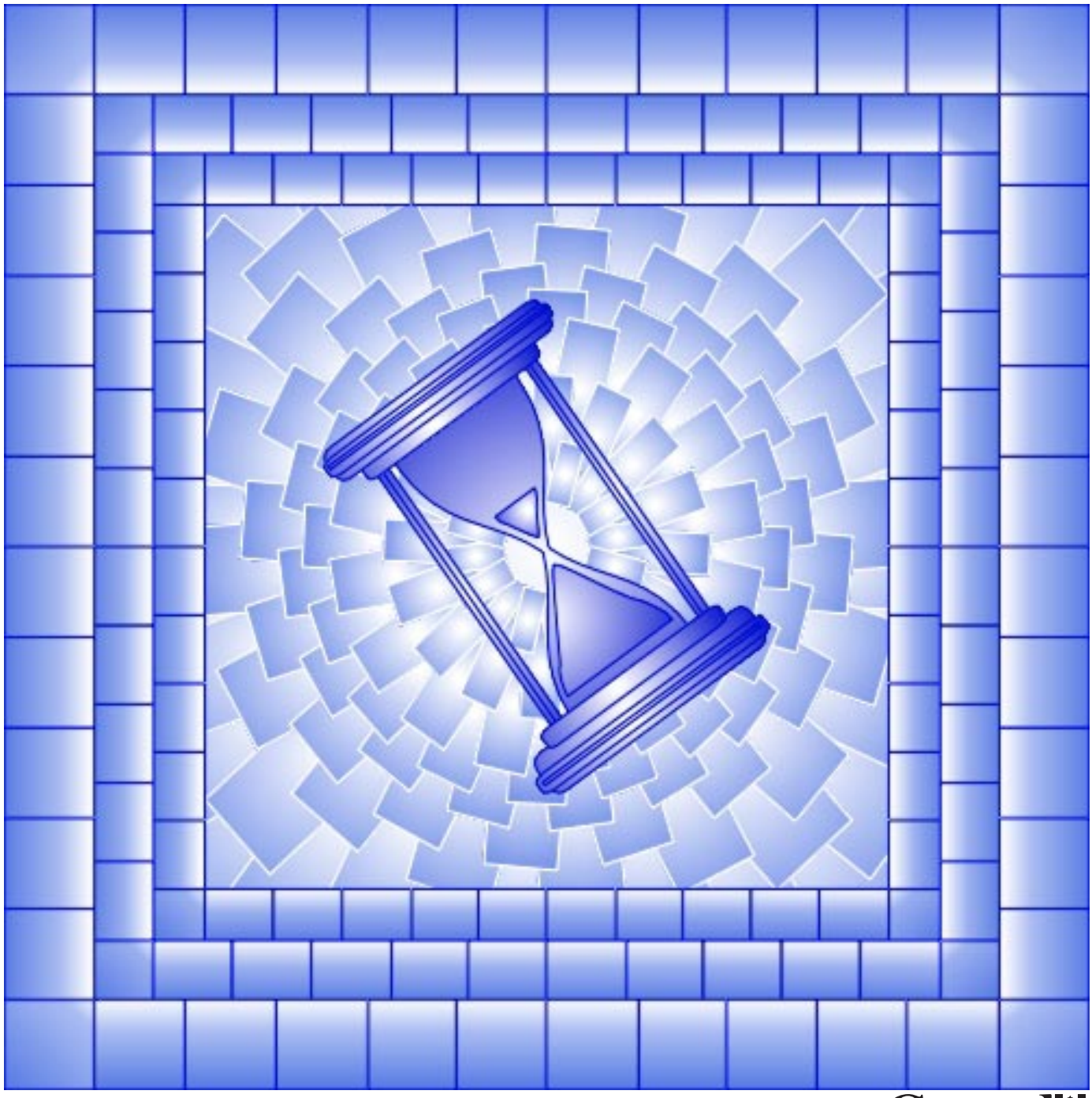
How Inflation and Income Tax Affect the Return on a Safe Investment

By Jacques Taillon

No 1



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Abstract

For decades, Canadians have been living in an inflationary environment. Everyone remembers that at some point in the past, consumer goods and services cost less. Even young people know that a candy bar cost less five or ten years ago than it does now. Thus the purchasing power of the Canadian dollar has declined over the years.

Even though everyone knows that things cost more now than they did in the past, there are situations in which this seems to be forgotten. The purpose of this article is to present a situation that shows the illusion of wealth that fairly long-term inflation can foster. We begin by looking at how inflation and income tax affect a retired person's interest income for a given year. Then we look at the effects of inflation and income tax on interest income over a longer period. When taxation is not factored in, the situation is one of investing a registered retirement savings plan.

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1.0 Introduction

For decades, Canadians have been living in an inflationary environment. Everyone remembers that at some point in the past, consumer goods and services cost less. Even young people know that a candy bar cost less five or ten years ago than it does now. Thus the purchasing power of the Canadian dollar has declined over the years.

Even though everyone knows that things cost more now than they did in the past, there are situations in which this seems to be forgotten. The purpose of this article is to present a situation that shows the illusion of wealth that fairly long-term inflation can foster. We begin by looking at how inflation and income tax affect a retired person's interest income for a given year. Then we look at the effects of inflation and income tax on interest income over a longer period. When taxation is not factored in, the situation is one of investing a registered retirement savings plan.

The analysis presented in this article assumes an inflationary context. In the case of deflation (where the average price of consumer goods and services drops), the situation changes completely. What seemed disadvantageous for savers in an inflationary climate becomes advantageous when there is deflation.

2.0 Mr. Smith and his interest income for a single year

The interest rates that chartered banks pay on savers' deposits generally take into account the observed or expected inflation rate. Interest rates are usually higher than the inflation rate. If this were not the case, putting one's money in a bank would automatically mean a loss of purchasing power. Probably in such a situation savers would look for other investment options (provided that they are aware of the effect of inflation). The interest rate obtained from the bank is called the nominal interest rate.

Thus, interest rates tend to be higher when the inflation rate is high than when it is low. There is nothing exceptional about obtaining an interest rate of 10% on a term deposit or guaranteed investment certificate (GIC) when the inflation rate is 7%. But if the inflation rate is around 2%, an interest rate of 10% on a term deposit would be remarkable. In the case of an inflation rate of 2%, an interest rate of 5% will be more common.

As you probably know, the inflation rate as measured by the consumer price index has been running around 2% since 1992 (see column 1 of Table 2, appended). Thus, if a person puts his or her money in very secure financial vehicles such as term deposits or guaranteed investment certificates, the expected yield with an inflation rate of this order will be closer to 5% than 10%. So what does this mean for retired persons who are planning to live on their interest income?

Take the fictitious case of Mr. Smith, a retiree who has invested $100,000 in guaranteed investment certificates. Assume that the inflation rate is 7% and that interest rates are 10% for 1996, the current year. In the following year, 1997, he will obtain interest income of $10,000. Mr. Smith believes that he can spend this $10,000 without drawing on his capital. Let us assume that he is now facing an inflation rate of 2% and interest rates of 5%; his interest income will be only $5,000 on his initial capital of $100,000. He therefore has only half the money to spend as in the previous case. Is this really how the situation should be interpreted? Where is the illusion of wealth?

To compare the two situations correctly, it is necessary to consider the effect of inflation on our retiree's financial situation. In calculating interest income, only nominal interest rates of 10% and 5% are considered. In the first case, with an inflation rate of 7%, Mr. Smith will have to increase his capital by $7,000 in order to maintain the same purchasing power in 1997. If he does not keep $7,000 of the $10,000 that he earned in interest in 1997, the value of his capital will decrease in relation to 1996, since $100,000 in 1996 is worth more than $100,000 in 1997.

This situation is similar to the one discussed in the introduction, concerning the decline in purchasing power due to inflation. To get a good understanding of this similarity, assume that Mr. Smith decides to spend his entire capital in 1996 (before the effect of the 7% inflation rate). Mr. Smith will be able to buy a whole range of goods and services for this amount. If he spends this $100,000 in 1997 after inflation has been running at 7%, Mr. Smith can no longer buy as many goods and services as in 1996. To be able to purchase the same basket of goods and services, he will have to add $7,000 to the $100,000 of capital that he already has.

The amount that Mr. Smith has at his disposal without drawing on his capital is therefore $3,000 in 1997 dollars ($10,000 - $7,000). Mr. Smith has exactly the same amount, $3,000, at his disposal in the case of an inflation rate of 2% and an interest rate of 5% (see Table 1). But as we have just seen, 1997 dollars do not have the same value as 1996 dollars. A 7% inflation rate will erode the real value of $3,000 to a greater extent than a 2% inflation rate.

Thus, a 7% inflation rate means that $1.07 in 1997 dollars is worth $1.00 in 1996 dollars. So $3,000 in 1997 dollars is worth only $2,804 ($3,000 / 1.07) in 1996 dollars. Hence the real return on the $100,000 capital is $2,804 or 2.8%. By the same token, with an inflation rate of 2%, $3,000 in 1997 dollars is worth $2,941 ($3,000 / 1.02) in 1996 dollars, representing a real return on capital of 2.9%.

The above can be considered from another angle. With a nominal interest rate of 10%, Mr. Smith will receive $10,000 and will have $110,000 of capital in 1997 dollars. As we saw above, 7% inflation means that $1.07 in 1997 dollars is worth $1.00 in 1996 dollars. We therefore observe that $110,000 in 1997 dollars is worth $102,804 ($110,000 / 1.07) in 1996 dollars. The actual return is therefore $2,804 ($102,804 - $100,000) in 1996 dollars.

As you may have noticed, the above example does not take income tax into account. If the tax rate that applies to our retiree is, say, 40%, the nominal interest rates of 10% and 5% before tax would be reduced to respectively 6% and 3% after tax. In the first case, the inflation rate of 7% exceeds the after-tax nominal interest rate. The return on the investment is therefore negative, since

the inflation rate is higher than the after-tax nominal interest rate. More specifically, the $6,000 (in 1997 dollars) in interest income is less than the loss of $7,000 (in 1997 dollars) of purchasing power due to the 7% inflation. After paying taxes, Mr. Smith will have $99,065 ($106,000 / 1.07) in 1996 dollars. He is therefore losing, in real terms, the amount of $935 in 1996 dollars (or -0.94%). Mr. Smith will thus see his real capital dwindle, even if he reinvests all his interest income. In the second case, the inflation rate of 2% is less than the after-tax nominal interest rate of 3%. Mr. Smith will therefore have $100,980 ($103,000 / 1.02) in 1996 dollars after tax. In real terms he gains $980 in 1996 dollars (or 0.98%).

Table 1 summarizes the two situations. These two examples clearly show that the real return on a person's capital may be either positive or negative, even though the initial return may seem high. Thus the effect of inflation and income tax should not be underestimated.

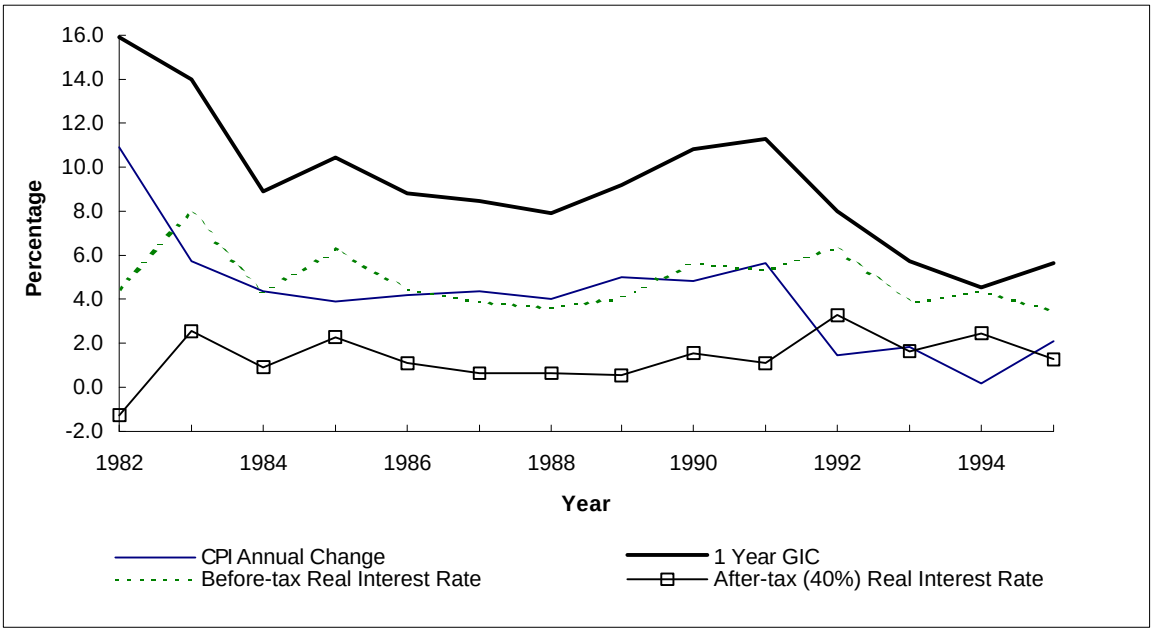
Table 1. After-tax real interest income

Item		Example 1	Example 2
1)	Nominal capital (in 1996 dollars)	$100,000	$100,000
2)	Inflation rate	7%	2%
3)	Nominal interest rate	10%	5%
4)	New capital = Nominal capital + nominal interest (in 1997 dollars) [1 + (3*1); 1 refers to the value from line 1]	$110,000	$105,000
5)	Value of the 1996 dollar expressed in 1997 dollars	$1.07	$1.02
6)	New real capital (in 1996 dollars) before tax (4/5)	$102,804	$102,941
7)	Before-tax real return (in 1996 dollars) (6-1)	$2,804	$2,941
4a)	Nominal interest rate less inflation (3-2)	3%	3%
5a)	Before-tax interest income (in 1997 dollars) (3*1)	$10,000	$5,000
6a)	Before-tax real interest income (in 1997 dollars) (4a*1)	$3,000	$3,000
7a)	Before-tax real interest income (in 1996 dollars) (6a/5)	$2,804	$2,941
8)	Tax on interest income	40%	40%
9)	After-tax nominal interest rate [(100%-8)*3)]	6%	3%
10)	New capital = Nominal capital + after-tax nominal interest (in 1997 dollars) [1 + (8*1)]	$106,000	$103,000
11)	After-tax real capital (in 1996 dollars) (10/5)	$99,065	$100,980
12)	After-tax real interest income (in 1996 dollars) (11-1)	- $ 935	$ 980
13)	After-tax real interest rate (12/1*100)	-0.94%	0.98%

3.0 Evolution of interest income from one-year guaranteed investment certificates from 1981 to 1995

We have looked at the effect of both inflation and income tax on interest rates for a single year. Now we will look at their effect over a longer period, that is, from 1981 to 1995. To do this, we will use the Canadian consumer price index (CPI) to represent inflation. To calculate interest on capital, we will use average annual interest rates paid by chartered banks[1] on guaranteed investment certificates (GICs. Lastly we will use a fictitious average combined federal/provincial taxation rate of 40% (see Chart 1). This rate may seem high to some, but a person's investment strategy is usually influenced by his or her marginal tax rate, that is, the tax paid on our last dollar of income.

Chart 1. Annual Change of CPI, 1 Year GIC, Before and After Tax (40%) Real Interest Rate When All Interest Income is Reinvested



Now, assume that Mr. Smith had $100,000 in capital in 1981 and invested that money in one-year guaranteed investment certificates for the next fourteen years. We want to see what return he obtained over the years. We will look at three scenarios: (1) Mr. Smith does not reinvest his interest income; (2) each year, Mr. Smith reinvests all his after-tax interest income in one-year guaranteed investment certificates; and (3) each year, Mr. Smith reinvests all his untaxed interest income in one-year guaranteed investment certificates inside a registered retirement savings plan. Situation 1 may represent a retiree who uses his interest income as one of his sources of income to cover day-to-day expenses. Situations 2 and 3, on the other hand, are more typical of someone who is investing for his retirement. In the second case, the investment income is taxable. In the third case, it is not.

[1] Bank of Canada Review, Quarterly, Section F1.

3.1) Mr. Smith does not reinvest all his interest income

In the first situation, Mr. Smith would use all his after-tax interest income for purposes other than reinvestment. The nominal capital (in current-year dollars) would remain $100,000 from one year to the next. As we saw in the first part of this article, Mr. Smith may have the illusion of not drawing on his capital but in actual fact, he would see it melt away. In 1995, with his $100,000 capital, Mr. Smith would be able to purchase only the equivalent of $56,600 in 1981 dollars (see column 3 of Table 2). Inflation has done its work. This shows the loss of purchasing power due to inflation.

3.2) Each year, Mr. Smith reinvests all his after-tax interest income in one-year guaranteed investment certificates

When Mr. Smith reinvests his interest income every year, he is increasing his chances of maintaining his purchasing power and improving it over the years. But what exactly is happening?

With an average combined federal/provincial tax rate of 40%, Mr. Smith will end up with $212,766 in 1995 (see column 3 of Table 3). However, these are 1995 dollars. Taking inflation into account, Mr. Smith will have, in 1995, the equivalent of $120,411 in 1981 dollars ($212,766/1.767; see column 5 of Table 3). In real terms, he has therefore increased his capital by 20.4% in 14 years.

In the first example of section 2.0, Mr. Smith made real after-tax interest gains. But in the other case, he incurred losses. When a tax rate of 40% is applied, both of these situations are also encountered in the 1981 to 1995 analysis. Indeed, in 1982, the after-tax real yield of the one-year guaranteed investment certificates is negative, that is -1.24% (see column 6 in Table 3). Mr. Smith thus finds himself in a less favourable situation than in the previous year, even though he reinvested all his interest income. In 1982, he has less capital in real terms than he had initially, namely $98,763 in 1981 dollars (see column 5 of Table 3). This may seem surprising, considering the high nominal interest rate earned by GICs in 1981 (15.88%). We therefore have an example that clearly illustrates the importance of taking into account both inflation and taxation when evaluating the return on invested capital.

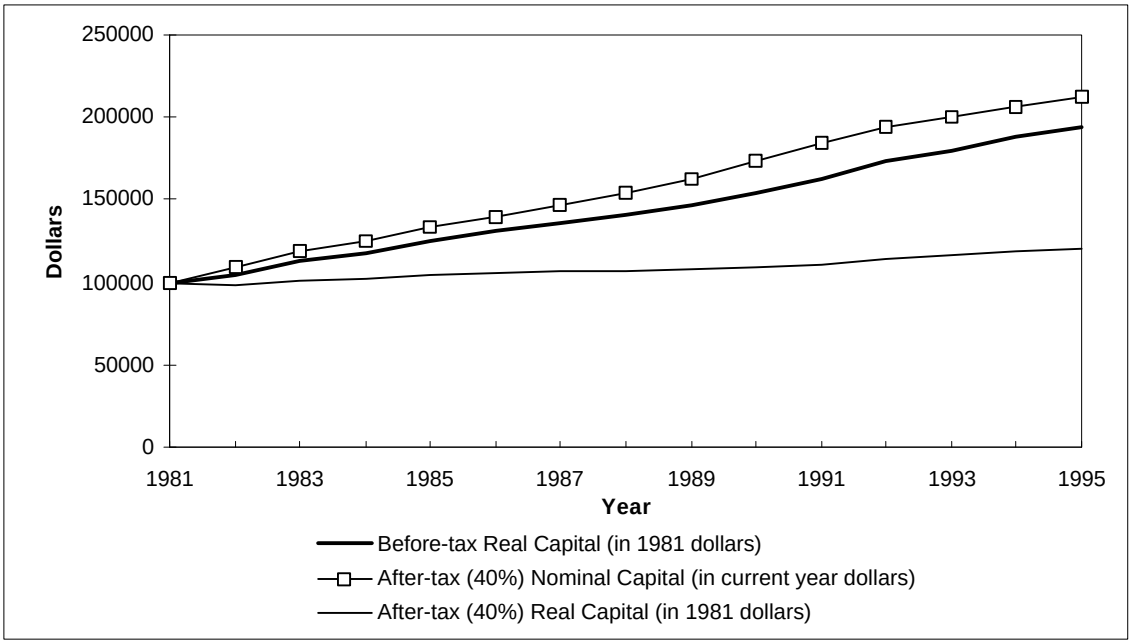
3.3) Each year, Mr. Smith reinvests all his untaxed interest income in one-year guaranteed investment certificates inside a registered retirement savings plan

From the above case, we can see the importance of putting one’s capital to work in a tax-sheltered environment. This is the reason why an investment vehicle such as a registered retirement savings plan is so important. If Mr. Smith can invest in GICs without having to worry about taxation, the return on his capital will be substantially greater during the same period.

If Mr. Smith reinvested all his interest income in GICs year after year, without taking taxes into account, he would find himself with a nest egg of $343,728 in 1995 dollars, a gain of 243.7% on his initial capital (see column 5 of Table 2). Impressive?

Once again, we are looking at the monetary illusion due to inflation. The fact is that this amount is expressed in 1995 dollars. However, the 1995 dollar is worth less than the 1981 dollar. Mr. Smith cannot purchase with $343,728 in 1995 what he would have been able to purchase in 1981 with the same amount. The prospect of such an amount was often dangled in front of savers in 1981, without it being mentioned that the dollars comprising this $343,728 would be less valuable than 1981 dollars. Hence, it is necessary to remove the effect of inflation to see what Mr. Smith's real gains are. To do this, we use the rate of inflation of 1995 in relation to 1981 (1.767) (see column 2 of Table 2). Mr. Smith's real capital in 1995 would thus be $194,526 ($343,728 / 1.767; see column 1 of Table 3). This amount therefore indicates that Mr. Smith could purchase 94.5% more goods and services in 1995 than in 1981. The amount of $194,526 compares favourably to the $120,411 obtained from the same initial investment with a 40% taxation rate (see Chart 2). The two amounts are expressed in 1981 dollars. However, this analysis does not take into account the income tax that Mr. Smith will have to pay when he withdraws his money from his registered retirement savings plan.

Chart 2. Capital When All Interest Income Is Reinvested



4.0 Conclusion

The monetary illusion due to inflation is a serious phenomenon. Savers should know that the buying power on the return of their investment is influenced by inflation. The taxation rate also plays a major role in the real return on an investment. What we have shown in this article is that these two influences are far from negligible. They may even completely cancel out the high returns from nominal interest rates. We have also shown the strength of a registered retirement savings plan, which allows interest income to accumulate while being sheltered from income tax.

A few comments on the evolution of the CPI and average annual interest rates paid by chartered banks on guaranteed investment certificates from 1981 to 1995

At the start of the period, from 1981 to 1982, the annual change in the CPI was 10.9%, whereas a one-year guaranteed investment certificate in 1981 yielded an interest rate of 15.88% on maturity in 1982. The before-tax real capital is $104,491 ($115,880 / 1.109; see column 5 of Table 2). The 4.49% spread between the nominal rate and the inflation rate [($104,491 - $100,000) / $100,000 * 100] constitutes the before-tax real interest rate (see column 2 of Table 3). The 1981 dollar is worth $1.109 in 1982 dollars (this means an index equal to 110.9 on the basis of 1981 = 100; see column 2 of Table 2). Similarly, the 1981 dollar is worth $1.767 in 1995 dollars. The interest rate for GICs is set before the inflation rate for the coming year is known.

The CPI followed a downward trend after 1982. From 1983 to 1991, the annual percentage change in the CPI ranged between 3.9% and 5.7% (see column 1 of Table 2 or Chart 1). Then, from 1992 to 1995, the annual change decreased even further, ranging between 0.2% and 2.1%. The before-tax nominal interest rates yielded by GICs followed the trend of inflation relatively closely (see Chart 1). This phenomenon illustrates the hypothesis of neoclassical monetary theory, according to which the real interest rate is low and relatively constant.[2] Before-tax real interest rates on GICs ranged from 3.53% to 7.89% (see column 2 of Table 3).

[2] Tremblay, Rodrigue (1992) Macroéconomique moderne - théories et réalités, Éditions études vivantes, Laval, p. 89.

Table 2. Inflation rate, purchasing power, guaranteed investment certificates and nominal capital

Year	CPI Annual % Change	CPI 1981=100	Purchasing Power in 1981 Dollars	Nominal Interest Rate For a 1 Year GIC in (year)	Before-tax Nominal Capital When All Interest Income is Reinvested
	Col. 1	**Col. 2**	**Col. 3**	**Col. 4**	**Col. 5**
1981		100.0	1.000		$100,000
1982	10.9	110.9	0.902	15.88	115,880
1983	5.7	117.2	0.853	14.02	132,126
1984	4.4	122.4	0.817	8.94	143,938
1985	3.9	127.2	0.786	10.46	158,994
1986	4.2	132.5	0.755	8.81	173,002
1987	4.4	138.3	0.723	8.44	187,603
1988	4.0	143.9	0.695	7.88	202,386
1989	5.0	151.0	0.662	9.19	220,986
1990	4.8	158.3	0.632	10.79	244,830
1991	5.6	167.2	0.598	11.31	272,520
1992	1.5	169.7	0.589	8.00	294,322
1993	1.8	172.7	0.579	5.69	311,069
1994	0.2	173.1	0.578	4.56	325,254
1995	2.1	176.7	0.566	5.68	343,728

Table 3. Nominal and real capital, before and after tax (40%) when all interest is reinvested

Year	Before-tax Real Capital	Before-tax Real Interest Rate	After-tax Nominal Capital	After-tax Nominal Interest Rate	After-tax Real Capital	After-tax Real Interest Rate
	Col. 1	**Col. 2**	**Col. 3**	**Col. 4**	**Col. 5**	**Col. 6**
1981	$100,000		$100,000		$100,000	
1982	104,491	4.49	109,528	9.53	98,763	-1.24
1983	112,736	7.89	118,741	8.41	101,315	2.58
1984	117,597	4.31	125,111	5.36	102,215	0.89
1985	124,996	6.29	132,963	6.28	104,530	2.27
1986	130,567	4.46	139,991	5.29	105,654	1.07
1987	135,649	3.89	147,080	5.06	106,349	0.66
1988	140,644	3.68	154,034	4.73	107,043	0.65
1989	146,348	4.06	162,528	5.51	107,634	0.55
1990	154,662	5.68	173,050	6.47	109,318	1.56
1991	162,991	5.39	184,793	6.79	110,522	1.10
1992	173,437	6.41	193,663	4.80	114,121	3.26
1993	180,121	3.85	200,275	3.41	115,967	1.62
1994	187,899	4.32	205,754	2.74	118,864	2.50
1995	194,526	3.53	212,766	3.41	120,411	1.30