TD Bank Financial Group

TD Economics

Special Report

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CANADIAN LONG-TERM REAL INTEREST RATES[1]

(a report prepared for TD Securities and TD Bank by Charles Freedman[2])

1. Introduction

Various measures of the long-term real interest rate in Canada and elsewhere have shown a trend decline since the mid-1990s, a tendency that received increased attention in the middle part of this decade when long-term nominal and real interest rates in the United States did not respond in the traditional way to the tightening of monetary policy. In this paper, I address a number of questions relating to the movements in long-term real interest rates in Canada and abroad. First, what has been the role in the decline of the long-term real interest rate of the various factors noted in the literature, and, to the extent that it can be determined, what is their relative importance? Second, what is the relative importance of global factors as opposed to domestic factors in explaining movements of Canadian long-term real interest rates? Third, looking forward about 10 years, what can be said about the likely movements of the factors that drive real interest rates, and what is the projected outcome for the long-term real interest rate in Canada?

An important element that makes it very difficult to reach definitive conclusions about these matters is the fact that many of the variables under discussion are non-observable and therefore must be estimated or proxied. This is true of the "pure" real interest rate and of the various time-varying risk premiums that feed into the various measures of nominal and real rates of interest. Our approach therefore is to first examine the various factors and approaches analytically, and then to see the extent to which the empirical proxies for the non-observable variables are consistent with the implications of the theoretical analysis.

In brief, our principal results are as follows. The trend decline in long-term real interest rates in Canada is the result of a number of factors, and no single factor can explain all aspects of the decline. The most important of these factors are global macroeconomic developments (the global saving glut), changes in global risk premiums, and changes in Canadian risk premiums. For a small economy that is very open to trade and capital movements, such as Canada, domestic real interest rates will track global real interest rates more closely than would be the case for a more closed economy. Nonetheless, Canadian real interest rates can deviate to some extent from their global counterparts as a result of country-specific macroeconomic and risk developments. Domestic macroeconomic developments would likely play a more important role in the determination of Canadian shorter-term real interest rates than they do for Canadian longer-term real interest rates. And in less open economies than Canada, country-specific macroeconomic and risk developments would be a more important driving force in the determination of real interest rates than in more open economies.

Forecasting future real rates of interest involves projecting both macroeconomic and risk developments in the global economy and in the Canadian economy. And especially in the global economy, these projections are fraught with uncertainty. That said, we come to the conclusion that a decade from now US long-term real interest rates might well be higher than at present, say on the order of 3%. The corresponding figure for Canadian long-term real interest rates would be in the neighborhood of 2¾%. Canadian long-term real interest rates are projected to be somewhat lower than their US counterparts because the fiscal performance in Canada is projected to be better than that in the United States. Taking a longer historical view, it can be argued that global real interest rates will simply be returning to historical norms and that the high real interest

rates of the 1980s and much of the 1990s are the historical anomaly.

Section 2 of this report examines the facts pertaining to developments in Canadian and foreign long-term real interest rates over the last five decades, with particular attention to the last 15 years or so. Section 3 looks at analytic approaches to the explanation of real interest rate movements, and focuses on factors influencing both the "pure" real interest rate and time varying risk premiums. In light of the openness of the Canadian financial system and the Canadian economy, attention is paid to both domestic and international factors. Section 4 assesses how the various analytic approaches match the developments in long-term real interest rates over the period under examination, and the likely implications for future movements of the long-term real interest rate. In section 5, I provide a summary of the analysis and offer some concluding remarks.

2. The facts

Real interest rates, with one important exception, are non-observable variables. They are typically measured as the difference between a nominal interest rate and the expected rate of inflation over the term of the nominal interest rate. The exception is the rate of return on indexed bonds, and even here market rates are the sum of a pure real rate of interest and one or more risk premiums. The expected rate of inflation that is subtracted from nominal interest rates to convert them into a proxy for real interest rates is also non-observable, and many measures of expected inflation are used in the literature. In any case, these real interest rate proxies also are the sum of a pure real rate of interest and risk premiums.

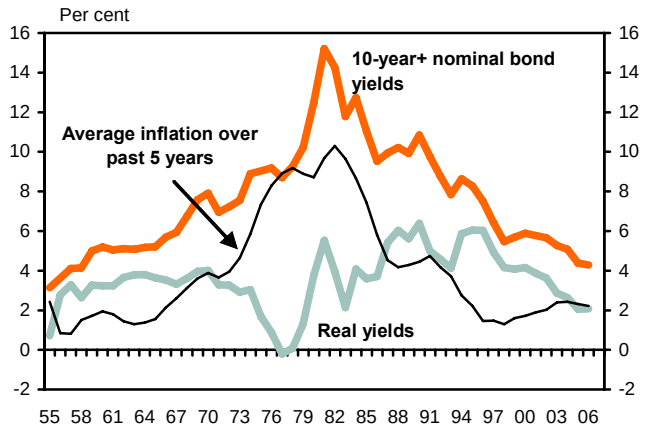
Among the measures that have been used to estimate expected inflation are simple lagged inflation over one or more periods, more complex measures using lagged inflation, for example those based on autoregressive forecasting equations, statistical approaches to deriving expected inflation from past data using factor analysis or principal components, and measures derived from surveys. In practice, most measures of expected inflation based on past inflation (for example, lagged inflation over one period, lagged inflation over five periods, or those based on autoregressive techniques) behave relatively similarly over longer time periods. While survey evidence offers a useful approach to assessing the data, it is limited in historical scope and the results are not in practice all that different from measures based on past inflation data over longer periods. Differences can nonetheless appear over shorter periods.

As noted, the exception to the assertion that the real rate of interest is non-observable is the rate of return on index linked bonds (known by different names in the various countries in which they are issued), which were initially issued in January 1983 in the United Kingdom, November 1991 in Canada, and January 1997 in the United States. These interest rate data are very useful as cross-checks but, because of the relative shortness of their time series and because of the relatively low liquidity of indexed bonds in many jurisdictions, they should be used in conjunction with other proxy measures for real interest rates to get a full picture of developments, particularly historical developments. And, to repeat, even measures based on the return on indexed bonds are a combination of the pure real rate of interest and risk premiums.

In this section of the paper, we will look at the behaviour of a few measures of long-term real interest rates over time. We will also compare the behaviour of Canadian and US measures of long-term real interest rates to get a preliminary indication of how similar or different they are, prior to beginning the more analytic section of the report.

Consider the Canadian over ten year bond yield. Figure 1 presents annual data since 1955 for the nominal interest rate,[1] the average total CPI inflation over the past five years as a proxy for expected inflation, and the difference between the two as a measure of the real interest rate. Use of the five-year rate of inflation gives a much

FIGURE 1: CANADIAN 10-YEAR+ BOND YIELDS



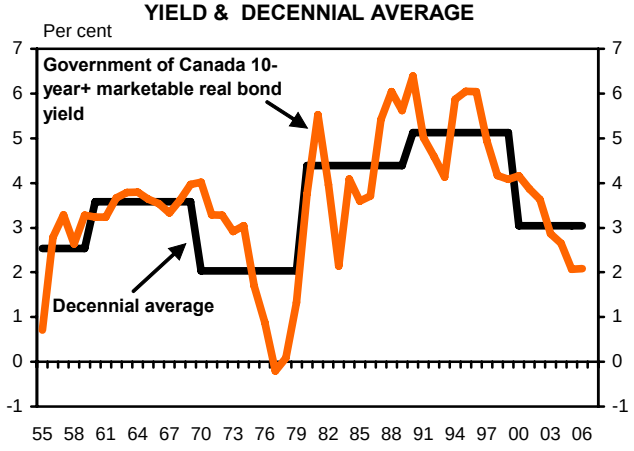
Source: Bank of Canada, Statistics Canada

smoother pattern for expected inflation and for the real interest rate proxy than shorter proxies for expected inflation such as the one-year inflation rate. One can characterize the behaviour of this measure of the proxy for the long-term real interest rate as follows. From the mid-1950s through the mid-1970s, nominal interest rates and a proxy for the expected rate of inflation rose more or less in parallel, with long-term real interest rates remaining at about 3%. With the sharp increase in inflation in the mid-1970s and with nominal long-term interest rates rising to a lesser extent, this proxy for long-term real interest rates fell to as low as zero in the latter part of the 1970s. The 1980s showed a completely different pattern with both nominal interest rates and the expected inflation proxy falling after 1982, but with expected inflation falling more rapidly. Real interest rates on this measure were fairly choppy but moved back up to over 5% by the latter part of the 1980s and remained at high levels in the first half of the 1990s. In the latter part of the 1990s, as actual and expected inflation rates settled around 2%, nominal interest rates fell to levels not seen since the 1960s and real interest rates declined, eventually reaching about 2% by 2005.

Looking at the decennial averages for this measure over the decades for the period 1955 to the present (figure 2), we find the following. The average real interest rates over the second half of the 1950s was 2½%, rising to 3½% in the 1960s, followed by 2% in the 1970s, almost 4½% in the 1980s, 5% in the 1990s, and 3% in the present decade.

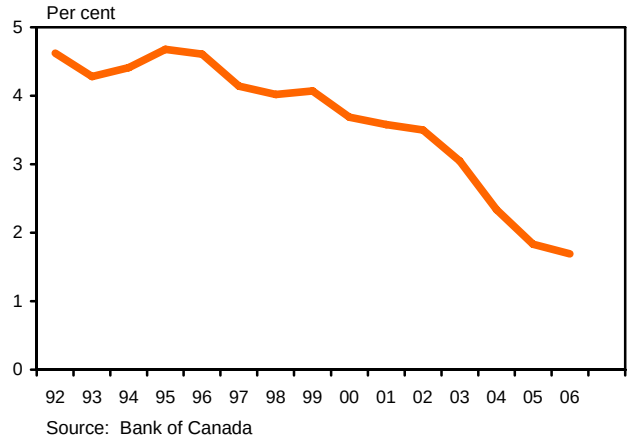
The rate of return on the indexed real return bond, an observable measure of the sum of the pure real rate of interest and risk premiums, is available for Canada only

FIGURE 2: CANADIAN 10-YEAR+ REAL BOND YIELD & DECENNIAL AVERAGE



Source: Bank of Canada, Statistics Canada

FIGURE 3: INTEREST RATES ON GOVERNMENT OF CANADA LONG-TERM REAL RETURN BOND

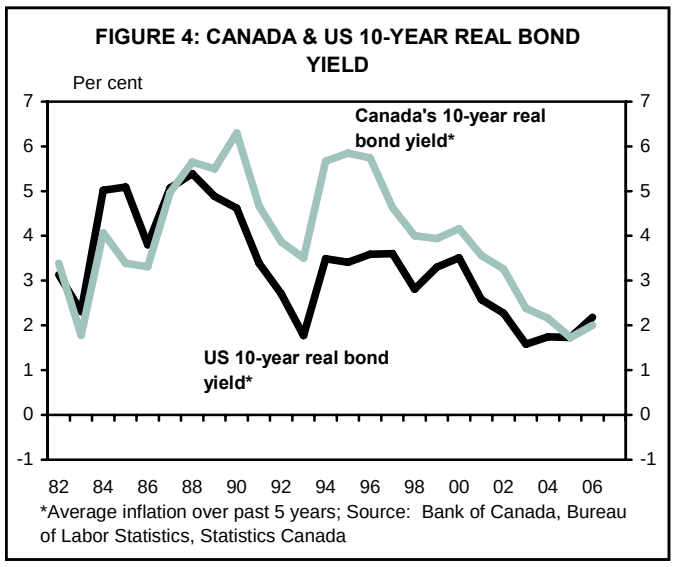


Source: Bank of Canada

from 1992 but shows a roughly similar pattern to the other measures (figure 3). It remained in the 4½% range from 1992 to 1996, fell to about 4% from 1997 to 1999, continued its gradual downward drift to about 3½% over the 2000 to 2002 period, followed by a much more rapid rate of decline between 2002 and 2005 to below 2%, and to under 1¾% in 2006. At the time of writing (July and August 2007), this rate has ranged between 2% and 2¼%. Over the period 1992 to 2006, the correlation coefficient between the rate of return on the indexed bond and that on the long-term benchmark bond yield adjusted by the lagged five-year rate of inflation is 0.9.

The US 10-year bond yield adjusted for expected inflation by the average lagged five-year CPI has a similar although not identical pattern to the real yield on the Canadian 10-year benchmark bond (figure 4). While real 10-year yields in Canada were below those in the United States in the mid- to late-1980s on this measure, they were well above their American counterparts throughout the 1990s, but converged to them in the middle part of this decade and fell below them more recently. The correlation coefficient between the Canadian and US real rates was about 0.7 for the entire period 1982 to 2006, but a much higher 0.9 for the second half of the period, i.e. 1994 to 2006.

In examining a number of measures of Canadian and US real interest rates, one sees that their basic pattern was roughly similar, although there are important differences in detail. Our initial conclusion on the basis of such data is that US real rates (which are a very important component of global real rates) likely played an important role in driving Canadian real rates, while leaving some room



for domestic developments. The analytic approaches to be discussed in the next section leave room for both global and country idiosyncratic developments to play a role in explaining movements in the pure real rates of interest and the risk premiums.

3. Analytic approaches

There are a number of factors that are discussed in the literature on long-term real interest rates. Interestingly, many of them can be incorporated into the traditional analysis of long-term interest rates based on the expectations theory, augmented by a variety of risk factors.

We begin with the pure expectations theory of long-term nominal interest rates. Consider a 10-year bond. According to the expectations theory, the nominal interest rate on a 10-year bond would be approximately equal to the average of the one-year nominal interest rates that are currently expected to prevail over the next 10 years. The lender expects to get the same return over the 10-year period by investing in the 10-year bond as he would by investing in a sequence of 10 one-year bonds. This variant of the model assumes that lenders are risk-neutral and are prepared to shift large amounts of funds between the 10-year bond and a sequence of the 10 expected future one-year bonds if the expected rate of return on one form of investment exceeds that on the other. It is this form of arbitrage that underlies the pure expectations theory.

Each nominal interest rate can be divided into a real interest rate and an expected inflation component. Thus, each expected future 1-year nominal interest rate is equal to the sum of the real interest rate and expected inflation for that year. And the nominal interest rate on a 10 year bond is therefore equal to the sum of the 10-year real interest rate and the 10-year expected rate of inflation.

In the real world, the pure expectations theory does not hold, as there are a number of elements of risk for which the lender requires compensation. The amount of compensation for each of them is not constant, but can vary over time as risks change with economic and financial conditions, and as the risk-aversion on the part of investors changes. These risk elements are therefore called time-varying risk premiums. Two of the most important for our purposes are the term risk premium and the inflation risk premium.

The term risk premium provides compensation to the lender for the loss of flexibility that comes from locking in funds for a long period. During this period, the price of the bond can fluctuate markedly if interest rate outcomes turn out to be different from those that had been expected at the time of the investment. Thus, if future interest rates turn out to be higher than expected, the return from the long-term investment would be less than that of a sequence of short-term investments and the price of the long-term bond will fall below par in the interim. Of course, the converse will be true when future short-term interest rates turn out to be lower than those anticipated at time of the investment and the price of the bond would rise above par in the interim. Because of the uncertainty of the outcome and the potential volatility of bond prices when interest rate outcomes differ from those anticipated at the time the bond is purchased, it is typically the case that long-term investors receive a premium for bearing the risk of locking in their funds.[2]

The inflation risk premium relates to the risk that the rate of inflation over the term of the investment will turn out to be different from that expected at the time of investment. Thus, lenders have to be compensated not only for the average rate of inflation expected at the time of the investment, but also for the uncertainty surrounding that expectation. While the long-term investor can end up gaining or losing as outcomes differ from expectations, once again there is some compensation paid for the risk associated with locking in funds, especially for long terms. The size of the compensation will differ over time as the risk associated with outcomes that are different from expectations increases or decreases. Note that investors in indexed bonds do not require compensation in the form of an inflation risk premium because such instruments are not

subject to uncertainty arising from unexpected inflation.[3]

There can also be a risk premium associated with a country's fiscal situation. To the extent that lenders are concerned about the sustainability of the fiscal track, they might demand additional compensation, even when they invest in the so-called "riskless" bonds of the central government of a country. An unsustainable fiscal track could lead to monetization of the debt (in which case it might also show up in inflation expectations and/or the inflation risk premium) or it could lead to the inability or unwillingness of a government to repay its debt. Concerns about unwillingness to repay debt may arise from a history of debt repudiation on the part of a country with fiscal problems even if it were able to repay.[4] Fiscal concerns are particularly common for purchasers of debt in developing and emerging economies, but they can also affect industrialized countries that are having serious fiscal problems.

There can also be liquidity risk premiums attached to bonds that are not actively traded. Another risk premium that enters the analysis is that required to compensate for default risk for entities such as corporations or junior governments, which are not considered "riskless" in the same way as a central government. Corporations that are unable to repay their debt can be forced into bankruptcy. The riskier is a corporation or junior government, the higher is the default risk premium demanded by investors.

Another element worth noting is that, leaving aside the risk premiums for the moment, the real interest rate can be treated as the sum of the equilibrium real interest rate for the period under consideration and the gap between the real interest rate and the equilibrium real interest rate for the same period. The equilibrium real interest rate reflects the long-lasting and typically slow-moving economic phenomena that drive savings and investment (the supply and demand for funds) over time, while the gap can be thought of as cyclical pressures that push real interest rates above or below the equilibrium.

Once we introduce risk premiums into the analysis, it becomes important to distinguish between the pure real interest rate and the proxies for the real interest rate. The first proxy to be analyzed is the difference between the nominal interest rate on unindexed long-term bonds and expected inflation. This proxy measure includes not only the "true" or "pure" real interest rate, but also the various risk premiums associated with long-term investments and any errors in the estimate for the expected rate of inflation. It is equal to the sum of the equilibrium real interest rate, the cyclical gap, the term risk premium, the inflation risk premium, the fiscal risk premium, the liquidity risk premium on unindexed bonds, the default risk premium on corporate bonds, and any error in measuring the expected rate of inflation.

The second proxy for the long-term real interest rate is based on the real rate of return on long-term indexed bonds. In addition to the equilibrium real interest rate and the cyclical gap, it includes the term risk premium, the fiscal risk premium, the liquidity risk premium on indexed bonds, and the default risk premium on corporate bonds. The inflation risk premium and the error in measuring expected inflation do not enter into the determination of the interest rate on indexed bonds since there is no inflation risk associated with the return on an indexed instrument and no need to measure expected inflation.

Thus the theoretical difference between the two proxies for the real interest rate (which we will assess empirically in the next section of this report) is equal to the sum of the inflation risk premium, the difference between the liquidity risk premiums on unindexed and indexed bonds, and the error in measuring expected inflation.

As we shall see in detail in section 4 of this report, much of the recent literature focuses on how the various elements that we have discussed affect the proxies for long-term real interest rates. The first term in the proxy for real interest rates derived from conventional bonds, the equilibrium real interest rate over the term of the investment, has received much of the attention. The concept of saving glut, with either an excess of saving or a deficiency of investment, particularly in the global arena, has played a considerable role in the discussion of the real interest rate "conundrum". The second term, the cyclical real interest rate gap, has received relatively little attention, since cyclical effects on the real interest rate are expected to be less important over a period as long as 10 years. The third term, the term risk premium, is also perceived to have declined over the last decade as the volatility of many real variables, including most notably that of real output, has declined, leading investors to the view that the financial environment is much more stable than in the past and therefore that the probability of very different set of outcomes than those expected at the time of investment has appreciably decreased. The fourth term, the inflation risk premium, is perceived to have declined over the last decade as the volatility of inflation has declined and inflation expectations have become much better anchored. The fifth

term, the fiscal risk premium, has been especially important in the case of Canada. It declined rapidly after the budgets of 1995 and 1996 put Canada on a much more sustainable fiscal track. The subsequent budgetary outcomes have maintained Canada's good fiscal record, and have probably caused the Canadian fiscal risk premium to disappear. While the sixth term, the liquidity risk premium, declined from the early postwar period as bond markets became broader and deeper, there has probably been little further change over the more recent period. The seventh term, the error of the proxy in estimating inflation expectations, may have been important in times of increasing and decreasing rates of inflation, but has probably been less important in recent years as the rate of inflation has been much more stable. However, at times when measures based on past inflation might have underestimated inflation expectations, such as in a period of widely recognized and anticipated rising inflation, the proxy for real interest rates based on past inflation would overestimate the actual real rate of interest.

The analysis thus far has assumed what economists call perfect substitutability. That is, it is assumed that investors and issuers of bonds would be willing to shift from one term to maturity to another term to maturity if the nominal interest rates that they faced moved even a small amount from those indicated by the expectations theory of the term structure augmented by risk premiums. Thus, for example, if the interest rates on 5-year bonds and 10-year bonds diverged at all from those indicated by the relationship, say if there were an excess return on the 10-year instrument, some combination of lenders and borrowers would shift their lending and borrowing in such a way as to eliminate the excess return. Either the lenders would shift out of 5-year instruments into 10-year instruments or the borrowers would do the reverse, or some combination of the two, so that the rate on 10-year instruments would decline and that on 5-year instruments would rise. If, however, the substitutability across instruments were imperfect rather than perfect, this type of arbitrage would not result in complete elimination of the excess return. A similar form of imperfect substitutability may hold across different types of borrowers (in the context of default risk), with lenders unwilling to increase the share of their portfolio in debt issued by specific borrowers by a very large percentage to take advantage of perceived excess returns. That is, as the perceived excess returns on bonds issued by a specific borrower increased, there would be an inflow into that instrument, but it would not be sufficient to eliminate the excess return.

Traditionally, imperfect substitutability has been modeled by making the desired asset allocation of lenders and the desired liability allocation of borrowers a function of the excess return. For our purposes, we can treat it as a form of "preferred habitat" (the term used by Modigliani and Sutch, 1966) in which certain kinds of lenders and borrowers prefer certain kinds of terms and/or instruments and require excess returns on other terms and/or instruments to shift out of that preferred habitat. The relationships discussed above would then have one extra variable that would capture any tendency of lenders and borrowers to prefer or avoid a specific term to maturity. This variable would be a function of the amount of investment in instruments with that term in the portfolios of those lenders preferring or avoiding that term and the amount of borrowing at that term by those borrowers preferring or avoiding that term.

In the context of preferences for certain types of assets, one element of the literature on the decline in real interest rates in recent years focuses on the increase in investments by central banks outside the United States in US treasuries, arguing that these investments have resulted in a substantial decline in the rate of return on US treasuries. That is, the focus by such investors on US treasuries pushes down the rates on those particular instruments because of imperfect substitutability by lenders across different types of borrower and perhaps across different terms (depending on whether such investors have preferences for certain terms to maturity). One implication of this hypothesis is that real interest rates on assets other than those preferred by these investors should increase. At a minimum this should show up in increases in the returns on other kinds of bonds, and perhaps equities, relative to treasuries, as well as increases in real interest rates in countries that are not the recipients of such official capital inflows. In other words, in periods in which such flows are occurring, the effects should be specific to treasuries in countries receiving the inflows, such as the United States, and real interest rates in non-recipient countries should actually rise.[5]

Another element in the "technical" or "structural" approach to the explanation of low real interest rates is the increasing desire of pension funds to invest in long-term instruments to offset their exposures. This change in their behaviour or at least in the intensity of their behaviour has

been attributed to the way that bond and stock markets have moved in the past few years and to regulatory changes. In this case as well, the hypothesis has implications for the movements of financial instruments that are not favoured by such investors.

While the above sets of relationships largely focus on domestic arbitrage conditions, there is another set of relationships that relates to international arbitrage conditions for countries whose exchange rates are flexible. Begin with a perfect substitutability model in which incipient excess returns on foreign investments result in portfolio adjustments by international lenders and/or international borrowers that result in such incipient excess returns being driven to zero. This type of arbitrage would imply that nominal interest rate differentials between countries would be exactly equal to expected movements in the nominal exchange rate. For example, if one-year interest rates in the home country were one percentage point above those in the foreign country, this would be consistent with an expected depreciation of 1 percent in the home country currency over the year. Foreign investors in home country financial instruments would thus obtain a one percentage point extra yield on the investment in the home country but would lose one percent in repatriating their funds from the domestic currency back into the foreign currency when the investment matured at the end of the year.[6] More generally, the home country nominal interest rate is equal to the foreign country nominal interest rate plus the expected depreciation of the home country currency over the period of the investment. And the real domestic interest rate equal to the real foreign interest rate plus the expected percentage rate of change in the real exchange rate, where the latter is defined as the expected change in the nominal exchange rate minus the differential in inflation rates between the two countries.

There are also risks in international investments that give rise to risk premiums. There is the risk of investing in a foreign country and the risk of investing in a foreign currency (unexpected movement in the exchange rate), and these risks can be added to the relationship linking domestic interest rates to foreign interest rates. The country risk premium includes the possibility of repudiation of the debt, as well as the relative magnitude of other risks in the country in which foreigners are investing compared to those in the country in which they reside. These would include premiums for relative term risks, relative inflation risks, relative liquidity risks, and relative fiscal risks. They could be either positive, in the case where the risk in the country in which the investment was taking place was greater that that in the country in which the investor resides, or negative, when the reverse was the case. Consider, for example, a situation in which fiscal risk was greater in the United States than in Canada. Other things being equal, US investors would then be willing to accept a lower real rate of interest on investments in Canada than on those in the United States.

Just as there is an imperfect substitutability version in the domestic arbitrage relationship, there is a similar imperfect substitutability version in the international arbitrage relationship where the effect of the international risk factors would be a function of the proportion of their portfolio invested by foreigners in the home country.

Thus far we have developed two relationships to explain the determination of the long-term real rate of interest – one from a domestic perspective and one from a foreign perspective.

From a domestic perspective, the long-term real interest rate is a function of the average expected future short-term real interest rates in the country over the time period under consideration, plus the relevant risk premiums. These risk premiums – the term risk premium, the inflation risk premium (in the case of an unindexed bond), the fiscal risk premium, the liquidity risk premium, and the premium for maturity preference – are related to domestic considerations.

From a foreign perspective, the domestic long-term real interest rate is equal to the foreign long-term real interest rate plus the expected change in the real exchange rate plus premiums for country risk (including, most importantly, relative risks in the country in which the investment is taking place compared to those in the country in which the investor resides) and currency risk.

How can both of these relationships be satisfied at the same time? The way that this can be done is to think of these relationships as being only part of a general equilibrium framework in which interest rates and exchange rates (as well as other variables) adjust to satisfy a number of equilibrium conditions. That said, in different situations, the explanatory factors in the domestic relationship or in the foreign relationship can play the more important role in explaining movements in real interest rates. Thus, in a large country such as the United States, one would expect shocks to domestic factors to play a larger role than in a small open economy such as Canada, where shocks to global

factors would be likely to play the more important role, but not necessarily to dominate totally.

More generally, one can analyze how demand shocks in the home and foreign country are reflected in movements of real interest rates in the home and foreign country and in movements of the real exchange rate, where the home country is small and the foreign country is large. There are four factors that appear to be particularly important in affecting how closely domestic real interest rates track foreign real interest rates following foreign and domestic demand shocks. These factors are the openness of the economy; the extent of the spillover of global demand shocks into domestic demand; the expected duration of domestic and global demand shocks; and the degree of substitutability in financial markets. The more open the economy, the larger the spillover from global demand shocks into domestic demand, the greater the substitutability in financial markets, and the longer the expected duration of domestic and global demand shocks, the closer real interest rates in the small home country will track real interest rates in the large foreign country. The next few paragraphs provide somewhat more detailed explanation of these results.[7]

Consider a positive shock to demand in the home country that was not associated with any global shock. The equilibration of supply and demand in the home country (or, equivalently, the equilibration of desired saving and desired investment) would occur through a combination of some increase in domestic real interest rates and a real appreciation of the currency of the home country. Both of these would act to moderate the rise in aggregate demand from the positive domestic demand shock. From the perspective of the foreign investor, the expected real depreciation of the domestic currency following its initial appreciation would be the factor in explaining why home country long-term real interest rates remain above their world counterparts. From the perspective of a domestic investor, it is the rise in future domestic one-period real interest rates for the period during which the demand shock persists that is the driving force behind the increase in the longer-term domestic real interest rate. Of course, the assumption is that the demand shock in the home country is too small from a global perspective to have any effect on world real interest rates.

Consider now the effect of the openness to trade of an economy on the interest rate and exchange rate movements resulting from such an exogenous domestic demand shock. Increased openness to trade is reflected in a greater effect on aggregate demand of a given change in the real exchange rate. Thus, the more open is the economy, the lower will be the appreciation of the real exchange rate and the increase in the domestic real interest rate that are needed to offset the upward pressure on aggregate demand resulting from a domestic demand shock. That is, while such shocks would result in some divergence of domestic real interest rates from international real interest rates, the extent of such a divergence would be less in the more open economy, and its real interest rates would therefore track global real interest rates more closely than those of a more closed economy.

Next consider a situation in which there was a shock to worldwide demand, say a major increase in investment demand worldwide, that was expected to persist for some time, but one that did not have much direct effect on aggregate demand in the home country. The resulting rise in the world real interest rate would equilibrate world savings and world investment (or to put it in a slightly different way, would equilibrate world aggregate demand and world aggregate supply). The equilibrating mechanism in the home country would involve a combination of some rise in real interest rates and a real depreciation in the domestic currency, such that net foreign demand for home country goods and services would rise as a result of the depreciation, and domestic demand would fall as a result of the higher real interest rate. From the perspective of a foreign investor, the rise in world real interest rates would partly but not entirely spill over into the home country, and the negative differential would be offset by the expected real appreciation of the home country currency following the initial depreciation. From the perspective of a domestic investor, expected future real interest rates in the home country would be higher but not by the full amount of the rise in world real interest rates. The more open that the home country is to trade, the lower will be the real depreciation of the home country currency and the larger will be the rise of the domestic real interest rates consistent with maintaining aggregate demand in the home country (i.e., the lower will be the negative differential with respect to global real interest rates). Thus, once again, domestic real interest rates in the more open economy would track global interest rates more closely than in the more closed economy.

If there were a spillover from the global demand shock to domestic aggregate demand (for example, a housing

boom in the United States would affect the demand for lumber in Canada), the effect of the global demand shock on the domestic real interest rate would be greater, and its effect on the real exchange rate of the country currency would be less, than if there were no spillover (i.e., the negative differential in real interest rates would be smaller). Moreover, the longer lasting the demand shock was expected to be, whether a domestic or foreign shock, the more the domestic real interest rates in the small economy would track global real interest rates.

The analysis thus far assumed perfect substitutability in financial markets. In the case of imperfect substitutability in financial markets, the less the degree of substitutability, the less domestic real interest rates would track global real interest rates following domestic demand shocks or global demand shocks.

In conclusion, most of the factors summarized above suggest that real interest rates in a country like Canada would tend to track global real interest rates (or in the case of Canada probably US real interest rates) more closely than would be the case for most other countries. The openness of Canada to external trade, the spillovers from US demand shocks to the Canadian economy, and the very high substitutability of Canadian financial markets with US financial markets all would act in the direction of Canadian real interest rates tracking US real interest rates closely. The final factor, the duration of shocks, would not necessarily be different in Canada than in other countries.

More generally, movements in global real interest rates would be expected to play a larger role in real interest rate determination in small economies that are very open to international trade than in large economies that tend to be less open to international trade, and similarly would play a larger role in economies that are very open to international capital flows than in economies that are relatively closed to international capital flows (whether because of law and regulations or because of lack of interest by international investors). Real interest rates in the quintessential small open economy that is open to both trade and capital flows would be the most affected by movements in global interest rates. Conversely, real interest rates in the large or closed economy should be relatively more sensitive to idiosyncratic domestic developments and relatively less sensitive to external developments. Nonetheless, even in small open economies, real interest rates would be affected by various risks, and differences in the magnitude of the risks in the small economy relative to those in large countries from which investment was coming would clearly affect the real interest rate in the small economy relative to the global real interest rate. Differences in the patterns of domestic and global demand shocks would also have some idiosyncratic effect on domestic real interest rates, and hence on the deviation of domestic real interest rates from global real interest rates.

4. Explanatory factors for past and future developments in global and Canadian long-term real rates of interest

An ideal explanation for movements in the real rate of interest would have the following elements. It would identify factors driving the global component of real interest rate movements as well as the factors driving the idiosyncratic component of national interest rate movements. It should be able to explain broad historical movements over the last three or four decades as well as the more recent developments that fall under the rubric of the "conundrum". Proposed explanations should also be able to specify their implications for variables other than the real interest rate and to show that these implications are consistent with the data. Included in such implications could be the following variables – current-account imbalances in various regions of the world; the pattern of forward interest rates and/or the slope of the yield curve; the growth of world output; and the equity risk premium. While not all the proposed explanations will have implications for all of these variables, the consistency with the theory of the movements of such variables for which the theoretical explanation does have such implications would provide a degree of comfort as to the relevance of the explanation.

In this section of the report, we examine in more detail the factors suggested in the literature as driving variables behind movements in the long-term real rate of interest in Canada and elsewhere. We begin by setting out the implications of each of these factors for a number of endogenous economic variables. It will become apparent that none of the factors provides a fully satisfactory explanation of the past developments and that it has probably been a combination of explanatory factors that has driven long-term real interest rates. We then look at each of the factors in more detail, assessing its capacity to explain some of the past developments and analyzing its likely implications for future global and Canadian long-term real interest rates. In looking forward, for each explanatory variable we will attempt to assess the likely evolution of the factors that drive it and what they would imply for the future move-

ments of long-term real interest rates. Finally, taking account of all the explanatory variables, we try to reach a conclusion as to whether real interest rates are likely to remain at the low levels prevailing over the recent period or whether they are likely to return to higher levels.

4A. Implications of proposed explanatory factors for economic variables

One way of differentiating among the many hypotheses that have been offered for low long-term real interest rates is to examine the implications of those hypotheses for variables other the long-term real interest rate. In Table 1, we set out some of these implications for the various hypotheses.

The four main hypotheses to explain the decline in long-term real interest rates over the past decade are listed at the top of Table 1, along with a factor that has received less attention globally but that has been important in the case of Canada, namely the improved relative fiscal situation. The main hypotheses for the reduction in the global real rate of interest are the saving glut, the reduction in inflation volatility, the reduction in overall volatility in the economy (most notably in output), and specific investment decisions by holders of international reserves and/or pension funds. The various economic variables for which each of these hypotheses implies an outcome are listed in the first column of Table 1. These variables are output growth, term spreads and the yield curve (two ways of expressing the same phenomenon), the equity risk premium, the spreads between the proxies for the real rate from conventional and indexed bonds, the appearance of the effects in many countries, current accounts, and effects on country or exchange rate risk premiums. In Table 1, the arrows indicate the direction of the effect, and the dash indicates that there is no effect.

Consider the global saving glut. An excess of intended saving over intended investment should lead to slower output growth, at least initially. Subsequently, the real interest rate movements resulting from the saving glut should lead to an equilibration of saving and investment and a return of output to its potential level. The saving glut hypothesis has no implications for the yield curve, since it should drive down real interest rates at all terms to maturity.[8] The excess intended saving would likely also drive down the equity risk premium. But it does not have any implication for the spread between the proxies for real rates (i.e., the difference between the proxy for the real interest rate from conventional unindexed bonds and the proxy from indexed bonds). It should affect interest rates globally[9] and lead to current account surpluses in those countries that are primarily responsible for the excess intended saving. Finally, there does not seem to be any clear implication for country

TABLE 1: IMPLICATIONS OF HYPOTHESES FOR VARIOUS ECONOMIC VARIABLES

Hypothesis / Outcome	Saving Glut	Inflation Volatility Down	Output Volatility Down	Reserves and/or pension funds	Improved relative fiscal situation
Long-term real interest rate	↓	↓	↓	↓	↓
Output growth	↓ (?)	-- or ↑	-- or ↑	--	-- or ↑
Term Spreads	--	↓	↓	↓	↓
Yield Curve	--	Less steep or more inverted	Less steep or more inverted	Less steep or more inverted	Less steep or more inverted
Equity risk premium	↓	--	↓	↑ (?)	?
Spreads between proxies for real rate	--	↓	--	--	--
Across many countries	Yes	Yes	Yes	No (?)	No
Current accounts	Yes	No	No	No	Yes
Country or exchange rate risk premiums	--	--	--	Maybe	Yes

or exchange rate risk premiums, except perhaps over the longer run as external debt accumulates in countries running current-account deficits.

The global decline in inflation volatility should lead to no change in economic growth or perhaps an increase, as better savings and investment decisions are made in the absence of inflation distortions. Term spreads decline and the yield curve is less steep or more inverted since the reduction in inflation uncertainty related to the decline in inflation volatility should have a greater effect on longer-term interest rates than on shorter-term interest rates. There is no clear implication for the equity risk premium. As noted in section 3, the reduction in inflation volatility should result in a decline in the spread between the proxies for real interest rates from unindexed and indexed bonds. Since the decline in inflation volatility has been global, it should lead to declines in nominal interest rates and in the proxies for real interest rates from unindexed bonds across many countries. It has no evident implication for current accounts or for country or exchange rate risk premiums.

The global decline in economic volatility should have similar implications to those from the decline in inflation volatility, with two exceptions. First, it should result in a decline in the equity risk premium, since the latter is associated with uncertainty related to economic performance. Second, since it would affect the proxies for real interest rates both from indexed bonds and from unindexed bonds, it would have no implications for the spreads between the proxies for real rates.

In passing, I would note that if the reduction in inflation volatility or output volatility were greater in one country than globally, the real interest rates in that country would fall relative to global interest rates. From the perspective of a domestic investor, it would show up as the reduction in one of the risk premiums in the domestic relationship, while from the perspective of a foreign investor, the relative reduction in risk in that country would show up as a reduction in the country risk premium in the foreign relationship.

The specific investment decisions related to international reserves and/or pension funds should have no implications for output growth, result in a reduction in term spreads (a less steep or more inverted yield curve) if international foreign exchange reserves were invested in longer-term financial instruments, lead to a possible increase in the equity risk premium as there is a shift out of equities into long-term bonds, and have no implications for the spreads between the proxies for the real rates. Unlike the other three hypotheses, it does not necessarily imply a global decline in real interest rates, but, assuming imperfect asset substitutability, a reduction in long-term real interest rates in those countries that are the destination of the investments in long-term bonds by the managers of international reserves and/or pension funds. Depending on the degree of asset substitutability across countries, it could have an effect on long-term interest rates in some other countries, but this effect, if it exists, should be considerably less than that in the countries that are the targets for the investments. The change in the destination of pension fund investments would not have any implications for current account deficits and surpluses. Nor would the investment of foreign exchange reserves have any effect on current accounts, to the extent that the reserves reflected the recycling of capital inflows into the countries accumulating them rather than a change in their net national saving. However, the investment of pension funds and international reserves might affect country or exchange rate risk premiums.

An improved fiscal situation in one country relative to the fiscal situation elsewhere would lead to a reduction in the long-term real interest rate in that country (relative to real interest rates globally) and may well have a positive effect on output growth. It would also lead to a reduction in the term spread in the country, as concerns about fiscal sustainability tend to affect longer-term real interest rates more than shorter-term real interest rates. Its effect on the equity risk premium is not clear, and it should have no effect on the spreads between the proxies for the real rates. In the case under examination, where the improvement in the fiscal situation is considerably greater in one country (a small country such as Canada) than more broadly, it would not have an impact on global interest rates. But, other things being equal, it would lead to an improvement in the current account of the country under examination through its effect on national savings. It would clearly affect the country risk premium, as foreigners would perceive the country as a less risky destination for investment.

Given that none of the hypotheses is fully consistent with all the developments in long-term real interest rates of the last few years (including less steep or more inverted yield curves, effects in many countries, and current account effects), it appears that more than one factor must have been at work over this period.

We now turn to a more detailed discussion of each of

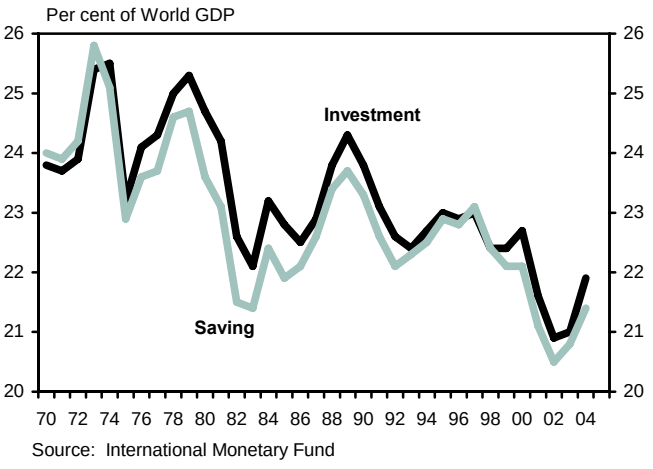
the hypotheses, including both its ability to explain past developments and its likely impact on future developments. In the course of the discussion, it will be important to distinguish between those developments that have a global impact and those that affect the differential between interest rates in Canada and global interest rates. More concretely, the saving glut, global inflation volatility, and global output volatility would affect global real interest rates, while movements in Canadian inflation volatility, Canadian output volatility, and the Canadian fiscal situation[10] that differ from global developments would lead to movements in real interest rates in Canada that could diverge from movements in global real interest rates. Similarly, specific demand and supply preferences in various countries, such as the destination of investments of foreign exchange reserves and pension funds would affect specific country long-term real interest rates relative to global long-term real interest rates. Finally, if domestic macroeconomic developments differed from their global counterparts, there would be some effect on domestic real interest rates relative to global real interest rates; however, as was discussed earlier, this effect would be smaller in more open economies, such as Canada, than in more closed economies.

4B. The saving glut hypothesis

The most commonly cited hypothesis in the literature on the low long-term real interest rates has been the saving glut hypothesis. The basic argument is that, over the last few years, ex ante (or desired) savings have exceeded ex ante (or desired) investment worldwide. The emphasis on global developments derives from the perception that the low interest rate environment over the last few years is a global phenomenon, affecting many countries, and therefore that the explanation must come from a worldwide phenomenon. In the classic model in which real interest rates are determined over the long run by real developments, namely factors affecting real savings and real investment, an upward movement in the desired level of savings relative to the desired level of investment would result in a decline in real interest rates. The latter would tend to reduce savings and/or increase investment in order to bring about a balance between savings and investment and hence to equilibrate the savings-investment relationship. Also, as we will see, there are implications from this hypothesis for regional current account developments.

There are two variants to this explanation. One focuses on the movement in savings (e.g., Bernanke, 2005)

FIGURE 5: GLOBAL SAVINGS AND INVESTMENT



Source: International Monetary Fund

while the other focuses on investment developments (e.g., Rajan, 2006). There is an important issue as to whether saving or investment developments are the more important in bringing about the resulting saving glut.

The principal analytic problem in trying to evaluate this hypothesis is that ex post or actual saving is equal by definition to ex post or actual investment. Estimates of global saving and investment are shown in figure 5.[11] There has been a gradual decline over the last three decades in the percentage of world GDP accounted for by saving and investment.

Ex ante or planned or intended or desired saving and investment are not observable variables. Hence the general approach of analysts has been to examine the behaviour of the economic forces that are believed to drive desired savings and desired investment in order to understand past developments and to provide a basis for the forecast of future developments.

As noted above, one potential flaw to the hypothesis that the saving glut is the principal factor explaining low long-term real interest rates, is that the glut in intended savings, whether caused by the behaviour of saving or the behaviour of investment, should have led not only to low real interest rates but also to relatively weak global economic growth. But, in fact, global economic growth has been relatively strong over the last few years, during the period of low real interest rates. Indeed, world economic growth over the last three years has been faster than in any period since the early 1970s. Although posing a challenge to this hypothesis, this phenomenon could perhaps be explained by the fact that the saving glut resulted in a

slowdown from what would otherwise have been even faster growth worldwide, mainly attributable to the impressive economic development of countries in East Asia and South Asia and rapid worldwide productivity growth. An alternative explanation is that there was an initial slowdown in growth, which was followed by the pickup in growth that resulted from the lower real rates of interest. This explanation, by itself, might explain a short period of rapid growth as economic output returned to potential, but probably not the lengthier period of rapid growth that we have seen and that is projected to continue.

Before looking at the driving forces behind saving and investment, in particular those that may have been major factors in bringing about the saving glut, we can look in some detail at some of the expected results of such a saving glut, as discussed more generally earlier in the context of Table 1. First, one would have expected a decline in real interest rates in many countries. And this is what we have seen. A number of studies have documented such a result. In some cases, they have looked at proxy measures for real long-term interest rates in various countries. For example, as shown in a recent OECD working paper, the downward decline in long-term real interest rates over the last decade or so shows up very clearly in the United States, Germany, and the Euro area, whether one uses inflation expectations from surveys or from an HP filter of CPI core inflation (Ahrend, Catte and Price, 2006, figure 2). A similar decline can be seen in Japan through the 1990s, but having reached very low levels at the end of 1990s the real interest rate in Japan has remained relatively stable over the present decade.

Another approach is to use measures of global real interest rates. In a recent Bank of Canada working paper (Desroches and Francis, 2007), the world real interest rate is measured as the common factor in G-7 real interest rates, where the latter are based on a measure of inflation expectations calculated by a five-year ahead dynamic forecast derived from an autoregressive representation of inflation. This global measure shows a gradual decline from a peak of over 5% in the early 1990s to a level of just below 2% in 2004.

A second implication of the saving glut hypothesis is that those countries that are largely responsible for the saving glut should have developed current-account surpluses while those that are in the position of savings deficit should have current-account deficits. While this result is required by the definition of the current-account surplus/deficit as the difference between domestic savings and investment, the movements in the current-account surpluses and deficits are consistent with our intuition as to where savings and investment movements have been most important. In particular, the United States has had the largest current-account deficit and developing economies such as China have had large current-account surpluses.

A third implication of this hypothesis, taken by itself, is that risk premiums should have remained more or less unchanged over the period. On the surface, there is no reason why the saving glut should have resulted in relative movements of yields on different types of securities, on securities with different terms to maturity, or on bonds in different countries. That said, it could be argued that the reduction in overall real interest rates might have led to a search for higher yield, and that such an attempt to achieve higher yields would have led to a shift from the lowest risk, lowest yield instruments to those with somewhat higher risk and higher yield, such as corporate bonds and longer-term issues. One could therefore argue that there might have been some decline in risk spreads and term spreads as investors attempted to make up for the income lost as a result of the decline in overall yields. In fact, we have seen such declines (and they will be discussed in more detail below), but they have probably been considerably larger than could be explained by the search for yield resulting from the saving glut alone.

The saving glut might also be associated with desired holdings of equities as well as bonds and this might have led to a decline in the equity risk premium. Alternatively, the decline in long-term real interest rates on bonds might have led to an increased demand for equities in an attempt to maintain the yield of the overall portfolio.

A fourth implication of the saving glut hypothesis, if it were expected to persist for some period of time (and the attempt to explain long-term interest rates by this hypothesis clearly suggests a view that such a glut has been relatively long-lasting and is expected to persist into the future) would be that the decline in forward nominal and real interest rates should be fairly similar across the entire time horizon. Ahrend, Catte and Price (2006, figure 8) show the data for forward nominal 3-month interest rates in the United States and the Euro area. Comparing the situation in January 3, 2000 and that in May 2, 2006 there is a roughly equal decline in forward rates over a 10-year horizon (implying nominal yield curves with unchanged slope). In 2004, in contrast, spot and near-term 3-month forward rates were

much lower than 3-month forward rates further in the future in both markets (implying much steeper slopes in the yield curve), but this can be explained by monetary policy actions taken to counter weakness in the economic environment.

Those who have emphasized the role of savings behaviour (as opposed to investment behaviour) as central to the saving glut have focused on a number of elements that might explain the world rate of desired savings declining less than the world rate of desired investment. These include the increasing importance in the world economy of those countries that have high rates of saving, most notably East Asian countries. The high rates of saving in these countries are partly the result of cultural and historical factors, and partly the result of the absence of safety nets at a time of rapid change and dislocation, which has forced households to build up their wealth for precautionary reasons. A second source of strength in the saving rate has been the sharply increased income of oil exporting countries over the last few years. While this factor cannot explain earlier developments (from the mid-1990s on), it may have contributed importantly to world savings behaviour over the past few years. A third element of the strength in saving rates has been the high corporate saving rates, as profits have been very high relative to historical standards. Also, the strength of demographically-driven household savings in economies with aging populations may have contributed to the relative strength of world desired savings.

What are the likely future developments in the world saving rate? One factor in the direction of maintaining or perhaps increasing the desired level of global saving would be the projected increase over time in the relative importance in the world economy of those developing countries that have traditionally had very high rates of saving. Offsetting this to some extent is likely to be the increased desire for consumption on the part of households in these countries as more of them move up the income ladder. Moreover, as the financial structures of such countries develop an improved capacity to provide retail credit, the purchase of durables may require less saving in advance than is currently the case. Also, to the extent that countries such as China act to improve the safety net underpinning the welfare of their population, households will have less need to save for precautionary purposes. The net result for world saving of these conflicting developments is hard to predict, but they will certainly be a key factor in the outcome. Similarly, if oil prices remain high, there will be a tendency for global savings to remain high, although here as well there will be offsetting factors as both households and governments in oil-producing countries increase expenditures over time.[12]

Views as to the likely developments in world savings would have to include some projection of future fiscal outcomes. Because of the important political element in such developments, it is very difficult to make accurate forecasts of this factor. For example, the sharp swings in the US budgetary position over the past 15 years were certainly unpredictable. The underlying political and economic pressures will likely prevent the budgetary situation in most countries from getting out of control, but many countries may continue to run fiscal deficits of the size that we have seen in the recent period. Canada will probably continue to be an outlier in this respect, although given the small size of the country, this will have relatively little effect on world savings. But, as we will discuss further below, a good fiscal performance by Canada will be helpful in maintaining the fiscal risk premium in Canada at a low absolute level, and at a lower level than in many other countries. Many of the developing and emerging countries tend to be reasonably conservative in their budgetary policies, and this will have a favourable impact over time on world fiscal outcomes, especially as they become a larger part of the world economy.

Demographic factors in advanced economies may also have offsetting effects. On the one hand, in line with the lifecycle hypothesis, the aging of the population in industrialized economies should eventually lead to lower rates of saving, as retirees run down their accumulated assets in retirement. However, the increase in life expectancy (and the uncertainty surrounding individual life spans) and the desire by retirees and prospective retirees to leave an estate to their progeny may cause some offset to this tendency to dissave. As well, if the increases in asset prices (both housing and equities) of the last few years, which have been an important factor in underpinning high rates of household expenditure and low rates of household saving out of income, do not persist, there will be pressure on households to increase their rates of saving.

It is difficult to come to a firm view on the outcome of these various pressures on world saving. Over time, it will be important for participants in financial markets to track the factors that drive the world saving rate as one of the key elements in determining the global real interest rate. I

believe that the factors affecting world saving will move only gradually and that the world saving rate will likely rise gradually from current rates, but will remain somewhat lower than average historical rates.

World intended investment appears to have been low relative to historical experience. In most major industrial countries, corporate capital investment has failed to match increases in corporate cash flow in recent years, as businesses remained cautious in spite of their improved balance sheet position. Similarly, Japanese investment was restrained following the collapse of the speculative bubble in the early 1990s. And investment in many emerging countries in Asia (excluding China) remained subdued after the financial crisis of the late 1990s. In some countries, the strength of new residential construction provided some offset to the weakness in corporate investment.

Among the factors that have been suggested for the dearth of new investment opportunities in advanced economies is the effect of slowly growing or declining workforces and capital-labour ratios that are already high. As well, the increasing desire of corporations to improve their balance sheet rather than to engage in new real investment may have been related to "the increasing competitiveness of the environment for individual corporations" (Rajan, 2006), even though the overall macroeconomic environment remained favorable. While the circumstances in many developing countries are exactly the opposite of those in advanced economies (rapidly growing workforces and low capital-labour ratios in these countries), the cautious attitudes following the financial crises of the late 1990s and some concern on the part of domestic and foreign lenders about the safety of investments in some of these countries may have lessened the tendency towards higher investment that might have been expected in these countries. And foreign direct investment in particular may have been restrained (relative to what it might have been) by the uncertainties of the legal and institutional arrangements in emerging economies. Another explanation that has been offered for the weakness in investment spending is the shift in the nature of investment from physical assets to research and development.[13] Finally, in some areas, such as telecoms, past excessive investment may still be in the process of being worked off.

Looking forward, one might expect higher investment rates in the emerging/developing economies in line with the demographic situation in those countries relative to those in advanced economies, accompanied by higher foreign direct investment as confidence increases in the stability of these countries. And improved financial infrastructures in developing countries will contribute both to the rise in foreign direct investment inflows and increased opportunities for domestic investment and residential construction. Thus, over time the differing demographic pressures on advanced and emerging economies will likely lead to substantially increased investments in developing and emerging economies by lenders in industrialized countries, provided that the institutional and legal environment and the financial infrastructure of developing and emerging economies are supportive of such foreign investment. In addition, as the cautious attitudes resulting from the financial crises of the late 1990s dissipate and the over-investment in the high-tech area is worked off, the relatively low investment ratios in many emerging economies are likely to reverse. All these developments should act in the direction of appreciably increased world investment rates.

Econometric studies of saving and investment also yield some insights as to the forces driving these variables. The analysis in the IMF World Economic Outlook of September 2005 found that two factors were particularly important in explaining the decline in savings in industrial countries over the 1997 to 2004 period. First was the increase in credit to the private sector (which is interpreted as likely approximating for the wealth effects from the sharp increase in house prices in many countries) and the second was the fall in public saving (especially important in the United States and Japan). The investment equation in the WEO suggests that investment appears to be below the levels that would usually be associated with this stage of the economic cycle.

A recent empirical study by Bank of Canada researchers (Desroches and Francis, 2007) found that investment is negatively related to the world real interest rate and stock market volatility, and positively related to growth in the labour force and in output and to favorable stock market returns. Savings are positively associated with world real interest rates and with temporary increases in real incomes, and negatively associated with measures of world private credit and house price indexes. Interestingly, the study finds that savings rise with an increase in the young dependency ratio, but also with an increase in the elderly dependency ratio. While the life cycle hypothesis would have suggested the reverse result for the latter, the bequest motive and increased uncertainty regarding life expectancy might account for the positive relationship. A

decline in fiscal deficits also leads to higher savings and lower real interest rates. A principal conclusion in this study (p.15) is that "the key factors explaining the trends in investment and savings over the last 35 years are variables that change relatively slowly over time. The variables affecting investment demand are found to include labour force growth, stock market returns, stock market volatility and economic and financial liberalization. Desired savings is mainly explained by the age structure of the world economy, temporary income and government deficits. Other variables such as the level of financial development – reflected in the ability to mobilize savings, to allocate capital, and to facilitate risk management – also affect savings."

Overall, it would appear that the main source of the saving glut has been relatively low intended investment rather than relatively high intended saving. Nonetheless, looking forward, the factors driving both intended saving and intended investment will play a role in the movements of long-term real interest rates. While some of the driving factors over the last few years may be long-lasting, others are likely to become less important or even disappear over time.

Looking forward, the combination of somewhat higher saving rates and appreciably higher investment rates should result in the reduction of the saving glut and somewhat higher real interest rates. The upward pressures on long-term real interest rates from movements in desired world saving and investment should in principle be gradual, and probably not overly strong. However, sudden changes in market views with respect to the fundamental factors driving world saving and investment could lead to abrupt changes. Also, it is extremely unlikely that a reversal of the global saving glut would return long-term real interest rates to the levels of the 1980s and 1990s because of the other factors that have also contributed to the decline in world real interest rates over recent years, factors to which we now turn.

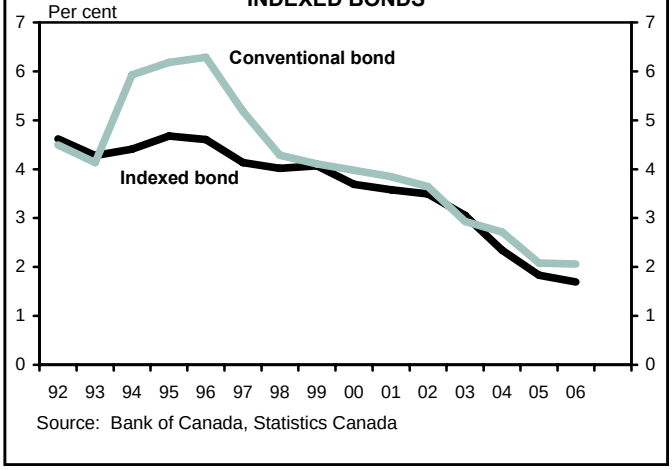
4C. The inflation risk premium

With the decline in inflation and in inflation volatility in the 1990s and 2000s in both industrialized and emerging economies, there was a gradual decline in expected inflation as well as in the uncertainty surrounding inflation. As well, inflation expectations increasingly became anchored to the announced target in inflation-targeting countries. The result of the increased confidence of investors that central banks would act to maintain the low rates of inflation that had been achieved was a decline in the inflation risk premium attached to conventional bonds. Of course, to repeat the point made earlier, this would have no effect on the return on indexed instruments, since they do not face any risk from unexpected movements in inflation. Hence, the decline in the inflation risk premium was probably an important factor in reducing nominal interest rates and the proxy for real interest rates derived from conventional bond rates, but not the proxy for real interest rates derived from the rate of return on indexed bonds.

As discussed above in section 3, the differential between the proxy for long-term real interest rates based on an unindexed bond and that based on an indexed bond is an estimate of the sum of the inflation risk premium, the error in measuring expected inflation, and the difference in the liquidity of the market for conventional, unindexed bonds and that of the market for indexed bonds.

In figure 6, one can see that this differential was high in the mid-1990s and much lower in the latter part of the 1990s and in this decade. This is consistent with a decline in the inflation risk premium on conventional bonds. Oddly, it was also low in 1992 and 1993. There are two possible explanations for this surprising result. One is that the estimate for expected inflation in these two years, which was based on past inflation during the period that included higher rates of inflation, overestimated the expectations that developed after the announcement of inflation targets and therefore underestimated the proxy for real interest rates based on conventional bond rates. The second was that liquidity was very low initially in the indexed bond market and hence a liquidity risk premium was incorporated into

FIGURE 6: CANADIAN LONG-TERM REAL INTEREST RATES BASED ON CONVENTIONAL & INDEXED BONDS



Source: Bank of Canada, Statistics Canada

the rate of return on indexed bonds, thereby reducing the differential.

The decline in inflation volatility would have been a factor in the global decline in real interest rates computed from conventional bonds, since inflation and inflation volatility have declined in most countries over the period under examination. The decline in the inflation risk premium would also likely have implied a less steep or more inverted term structure for conventional bonds. Because the uncertainty surrounding inflation was typically greater over longer periods of time, any reduction in that uncertainty and in the inflation risk premium should have more impact on financial instruments with longer terms than those with shorter terms. However, disentangling this factor from changes in the term risk premium discussed in the next section would be very difficult.

Looking forward, while there may be some reversal in the decline in the inflation risk premium if central banks are faced in the future with unfavorable shocks that they cannot easily offset in the short run, the commitment of central banks to maintaining low rates of inflation and to countering upward pressures on inflation over time[14] should prevent the inflation risk premium on conventional bonds from rising very much from their current low levels. However, given the current low level, there would be little expectation of a further decline in the inflation risk premium.

4D. The term risk premium

The term premium has been defined in a number of ways. The two most important from our perspective are the term premium on individual forward rates and the term premium on long-term instruments. The latter is the average of the former over the period of the investment.[15]

One approach used to estimate the forward premium is to compare forward rates, the implicit one-period interest rates for future periods embedded in the term structure of interest rates, with the subsequent actual one-period rates of interest. The forward rates include both the expected future one-period rates and risk premiums. If forward rates were typically larger than the subsequent actual rates, it could be interpreted as an indication of a term risk premium. Moreover, one would expect forward rates further out the term structure to incorporate a larger term risk premium than nearer-term forward rates, because risks are greater, the longer the period of time for which funds are committed. In such circumstances, the term structure would be positively sloped on average.[16]

To be more concrete, the forward risk premium M periods out can be measured as the average difference over time between one-period forward rates M periods in the future and the subsequent actual outcomes of the relevant one-period rate. That is, if the forward rate for a one-period instrument M years in the future on balance over-predicted the one-period rate that subsequently eventuated M periods later by x basis points, the estimate of the forward risk premium on the one-period instrument M years in the future would be x basis points. And the yield premium for an N-period instrument would be the average of the estimated term risk premiums on the one-period instrument from periods 1 to N. However, because other factors can also enter into the relationship between forward rates and subsequent spot rates, such as market liquidity for the instrument or the inflation risk premium, the estimates for forward and yield risk premiums may not be very precise.

The decline in overall economic volatility, in particular output volatility implies a clear decline in the term spread, hence a less steep or more inverted term structure of interest rates, as well as a decline in the equity risk premium. The reason for the less steep or more inverted term structure is that the term premium further out the yield curve is likely to be more affected by the reduction in economic volatility than the term premium at the short end. Given that the reduction in output volatility in recent years has been widespread internationally, the decline in the term risk premium would be consistent with a global decline in long-term real interest rates.

While estimating movements of the term risk premium over time is beyond the scope of this report, estimates of such movements can be found in the literature. The OECD study by Ahrend, Catte and Price (2006, figure 11) presents a Federal Reserve Board chart that shows a clear trend decline over the period 1990 to 2005 in the real term premium

In a recent article, Kim and Orphanides (2007) estimate that the two-year forward premium has declined from approximately 1% to 2% in the early 1990s to about zero currently, and the 10-year forward premium has declined from slightly above 3% in the early 1990s to about 1% at present. This would imply that the yield premium on 10-year bonds has declined from about 2% to 2½% in the early 1990s to about ½% currently. I would argue that the pure term risk premium, which would exclude the inflation risk premium and other risk factors, was probably lower

than the 2% to 2½% estimate for the early 1990s but close to the ½% estimate currently. In any case, there appears to have been a reduction in the term premium over the last decade and a half. And this reduction is probably due largely to the reduced volatility of the economy.

Looking forward, it does not seem that there is much likelihood of further declines in the term risk premium. Whether it will increase from the current low level will depend in large part on whether the lower volatility of the economy as a whole that we have seen over the last few years can be maintained. For those who explain the lower volatility of the economy as a result of fewer and/or smaller shocks than in past decades, there is a considerable likelihood of a reversal in the lower term risk premium since there is little reason to expect a continuation of this more benign environment over the long run. In contrast, for those (including myself) who attribute an important role in the reduction of economic volatility to better policy, most notably to monetary policy that has kept inflation low and stable and has thereby avoided many of the distortions associated with high rates of inflation, the likelihood of a substantial increase in term risk premiums in the future is much less.[17] This conclusion is, of course, based on the assumption that monetary policy will continue to maintain the low and stable rates of inflation of recent years.

4E. Supply and demand preferences

The two demand preferences that have received most attention in the literature are the purchases of US treasuries by foreign countries as they accumulated foreign exchange reserves and the tendency for pension funds and other long-term institutional investors to shift into longer-term debt. The main supply preference was the decision by the US Treasury to stop issuing long-term bonds during the period between October 2001 and February 2006.

Consider first the investment of foreign exchange reserves. If financial assets were perfectly substitutable for one another, a desire on the part of central banks and other managers of foreign exchange reserves to hold their foreign exchange claims in a particular form, such as long-term US treasuries for example, would have no effect on the rates of return on other financial assets, since other investors would adjust their portfolios to take advantage of the higher interest rates on financial instruments that are not desired by holders of foreign exchange reserves. Similarly, other borrowers would shift their liability issues into the desired term to take advantage of the lower interest rate on that term (assuming that there is perfect substitutability between treasuries and the instruments of other borrowers, after taking account of the default risk premium).

Suppose, more realistically, that not all financial assets are perfectly substitutable for one another. And suppose further that there is very high substitutability among bonds of different terms and of different currencies and of different borrowers, but much less substitutability between bonds and equities. In such a case, the purchase of US treasuries to hold as foreign exchange reserves could leave the term structure, the default risk premiums, and international bonds spreads more or less unchanged, while rates of return on equities would have to rise (i.e. the equity risk premium would rise and equity prices would fall).

If there were very imperfect substitutability across all assets, then the decline in the rate of interest on treasuries would be accompanied by an increase in the rate of return on other financial instruments. That is, risky spreads would increase, the equity risk premium would rise, and the rate of return on the bonds issued by those countries that were not a destination of foreign exchange reserves would tend to rise, with the effect being most strongly felt on those instruments that were sold to finance the capital inflows into the countries accumulating reserves. Moreover, if the focus of the purchase of US treasuries were on a particular term to maturity, the interest rates at that term to maturity would decline while those on treasuries with other terms to maturity would rise.

It is important to emphasize that we assume in the above analysis that the only factor driving the system in this case is the purchase of US treasuries arising from the accumulation of foreign exchange reserves, but that savings and investment patterns are unchanged. This would imply that the source of the foreign exchange accumulation was capital inflows into the countries accumulating reserves, and that these capital inflows would be accompanied by a reduction in the desired holdings of other financial assets, such as domestic equities or other debt. If, however, the accumulation of foreign exchange reserves was related to an increase in overall saving (and an increase in the current account) in the countries accumulating reserves, then the rates of return on all assets could decline, but even here the decline in the rate of return on the assets preferred by investors of the foreign exchange reserves should exceed that on other assets, providing substitutability is not perfect.

The analysis of the shift by pension funds into longer-term debt and the decision by the US Treasury to cancel its issue of long-term debt in 2001 would be very similar to that discussed above, with the exception that there is no reason to think that there would be any change in saving behaviour accompanying the portfolio change. Thus, whether such actions have a large effect on the interest rate of the financial instrument being demanded or supplied relative to those on other financial instruments would depend on the degree of substitutability across markets for the various types of financial instruments. It has been argued that the shift by pension funds was most important in the United Kingdom, where such funds had previously been invested largely in equities and where the regulations governing pension fund investments were changed. The shifts in pension fund portfolios appear to have been less important in other jurisdictions.

A final analytic point that is worth noting is that the substitutability across asset classes and terms is likely to be greater over the longer term than over the shorter term. Thus, even if there were some effect on specific interest rates of investment and borrowing preferences, such effects should become less important as time passed. Financial markets would gradually adjust over time, and participants in financial markets might well introduce new products and innovative techniques to take advantage of interest rate differentials arising from investment and borrowing preferences.

To test for such differentiated effects on the targeted financial assets versus others, one could examine spreads of various sorts, or forward rates on different terms of the instrument favoured by managers of foreign exchange reserves. Over the period under examination, the fact that long-term interest rates of many countries and of many issuers all fell, and in some cases fell more than those of US long-term treasuries (as evidenced by the decline in spreads) indicates that this factor was not the only factor at work, and also that it was probably not the principal factor at work.

Warnock and Warnock (2006) argue that although the improved credibility of US monetary policy contributed importantly to the decline of US nominal long-term interest rates in the 1990s, more recently foreign official flows into US government bonds have been a key factor reducing long-term nominal interest rates. They estimate that the foreign official flows into US government bonds over the previous year accounted for a decline of 90 basis points in the 10-year US treasury yield. In my view, this estimate is unreasonably large. The authors do recognize the partial equilibrium nature of their analysis, and point out that their results might overstate the effect of foreign official inflows by not completely capturing the effects of other factors. Most important, they may have conflated the effect of the saving glut and that of the foreign official inflows.

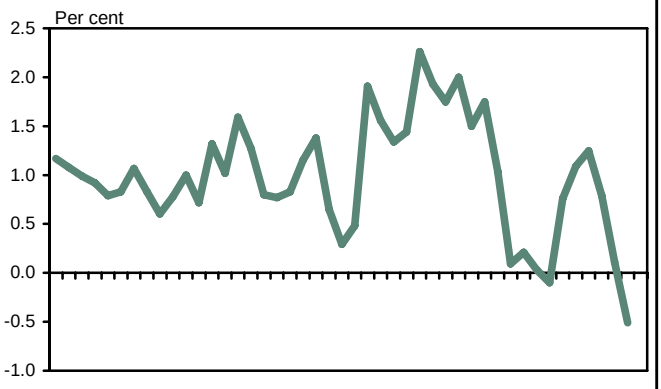
In sum, the effect on interest rates on specific financial instruments of supply effects and demand preferences depends on the substitutability across financial instruments. The greater is the substitutability, the less is the effect of such supply and demand pressures, as other participants in financial system change their positions in financial instruments to take advantage of any interest rate effects. Substitutability is greater in the longer run than in the shorter run, as new instruments and techniques are developed to take advantage of interest rate spreads resulting from supply and demand pressures. Thus, while shifts in asset demand related to official capital flows and pension fund investments may have had some short-run effects on specific interest rates, they are unlikely to have played an important role in the longer-term global developments. And I would expect that future effects on real interest rates connected to shifts in asset demand related to official capital flows and pension fund investments would tend to dissipate in the longer run.

4F. The fiscal risk premium

A very important factor in the movement of Canadian long-term real interest rates relative to those in other countries, most notably the United States, appears to have been the improvement in the fiscal track in Canada that began with the February 1995 budget of the federal government. Figure 7 sets out the differential between 10-year nominal bond yields in Canada and those in the United States and figure 8 depicts the real differentials. In both cases there has been a trend decline since the mid-1990s and the differentials are now lower than those that prevailed in the 1960s.

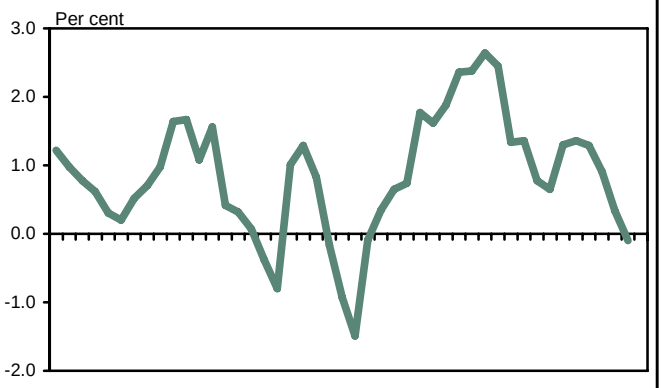
Looking forward, if Canadian fiscal outcomes continue to be better than their US counterparts, the apparent negative fiscal risk premium on Canadian government bonds relative to their US counterparts that seems to be developing could well continue. In such a case, the Canadian long-term real interest rates would be lower than those in the United States, other things being equal. This effect on interest rates would be the result of the relatively low fis-

FIGURE 7: CANADA-US SPREAD: NOMINAL 10-YEAR BOND YIELDS



Source: Bank of Canada, Statistics Canada

FIGURE 8: CANADA-US SPREAD: REAL 10-YEAR BOND YIELDS



Source: Bank of Canada, Bureau of Labor Statistics, Statistics Canada

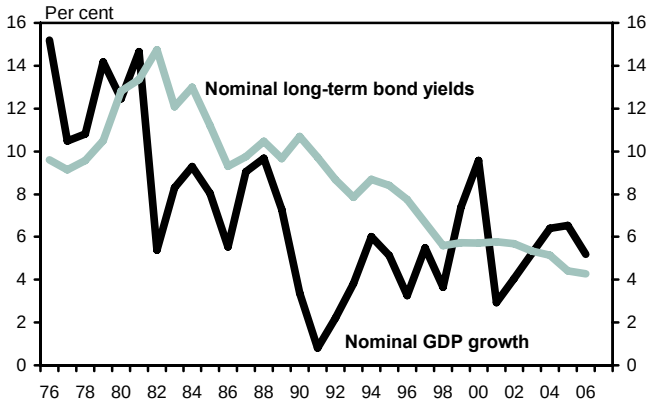
cal risk premium in Canada, rather than specifically linked to the supply of long-term debt provided by the federal government. Thus, even if the better fiscal position resulted in a reduction only in short-term debt issued by the federal government, the lower fiscal risk premium should result in a reduction in the long-term real interest rate. However, either a deterioration in Canadian fiscal performance or an improvement in US fiscal performance could result in the relative fiscal risk premium on Canadian instruments moving to zero or positive. My own view is that in the medium run, Canada's fiscal performance will continue to be better than that of the United States and that this will lead to Canadian real long-term interest rates being lower than their US counterparts on average. Moreover, if Canadian inflation performance in the future is as good as, or better than, the US inflation performance, lower real interest rates in Canada than in the United States would also translate into lower nominal interest rates in Canada than in the United States.

4G. Addendum on a link of nominal and real interest rates to nominal and real GDP growth

Some commentators have emphasized a link between GDP growth and the level of interest rates. There is a theoretical aspect to the presumed relationship. In growth models, there are golden rules and modified golden rules in the steady state that indicate the level of the real rate of interest that is consistent with the maximum sustainable per capita level of consumption. In the Solow model, the golden rule outcome is that the real interest rate should equal the growth rate of real output. In models with optimizing consumers, abstracting from technological progress, the modified golden rule is that the real interest rate should equal the rate of growth of the labor force plus the rate of time preference. Moreover, dynamically efficient growth paths require that the real interest rate exceed the growth rate of real output. In these neoclassical growth models, the real interest rate is best thought of as the real rate of return on capital or equity. What is observed in actual economies is that the average real rate of return on government securities is considerably less than the average real rate of return on equity, and the difference has come to be known as the equity risk premium. I would conclude that the relationship between the real interest rate on government securities and the real growth rate of output is likely to be very loose, particularly since even the theoretical models require only that the real rate of interest should exceed the growth rate of output, but they do not constrain the real rate of interest to move with real output growth (except for golden rule outcomes).

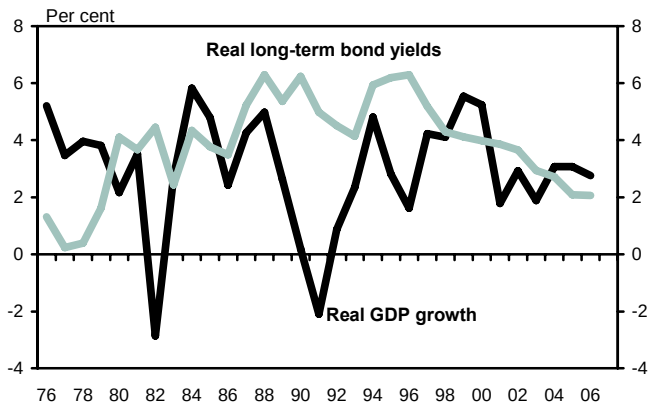
In Canada, there is a relatively weak empirical relationship between nominal GDP growth and nominal long-term interest rates, and virtually no empirical relationship between real GDP growth and real long-term interest rates. These results are shown in figures 9 and 10, respectively. Over the period 1976 to 2006 the correlation coefficient between nominal GDP growth and nominal interest rates was 0.42, while that between real GDP growth and real interest rates was -0.18. This indicates that most of the presumed relationship comes from the inflation component of nominal GDP growth and nominal interest rates.

FIGURE 9: CANADIAN NOMINAL LONG-TERM BOND YIELDS & NOMINAL GDP GROWTH



Source: Bank of Canada, Statistics Canada

FIGURE 10: CANADIAN REAL LONG-TERM BOND YIELDS & REAL GDP GROWTH



Source: Bank of Canada, Statistics Canada

5. Summary and conclusions

What is the final outcome of this analysis? First, it would appear that the explanation for the developments in real interest rates globally and in Canada over the last decade or so is multifaceted, with no one single explanation able to account for all the relevant phenomena. Second, it appears that the saving glut has been a key factor in the decline of the global real interest rate over the period under examination, along with the declines in the inflation risk premium and the term risk premium. Demand and supply preferences for specific assets or specific terms to maturity might help to explain developments in the rates of return on particular assets in certain countries, but do not rank in importance with the other factors.

Movements of global real interest rates (largely caused by the saving glut and the worldwide decline in term and inflation risk premiums) played a key role in the decline in Canadian real interest rates. In addition, the improvement of the fiscal situation in Canada relative to that in the United States contributed importantly to the fact that Canadian long-term real interest rates declined more over the period than did US long-term real interest rates. It is likely that the declines in the term risk premium and the inflation risk premium in Canada were not much different from the declines in these risk premiums elsewhere, and therefore the relative movements in these risk premiums were unlikely to have contributed much to the relative decline in Canadian long-term real interest rates.

Looking forward, the level of Canadian long-term real interest rates that is likely to prevail a decade from now will depend both on global developments and on specifically Canadian developments. Let us begin with global developments since these are likely to play a major role in real interest rate movements in an economy, such as Canada's, that is very open with respect to both trade and capital movements and that is subject to major spillovers from external demand shocks. The factors affecting the saving glut are likely to evolve gradually, since they tend to be rather sluggish. However, while changes in the variables underlying saving and investment are likely to be gradual, there can be abrupt changes in perception with respect to the factors influencing saving and investment, and such changes in perception can cause sudden changes in real interest rates. For example, an announcement by the Chinese authorities of a policy change with respect to safety net arrangements that would lead to a reduced saving rate in that country could in principle have significant implications for market projections of future world savings and of global real interest rates. Similarly, an announcement of changes in demographic projections by statistical bureaus might affect market views of future demographic movements and hence have an abrupt influence on real interest rate projections.[18]

As described above, there are many factors driving global saving and investment projections, and the projected outcome for some of these factors remains very uncertain. Overall, I would expect that the conflicting factors affecting desired saving would tend to lead gradually to a somewhat higher saving rate, while desired investment expenditures would have a stronger upward tendency as they return to more traditional levels. Among the factors

that would prevent saving rates from increasing more would be the tendency of households in emerging economies moving up the income scale to choose to spend more of their incomes on consumer goods and services. An important development facilitating this adjustment would be the improvement in retail finance that would likely accompany the economic development of these countries. Among the more important factors that would put upward pressure on investment rates would be the return to normalcy in Southeast Asia as the memory of the crisis of the late 1990s dissipates. Perhaps most important would be the desire over time of those industrialized countries with rapidly aging populations and fewer investment opportunities to increasingly invest in those emerging economies with much younger populations and consequently more investment opportunities. What will be crucial in this context will be the ability of the emerging and developing economies to improve their legal and institutional frameworks, and their capacity to improve financial institutions and markets to facilitate such capital inflows. My overall judgment is that there will be a gradual reduction in the saving glut that will lead to some upward pressure on long-term real interest rates.

The downward movement in the inflation risk premium and term risk premium could reverse if the commitment of central banks to achieving low and stable inflation were to weaken, or if it turned out that central banks were less able to achieve this goal than currently seems to be the case. My own expectation is that central banks will continue to maintain low and stable inflation rates and that these risk premiums will remain low relative to the level seen in the 1980s, although they might increase somewhat from current levels.[19]

The least important factor globally looking forward relates to investor and borrower preferences for specific types and terms of financial instruments. In part, this relates to the fact that substitutability across markets is higher over the longer run than it is over the shorter run and, relatedly, to the ability of financial participants to arbitrage across markets and/or to engineer new products that would take advantage of differences in rates of return across financial instruments and markets.

Over the shorter term, differential movements in Canadian and global demand shocks could also lead to deviations between Canadian long-term real interest rates and global/US long-term real interest rates. However, unless the differential demand shocks are very significant in size, they should not have long-lasting appreciable effects on the long-term real interest rate differential.

I would expect US long-term real rates 10 years from now to be higher than the lows that they reached of about 1% to 1½% and even than the current levels of about 2% to 2½%, and that they would be in the neighborhood of 3%, somewhat above the long-term real rates of about 2 2/3% prevailing in the relatively stable 1961 to 1965 period.[20] This projection is somewhat higher than the level that prevailed during the reference period because the United States no longer has the advantages of having the only large open financial market in the world, and being by far the largest economy in the world and the center of the world financial system. As well, its internal and external debt situations are far worse than in the earlier period. The nominal long-term rates corresponding to those projected real rates would be about 5%, assuming that the explicit or implicit target rate of inflation is set at 2 percent. If inflation rates should rise and/or become more volatile, I would expect real rates to be somewhat higher than this projection and nominal rates to be higher by a greater amount. If target inflation rates in the United States should be reduced below 2%, it would likely have little effect on long-term US real interest rates, but would result in lower long-term US nominal interest rates.

As far as Canadian long-term real interest rates are concerned, possible deviations from global rates could arise from differences in inflation volatility or economic volatility relative to those elsewhere. The most likely outcome in my view is that inflation volatility and economic volatility remain subdued in Canada in much the same way as elsewhere, and therefore idiosyncratic developments arising from these types of volatility in Canada would not be a source of deviations of long-term real interest rates in Canada from long-term global real interest rates. What is more likely is that Canada will adhere to a better fiscal track than the United States and therefore will be able to maintain slightly lower real interest rates than in the United States because of a lower fiscal risk premium. The projection for long-term real interest rates in Canada 10 years from now would therefore be on the order of 2¾%. As is the case with the global projection, I believe specific demand and supply characteristics of Canadian debt will not be very significant in the longer run although they could influence short-run movements in long-term real interest rates. If the target rate of inflation remains at 2%, this would imply a long-term nominal rate of interest in the

neighborhood of 4¾%.

The implication of the above analysis is that both US and Canadian yield curves should have small positive slopes on average, as a result of the small remaining term risk premium, inflation risk premium, and, where relevant, fiscal risk premium. Over time, as aggregate demand movements put upward and downward pressure on inflation relative to explicit or implicit inflation targets, the yield curve will have periods of negative and positive slope.

Of course, there is a great deal of uncertainty surrounding these projections. What is most important in assessing them is to remember that they are conditional on the assumptions contained in the above discussion.

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Endnotes for the title

[1] This non-technical study is based on an earlier more technical study, which is available on request from TD Economics, (416) 982-8065.

[2] Scholar in Residence, Economics Department, Carleton University, Ottawa, Canada; formerly Deputy Governor, Bank of Canada. I would like to thank Deming Luo for very helpful research assistance, and Don Drummond and John Murray for very useful comments on an earlier draft of this report.

Endnotes for the report

[1] Throughout this report, we use annual data. Because the focus of the report is on trends over the longer term, annual data are sufficient for our purposes.

[2] While the discussion in the text focuses on the uncertainty with respect to the price of the bond and hence implies a positive term premium for long-term bonds, if the concern by investors is primarily related to the uncertainty with respect to the income received from a sequence of short-term investments, the term premium on a long-term bond could be negative. For example, if the major investors in the market were pension funds, which wanted longer-term certainty of income receipts because of their expected payment outflow patterns, long-term risk premiums might well be negative.

[3] Some analysts incorporate both the inflation risk premium and the pure term risk premium in the concept of the term risk premium on nominal interest rates. Alternatively, one could consider the term risk premium as applying to the uncertainty surrounding long-term real interest rates, leaving the uncertainty surrounding the expected rate of inflation to the inflation risk premium.

[4] In addition, to the extent that the debt is denominated in a foreign currency, the country may not have sufficient foreign exchange to repay such debt.

[5] There might be some difficulty in disentangling the effects of a worldwide saving glut, which could be associated with high global savings and which would likely lead to a decline in interest rates in many countries, and the effects of specific investment preferences in those countries that were building up their international reserves as a result of large capital inflows, which would likely lead to differentiated results in interest rates in different countries. In principle, the movements of cross-country spreads could help to differentiate between these cases.

[6] Borrowers could also shift between debts issued in the home currency and debts issued in the foreign currency to minimize their expected costs.

[7] The appendix to the more technical version of this paper mentioned in footnote 1 of the endnotes for the title provides a much more detailed analysis of the four factors discussed in the text.

[8] However, if the saving glut is expected to persist for only a relatively short period of time, its effect would be greater on short-term real interest rates than on long-term real interest rates, and the yield curve should become steeper or less inverted.

[9] To the extent that there is a home country bias in financial investment, real interest rates in those countries that are the principal source of the global saving glut should decline more than real interest rates in other countries.

[10] Global changes in the fiscal situation are not treated separately here, but rather are included as part of the saving glut. If there were important changes in the sustainability of the global fiscal track, it would have to be treated separately since it would affect fiscal risk premiums.

[11] The difference between the two variables, which are equal by definition, can be attributed to measurement error.

[12] Some countries, such as Norway, have been very disciplined in holding down spending out of income from non-renewable energy sources. Others have been considerably less disciplined in previous episodes of high oil prices, but seem to be making more of an effort to save much of the increase in their income in this most recent episode.

[13] But if the spending is being expensed, it should have shown up as a reduction in corporate profits, which has not been the case.

[14] Under flexible inflation targeting or the equivalent in countries that do not have a formal inflation target, central banks act to bring the rate of inflation gradually back to the target following a shock that has dislodged it from its explicit or implicit target. The gradualism is intended to avoid undue volatility in output and possibly in interest rates. As a consequence, for some period of time after the shock the rate of inflation will differ from the target rate.

[15] Kim and Orphanides (2007) describe these two concepts as the forward premium and the yield premium, respectively. Se also Swanson (2007) for a discussion of issues related to the term premium.

[16] Recall that the inflation risk premium would also be higher for longer-term instruments than for shorter-term instruments, and that it would be hard to disentangle the two effects on the yield curve.

[17] In this context, I would note that, contrary to the view that the economic environment has been benign in recent years, this group believes there have been many shocks of a sizable nature in recent years, including the collapse of the high-tech bubble, the stock market crash, the terrorist attacks of 9/11, Enron and other financial debacles, and the sharp increase in energy prices in the recent period.

[18] In this context, the possibility of overshooting in long-term real interest rates following changes in market perceptions of some of the driving factors is worth noting.

[19] The judgment in the text refers to risk premiums on central government debt in industrial countries. The risky spreads on both corporate debt and emerging economy debt seem to have reached levels that are unsustainably low and will probably increase to some extent from current levels.

[20] The choice of 1961 to 1965 as a reference period is based on the fact that it succeeded the economically more volatile 1950s and preceded the period of rising inflation that began in the second half of the 1960s.