



C.D. Howe Institute
Institut C.D. Howe

C.D. Howe Institute

COMMENTARY

THE PENSION PAPERS

The Case for Trills:

Giving Canadians and their Pension Funds
a Stake in the Wealth of the Nation

Mark Kamstra
Robert J. Shiller



In this issue...

The time is right for Trills, a new security that would offer great direct benefit to Canadians as well as to the Government of Canada.

THE STUDY IN BRIEF

THE AUTHORS OF THIS ISSUE

MARK KAMSTRA is an Associate Professor of Finance at the Schulich School of Business, York University, and an Academic Advisor to the Pension Advisory Panel, C.D. Howe Institute.

ROBERT J. SHILLER is the Arthur M. Okun Professor of Economics, Professor of Finance at the Department of Economics and School of Management, Yale University. He is also Research Associate, National Bureau of Economic Research, and Chief Economist, MacroMarkets LLC.

Rigorous external review of every major policy study, undertaken by academics and outside experts, helps ensure the quality, integrity and objectivity of the Institute's research.

\$12.00; ISBN 0-88806-754-2
ISSN 0824-8001 (print);
ISSN 1703-0765 (online)

This study proposes that the Government of Canada issue a new debt security, the “Trill,” which would essentially offer Canadian investors an equity stake in the Canadian economy. The Trill is so-named because its coupon payment would be one-trillionth of Canada’s GDP. Similar to shares issued by corporations paying a fraction of corporate earnings in dividends, the Trill would pay a fraction of the “earnings” of Canada. Coupon payments would rise and fall with the GDP.

For average investors, the Trill would be a useful new source of income, offering both exposure to income growth and protection against inflation. This security would also appeal to large institutional investors. Pension funds have a need to match their long-term liabilities with assets that can provide stable, long-term cash flows. Currently, a large part of fund assets are held in nominal fixed-coupon Government of Canada securities. These securities do not provide protection from inflation and the limited numbers of real return bonds the government issues do not provide exposure to income growth.

For Government, Trills would also be beneficial. The authors show the cost of issuing Trills would be low, possibly less than some current government securities. Trills would have the additional benefit of providing a natural hedge against budget shortfalls, thus improving the government’s ability to achieve its goal of more stable funding. Most promisingly, the proceeds could be used to fund federal government obligations that are currently unfunded.

The study uses an asset pricing model to evaluate federal government employee and veteran future benefits, the likely characteristics of a Trill. The authors show that the securities would offer an attractive combination of risk and return for investors. Trills are an asset that cannot be replicated with existing assets, and would allow investors new portfolio diversification strategies that preserve high returns and lower volatility.

The issuer and the investor both stand to gain from Trills, making it a win-win financial innovation.

ABOUT THE INSTITUTE

The *C.D. Howe Institute* is a leading independent, economic and social policy research institution. The Institute promotes sound policies in these fields for all Canadians through its research and communications. Its nationwide activities include regular policy roundtables and presentations by policy staff in major regional centres, as well as before parliamentary committees. The Institute’s individual and corporate members are drawn from business, universities and the professions across the country.

INDEPENDENT • REASONED • RELEVANT

Perhaps the most pressing issue today for pension fund managers and, thus, investors saving for retirement, is the availability of assets that will provide stable long-term cash flows to fund expected payments to pensioners.

Traditionally, a large part of any pension plan's holdings has been in fixed-income assets such as long-duration government bonds. Pension funds typically hold about 25 percent to 30 percent of their net assets in fixed-income and inflation-protected bonds, highlighting the importance of very low risk securities. The Government of Canada currently issues a range of such debt instruments, including short-term and long-term debt with either nominal or real coupon payments. The largest portion of this debt is short-term, nominal-fixed coupon, which serves a primary objective of the federal government's debt strategy: providing a source of stable, low-cost funding for its operations.

In this *Commentary*, we make the case for the Government of Canada to issue a new security, one that we believe would offer great direct benefit to Canadian citizens as well as the Government of Canada. This new security would have its coupon tied to Canada's gross domestic product (GDP). Ideally, this security would be long term in maturity, perhaps even perpetual. Such a security would be attractive to private and public pension funds, as it would provide access to a broader range of income-earning potential in Canada. We believe this new debt instrument would also be of interest to the government for its stabilizing influence on the budget (as coupon payments would fall with declining budget revenues).

A small-denomination GDP share, for example, might pay a coupon each year of one-trillionth of that year's GDP, or about \$1.40 at current levels. On this basis, we propose the name "Trill" be used to refer to this new security. Similar to shares issued

by corporations paying a fraction of corporate earnings in dividends, the Trill would pay a fraction of the "earnings" of Canada. Given the characteristics of GDP growth, our valuation of the Trill indicates its yield would be very attractive to the issuer, the Government of Canada – and, for the same reasons, would be a useful new source of income to investors who want exposure to income growth and protection against inflation.

Why Investors Need Trills

Because nominal GDP would be used to determine the Trill's coupon value, the inflation-protection properties of the Trill would resemble that of Canada's Real Return Bonds (RRBs) and the US Treasury's Inflation-Protected Securities (TIPS). Inflation protection alone would be sufficient to generate interest in Trills comparable to that which exists for RRBs and TIPS. Further interest would be generated by an additional desirable characteristic of Trills; namely, that their coupons would respond to variations in GDP. Trills would protect relative standards of living in retirement, since they are a constant share of GDP, in contrast to an RRB or TIPS, which purchase a declining real share of a growing GDP over time.

The recent successful effort by the Ontario Teachers' Pension Plan (OTPP) to take over BCE Inc. is an example of pension plans' thirst for long-duration assets. Matching cash inflows and outflows is at the heart of any pension fund investment strategy since pension obligations stretch out over decades. Many plans, such as OTPP, offer benefits that are linked to wages as they accrue and to inflation once they are in pay. Investing in real assets and inflation-protected bonds are two ways these plans seek to generate steady, inflation-protected income flows.

There is a wide range of assets currently available to large pension plans. These include: municipal, provincial, territorial and federal government bonds; international government and real return (inflation-protected) bonds and debt; domestic and

We would like to thank Robin Banerjee, Lisa Kramer, Yvan Guillemette, David Laidler, Finn Poschmann, Bill Robson, and the C.D. Howe Institute Pension Papers Advisory Panel – in particular, Bruce Gordon, Steven James, Nicholas Le Pan, Andrew Spence and Terry Troy – for helpful comments and suggestions, and Hormuz Dastur for research assistance. Any errors are ours alone.

foreign publicly traded equities; derivatives (such as equity swaps and futures, exchange-traded futures contracts and foreign-exchange forwards); commercial paper, bank notes, mortgages, private equity, real estate and infrastructure assets. A reasonable person might wonder, what more does the market need?

Although the availability of publicly traded debt, equity and derivative securities, as well as private equity assets, makes for a fairly comprehensive menu with which to diversify a portfolio, these securities represent a small fraction of the wealth of the nation. Wages, salaries and supplementary labour income make up roughly two-thirds of Canada's GDP, but trading on claims to these income flows is essentially closed off to markets and investors. While it is true that government debt is a claim on future labour income, the majority of this debt is short term and produces income flows that are fixed nominal coupons. Claimants to this debt may benefit from avoiding the repercussions of a slowdown in the economy, but they do not enjoy the gains from a growing Canadian economy as would claimants to a security such as a Trill, which would grow with GDP.

Corporate profits (including those generated by private equity firms) represent approximately 20 percent of Canadian GDP. Without access to direct claims on future labour income, which makes up the bulk of the remaining income flows in Canada and hence the bulk of the wealth of the nation, pensioners are restricted to the return from holding capital. During the 20th century baby boom, the capital/labour split of corporate income may have favoured the relatively scarce resource of capital. But in the 21st century, labour is likely to become relatively scarce, and returns to capital will likely decline.

If afforded the opportunity to invest in Trills, investors could insulate themselves from declining returns to capital and ever more expensive labour costs. Even if the capital/labour split of corporate income remains steady in the coming decades, the opportunity to purchase this new class of security brings with it the potential for higher returns that exhibit less volatility over time, the classic win-win of diversification.

The target-income funds, or life-cycle funds, that are newly popular in Canada are designed for people in a specified age cohort. For example, the Scotia Vision Conserv 2030 Portfolio invests for those planning to retire in 2030, while the Fidelity ClearPath 2045 Sr A plan invests for people who want to leave the work force in 2045. These funds have high equity exposure when their participants are young and reduce the exposure as they age. In the future, they could better fulfill their basic mission by taking a dynamic portfolio strategy involving Trills. Ideally, they would hold a relatively small proportion of their portfolio in Trills (or even short Trills) when their participants are still young, so as to reduce their exposure to the risks of the economy and their labour income. As participants approach retirement, when their welfare increasingly depends on investments rather than labour income, the funds would invest progressively more heavily in Trills.

Holders of Registered Retirement Saving Plans (RRSPs) could also benefit from options that are tailored to their individual circumstances. The RRSP could, for example, hold investments in target-income funds that optimize Trill holdings. As we outline below, estimating the return to holding a Trill is fairly straightforward. Standard mean-variance (return versus risk) optimization over asset classes, including the estimated return to holding Trills, suggests that Trills would allow investors a return very nearly as high as that of the TSX, with half the volatility. Indeed, investors gain a much higher return and lower volatility than if Trills are excluded from the mix. This mean-variance optimization produces an optimal portfolio composition of 47 percent of assets in long-term bonds, 17 percent in the TSX index and 36 percent in Trills. Thus, the addition of Trills to the asset mix available today would likely have a dramatic impact on investor portfolio composition and investor well-being.

Why Ottawa Should Introduce Trills

The benefits and the costs to Canadians more generally are of primary concern when considering the introduction of the Trill. While a positive argument can be made for investors holding this

new security, an important question is whether issuing Trills make sense for the issuer, the Government of Canada. Is the investor's gain the taxpayer's loss?

To understand if a case can be made for issuing these new securities, it helps to consider the current objectives of the government with respect to issuing debt obligations, and look forward to the challenges of managing the nation's wealth. The Government of Canada issues very few classes of securities, but ensures that the issued securities are both easily marketed at favourable yields and traded in liquid, well-functioning markets. An explicit statement of the Government of Canada's debt policy can be found in the 2007 budget plan.

The main objective of the federal debt strategy is to raise stable and low-cost funding to meet the operational needs of the Government. An associated objective is to maintain a well-functioning Government of Canada securities market, which helps to keep debt costs low and contributes to efficient capital markets by providing important pricing and hedging tools. (Annex 3.)

So the first priority of the government, in normal times, is to raise stable and low cost funds for government activities. Stability and low cost are actually competing goals, as the short-term securities issued by the government are typically cheapest to issue, but also exhibit the most volatility in yield over time. We will discuss the second priority – maintaining efficient financial markets – after careful consideration of the cost and stability of funds associated with issuing Trills.

The Cost of Borrowing

To preview our results, the cost of Trills would likely be little more than 1 percentage point above that of short-term government debt (the return to Trills would be from the coupon and the capital gains), and the coupon yield would be very low, in the same range as RRBs. The competing goal of stable funding for the government clearly favours the introduction of the Trill. A fiscal planner, concerned with the cost of servicing debt in a recession, would view the Trill as a natural hedge

against budget shortfalls – the coupon paid on the Trill will track government revenues as both rise and fall with the GDP.

What features enable low-cost funding? Basically, any security that moves risk away from the investor and onto the issuer will be more highly valued by investors and therefore entail a lower cost for the issuer. Still, it seems likely that the cost of issuing Trills would be higher than that of issuing fixed-coupon, inflation-protected debt.

The inflation-protected RRBs already issued by the Government of Canada have a number of features that are attractive to investors. There is virtually no default risk with RRBs (likely no more than a Trill would pose), there is little or no inflation risk (which is similar to the inflation protection afforded by the Trill) and, unlike the coupon from a Trill, the RRB is fixed in real terms. In good times and bad, an investor gets a known, risk-free real return.

The coupon from the Trill, on the other hand, will vary with the GDP of the economy. This is good for the issuer, the Government of Canada, because when the economy is expanding rapidly and the Trill pays more to the investor, the government has better tax revenues and hence better ability to pay. When times are bad, the Trill pays (relatively) less, which is also good for the government because this is exactly when tax revenues fall.

For some investors, in good times there is less need for a big coupon from the Trill – all of an investor's income sources are likely paying off in good times. In bad times, when the investor may really need the money, the Trill is paying less. In the language of financial economists, the Trill exposes investors to systematic risk and insures the government against it. These investors will need to be compensated for bearing this risk. For other investors, including pension funds, this disadvantage comes with an important offsetting advantage: Trills will provide higher incomes when their wage-indexed liabilities are growing more quickly in booms, and lower incomes when their wage-indexed liabilities are growing more slowly in slumps.

These cross-cutting considerations make it difficult to estimate whether Trills or regular fixed-coupon nominal debt will be cheaper for the Government of Canada to issue. Trills provide inflation protection while fixed-coupon, nominal debt provides fixed (albeit nominal) income flows. A more formal way of estimating the cost of capital associated with issuing Trills is through an examination of Canadian GDP's historical record. By treating GDP as a dividend and using tools for pricing income-producing assets, we can estimate the price and return of a Trill.

The valuation of any income-producing asset first requires an estimate of the risk premium¹ demanded by investors. Standard techniques to evaluate an asset's risk exposure rely on the availability of returns to that asset. To begin, one must estimate what a Trill might be worth, and then estimate how returns to a Trill would vary over time and co-vary with other risky assets. We apply a conservative estimate of the risk premium, using the premium investors expect for holding risky equities as a proxy for the premium investors would no doubt expect when holding a Trill. We employ an extension of the Gordon Model (1962) developed by Donaldson and Kamstra (1996).

THE GORDON GROWTH MODEL

The Gordon Growth Model discounts expected future cash flows, defining the price (P) of an asset as equal to the next period's cash flow (D) divided by the discount rate (r) minus the growth rate (g) of cash flows: $P=D/(r-g)$. Extensions we consider allow time-varying discount and dividend growth rates.

This valuation exercise will provide a lower bound on the value of a Trill and an upper bound on the cost of capital to the issuer, the Government of Canada. The Donaldson – Kamstra (DK) technique permits extremely complex scenario analysis that is otherwise infeasible, considering scenarios in which the income-flow growth rates and/or the risk premium never settle down and

possibly influence each other as well. Details on this procedure and related issues can be found in the Appendix.

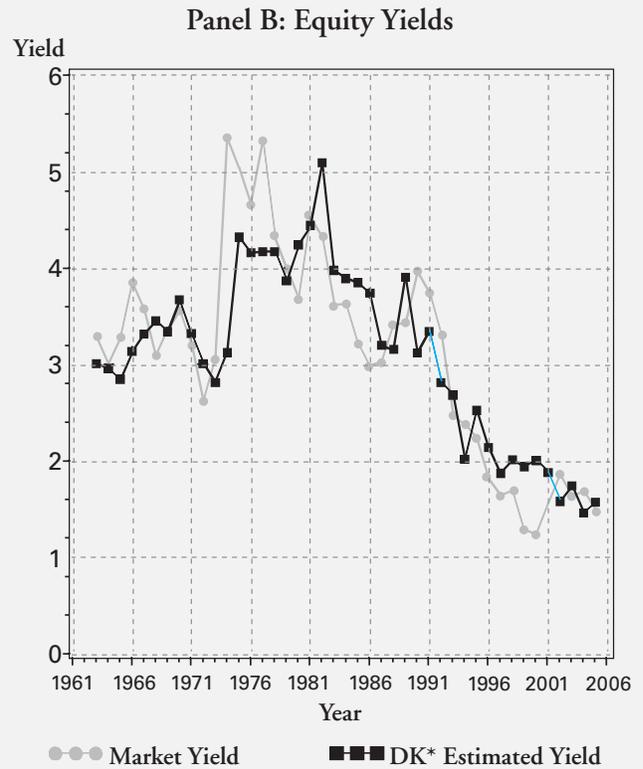
Figure 1 displays DK prices and associated yields for the TSX index (prices in Panel A, yields in Panel B) and what they would have been for Trills (Panels C and D) from the early 1960s to 2005, with prices normalized so that each investment is worth one dollar in 1966. Panels A and B also plot realized market prices and yields for the TSX index, which we will use to evaluate the success of the DK procedure. If the DK procedure is helpful, then the prices and yields it produces should capture the main features of the market price and yield – rapid appreciation over the past 40 years with remarkably low dividend yields.

Although the estimated prices (the line indicated with squares in Panel A) fall well below market prices (the line indicated with solid dots in Panel A) for the late 1990s, the estimated and actual prices generally move together. Indeed, the actual and fitted yields are highly correlated with a coefficient of more than 0.85. Altogether, application of the Donaldson-Kamstra approach to pricing the Canadian equity market lends some confidence to the notion that the DK estimated prices for the Trill would be a good first approximation to market prices, and that the estimated yields should not be wildly off the mark. If anything, the estimated prices and yields for the Trill are conservative, underpricing the asset and overestimating the required yield, because this method takes no account of the particular benefits these securities will offer to investors – pension funds in particular – that currently have no access to this type of asset.

Panels C and D of Figure 1 display estimated prices and yields respectively for Trills from the early 1960s to 2005, again with prices normalized to equal one in 1966. As we saw for the TSX index, prices increased dramatically in the 1990s. The similarity to the TSX index is not coincidental and comes from the favourable interest-rate environment and declining equity premium,

1 The risk premium is an ex ante premium or extra return (or price concession) investors demand when they decide to invest in risky assets like equities instead of risk-free debt.

Figure 1: Estimates for Equity Prices and Yields: The Donaldson – Kamstra method



* Price Estimate using the Donaldson – Kamstra valuation method.
Sources: Authors' calculations; TSX-CFMRC statistics.

which affects identically the value of the TSX index and the Trill.

The more dramatic increase in the plotted price of the Trill relative to the TSX index comes from the relatively rapid increase in the cash flow from owning a Trill, combined with the low fade rate² of this cash flow growth. (An increase in the growth rate of the Trill's cash flow is expected to persist much longer than that of the TSX index.) In general, good news (or bad) is expected to persist for the Canadian economy longer than for public equity. Hence, the strong economic growth of the 1990s would have led to very sharp increases in the value of a Trill, even sharper than that of the TSX index.

Given these results, it is likely that had Trills been available, we would have seen very aggressive appreciation in their price over the past half century, perhaps even greater than we have seen for the TSX index. The coupon yield on Trills (that is, the cash-flow-to-price ratio) would have been lower than the dividend yield on the TSX index, though the two would have been similar in magnitude.

The estimated coupon yield for Trills is attractive from the perspective of the issuer, hovering just above 1 percent in 2005 and typically resting below 2.5 percent. This compares very favourably with the yield offered on Treasury bonds, both real return and nominal coupon. The average total return to holding a Trill over the last half century would have been just over 12.5 percent, versus 11.5 percent for the TSX index, just under 10 percent for long-term bonds and a little over 7 percent for one-year Treasury bills (all in nominal terms). This high total return (and cost to the government of issuing Trills) is an outcome of the risk premium we imposed in our scenario analysis. Lowering our assumed risk premium lowers the total return to the Trill, but does not alter the dynamics of the return appreciably.

Another way to calculate the cost of capital relevant to issuing Trills is by estimating a Capital Asset Pricing Model (CAPM) beta for the Trill;

calculating the degree of correlation between the return on the Trill and the market return (typically proxied by the overall stock index). While the return to a Trill itself should be the appropriate measure of the total market return, since the Trill represents a claim on the GDP of the entire Canadian economy, we use a classic CAPM estimation for the purposes of evaluating the risk and appropriate reward for holding a Trill. Our analysis measures the amount of the TSX index return that is in excess of the Treasury bill return. The market excess return this CAPM regression produces a beta of approximately 0.30, showing that the Trill is clearly a low-risk asset.

The CAPM estimate of the required rate of return is 8.35 percent, indicating a risk premium of only 1.35 percent, about 2 percentage points lower than the conservative estimate we imposed to estimate the price of Trills, versus a premium of virtually zero for long-term nominal government debt.

So even before taking into account the additional willingness-to-pay of investors who would find Trills uniquely attractive, we conclude that the cost of Trills would likely be low, and possibly less than some outstanding government securities. The competing goal of stable funding for the government, moreover, potentially counterbalances any higher cost of borrowing. Georges (2003) shows that considerations of the overall budget balance through the business cycle can impact optimal debt management. Traditional analysis of debt management emphasizes debt maturity structure as a choice between low cost but volatile short-term debt and higher cost but more stable long-term debt. Georges (2003) points out that a fiscal planner would typically be most concerned with the risk that the cost of servicing debt jumps up at a time when the government budget can least afford it, say in a recession. This echoes a motivation for the offering of real return bonds in Canada: the value of diversifying government debt obligations to reduce the risk of a budget crisis, even if this diversification increases the average cost of borrowing to the government.³

2 Fade rate refers to the speed of a reversal to a baseline level.

3 We are grateful to Nicholas Le Pan for his insights on the process leading up to the adoption of RRBs in Canada.

Liability management issues lead directly to the Trill as a natural hedge against budget shortfalls – the coupon paid on the Trill would track government revenues as both rise and fall with the GDP.

Variants on the Trill could include bonds with coupons based on national income or consumption, or even tax revenues. Like GDP, these economic statistics are commonly revised over time. For example, a given year's final GDP figure may not be known with certainty for some time. Nevertheless, dividends are routinely paid to shareholders based on preliminary corporate earnings estimates, not final figures restated years later. Choosing a fixed date on which to determine the Trill's coupon, say three months after fiscal yearend, and using the real-time GDP estimate available at that time, would enhance investors' understanding of the income stream provided by a Trill.

Maintaining Efficient Financial Markets for Currently Available Debt Instruments

The impact of Trills on financial markets is an important consideration from the perspective of the Government of Canada. How would room be made for Trills without compromising traditional debt markets? It may be difficult to substitute Trills for conventional debt as it comes due. Capital markets rely on the term structure of Government of Canada nominal debt as a reference point for pricing other fixed-coupon nominal debt, and as a hedging instrument. This debt is also used to park wealth by foreigners seeking a safe haven from political and economic instability.

The current and ongoing reduction of the federal debt is already constraining the Canadian government's financing choices. So reduction of outstanding nominal-coupon debt to make room for a new debt instrument is unlikely. If it is not possible to make room for Trills in the regular issuance of government securities, there is a way forward: using the proceeds from the sale of Trills to fund federal government obligations that are currently unfunded, thus ensuring that the net indebtedness of the government does not increase.

Potential Uses for Proceeds from Trills

The most obvious use of the proceeds of Trills in the nearer term would be the funding of currently unfunded government obligations. A precedent for this change would be the government's 2000 move to fund future employee pensions: rather than adding a book-keeping entry to its unfunded pension liabilities every year as previously, the federal government now issues additional funded debt and is building a pension fund administered by an arm's-length board to invest in order to pay future pension

The most obvious use of the proceeds of Trills in the nearer term would be to fund federal government obligations that are currently unfunded

benefits. The federal government still has many unfunded obligations on its books – for example, the fair value of other employee and veteran future benefits as of March 31, 2007, was estimated at \$62.8 billion (Receiver General of Canada 2007, p. 2.18). Establishing investment funds to cover these and other liabilities is arguably desirable in its

own right, and would permit the federal government to issue large amounts of Trills without affecting its net indebtedness or reducing outstanding securities of other kinds.

Another potential use of the proceeds from the sale of Trills would be an investment fund similar to those established to manage budget surpluses in many countries around the world, such as Norway's Government Pension Fund, and Canada's own Alberta Heritage Fund. The government would want to invest the proceeds from the sale of Trills to earn sufficient returns to cover their coupon payments. To the extent there are surpluses and shortfalls in the income flows from such a fund, these could be used to stabilize government revenues. In this way, government cash flows would be less vulnerable to macroeconomic surprises such as those resulting from the Canadian economy's traditional reliance on oil and raw materials. Such a fund would face governance issues, and the proposition that the government can deploy such funds more effectively than private investors would strike many Canadians as doubtful. To mitigate this, we recommend that the proceeds from issuing Trills be pooled in a fund similar to that managed by the

Canadian Pension Plan Investment Board. They should be used to invest in international assets only, which would both promote diversification and prevent political influence from directing the investments toward (low-return) special-interest domestic projects.

Should the Government of Canada decide to issue Trills, we expect other countries to follow suit over time, just as Finland's introduction of Real Return Bonds in 1946 led to many other nations following suit. The availability of Trills issued by countries around the world would present an opportunity for nations to buy each other's Trills, using the proceeds from the sale of their own Trills. This would result in the pooling of income across nations and the reduction of the volatility of those nations' income streams, because different nations' business cycles are less than perfectly correlated.⁴ This is an attractive prospect: if developing countries were to issue Trills and purchase developed countries' Trills, the booms and busts the developing countries experience would have a muted impact on their ability to provide basic services and to manage their own debt obligations. Emerging market economies have perhaps the most to gain from the introduction of Trills, but the prospect of a developed economy sharing in the growth of these emerging economies should be reward enough for providing this free-market-priced insurance policy.

Who Would Buy Canadian Trills?

While we expect pension funds and individual Canadians would line up to purchase Trills, they may not be the only interested parties. Foreigners would also be potential purchasers. As noted in the previous section, purchases of other countries' Trills would offer a new and valuable kind of international diversification.

Should we be concerned with foreigners owning this sort of claim on Canada's income? We do not think so. First of all, foreigners are already allowed to own Canadian Government debt, so Trills set no precedent. Furthermore, if Trill-equivalents from other countries become available to

Canadians, the resulting exchange of claims would be of great value to Canadian pension fund managers (and fund managers from around the world) because of the benefits of diversification. Business cycles of nations, while correlated, do not move in lock step, and the availability of assets that perfectly track GDP cycles of nations from around the world would provide a new asset class for diversification, an important contribution of Trills.

Trills even offer the potential to stabilize world economies by increasing international interconnectivity and reducing the incentive of governments to engage in mutually destructive trade wars.

Similar Securities from Around the World

The first proposal we know of for a true GDP-linked bond came from Shiller in 1993. In *Macro Markets: Creating Institutions for Managing Society's Largest Economic Risks* he draws comparisons between a firm's earnings and a country's GDP, and describes the same GDP-linked security that we propose here.

Borensztein and Mauro (2004) sought to revive the case for GDP-growth-linked bonds, Kruse, Meitner and Schroder (2005) detail how to price bonds with coupons tied to the growth of the GDP, and Griffith-Jones and Sharma (2006) outline the benefits of introducing GDP-linked bonds and document various countries' efforts to establish such instruments. To the best of our knowledge, no country has issued true GDP shares. In the mid-1990s, bonds with attached GDP warrants were issued by Bulgaria, Bosnia and Costa Rica in concert with their Brady Plan restructurings. These bonds included clauses to increase coupon payments at predetermined GDP thresholds rather than smoothly with the GDP.

In 2001, Singapore issued the New Singapore Shares, which pay a 3 percent return plus the economic growth rate of Singapore, if positive, rather than a coupon tied to the GDP level. Argentina's 2005 GDP warrants are a fairly complicated financial instrument. Payments are linked to the growth of the economy, rather than the level of the GDP, and are conditional on three

⁴ See, for instance, Backus, Kehoe and Kydland (1995) and Baxter (1995).

criteria being met simultaneously. First, real GDP must be at a higher level than a predetermined baseline GDP. Second, real growth of GDP must be greater than a baseline growth. Finally, there is a total payment cap.

In contrast, the Trill would be as simple and familiar as shares in corporations. We believe that transparency and simple structure are essential to establishing demand for these securities and ensuring that their market is liquid. Tying the Trill's payment to the level of the GDP of Canada would accomplish these goals.

While a few countries have experimented with GDP-bond-like instruments, a sensible question to ask is why there has been no attempt to issue a true GDP bond. There are several possible reasons for the limited interest to date. First, it is plausible that government Treasury officials do not perceive any need to issue such a security. The primary obligation of any country's Treasury (as it is commonly perceived) is to enable low-cost financing for government's operational needs. Treasuries are not generally perceived as having a risk-management role. Investors will typically be willing to pay a higher price for fixed-coupon debt than for GDP bonds whose coupons would fluctuate with the economy's performance. Hence, fixed-coupon debt and, especially, real-return debt will normally be relatively cheaper for the government to issue. Our own analysis indicates the cost of issuance of the Trill will be in the order of 135 basis points above other government debt.

It is likely no coincidence that the countries that have experimented with GDP-bond-like instruments have typically been those facing debt crises; those with few or no alternative options for issuing low-cost debt. Just as new, risky firms have trouble accessing low-cost public debt markets and instead turn to issuing higher cost instruments such as new equity, the countries that have explored the possibility of issuing GDP-like bonds have been, for the most part, those with few other options than to be innovative in their search for capital.

Another reason for Ottawa's limited interest in issuing GDP bonds likely arises from the secondary objective of the Canadian government's debt policy – to ensure the efficiency of the market for government securities. To date, the government has sensibly focused its efforts on providing liquidity to the traditional nominal-coupon bond market. Without the regular and routine issue of large quantities of new nominal government debt, the market for nominal debt instruments cannot function properly.

This pressure to promote government debt market liquidity has a tendency to mitigate any potential interest in exploring new debt instruments. Even in the US, where there is a growing federal debt, the Treasury experiences continuing high demand for nominal Treasury notes, bonds and bills. In Canada, where the government is reducing the size of the national debt and consequently reducing the need to issue new bonds, there is additional pressure to keep Treasury markets liquid.

There is a possibility that Trills could be privately issued. But Trills, by their very nature, are most naturally issued by a national government. A national government can most effectively hedge the claims provided by a GDP bond with both the right to tax income and the ability to invest proceeds from issuing the GDP bond in other nations' similar securities.

Notwithstanding their novelty and these reservations, however, we feel that Trills would be a useful addition to the range of available government securities in Canada. Pension funds in Canada are larger than ever, and the good fit between this type of asset and their liabilities suggests to us that there would be a lively appetite for Trills, and that Trills would be issueable at reasonable cost to the government. Importantly, moreover, we think that by funding currently unfunded liabilities, the federal government could issue Trills without either increasing its net indebtedness or hurting the liquidity and completeness of the markets for other government securities.

Trills would be a useful addition to the range of available government securities in Canada

Conclusions

A Trill is essentially an equity stake in Canada's economy. When publicly traded companies issue equity rather than debt, they typically do so because debt markets are not available to them or the addition of more debt to their capital structure would unacceptably increase their risk of bankruptcy. Given a choice, incumbent equity holders would rather not have to share with others the growth potential of a company. For the introduction of Trills to make sense for Canadians, it must be the case that the availability of an equity stake in Canada solves some problem that issuing debt cannot solve.

We believe this new debt instrument would be of interest to the Canadians for its stabilizing influence on the budget (as the Trill's coupon payments would fall with declining budget revenues), in contrast to the menu of fixed-coupon debt instruments currently available. Our valuation of the Trill indicates its yield would be very attractive to the issuer, the Government of Canada, and Trills would, at the very least, provide a convenient tool to fund federal government obligations that are currently unfunded, making government finances more transparent.

We have made a case that Trills would also help pension plans diversify into inflation-protected

assets tied to the wealth of the nation and would allow individuals planning for retirement to enjoy the benefits of real economic growth in Canada. In the language of financial economists, the current menu of available assets is incomplete. There are risks in the economy, related specifically to human capital and the GDP, that cannot be traded in existing financial markets. (The risks associated with companies' fortunes, in contrast, can be traded in existing equity and corporate bond markets.) For investors seeking a return tied to Canadian labour productivity and the overall growth in the economy, there is simply no substitute for the Trill. Introducing Trills would help complete financial markets, which would lead to better diversification and hedging possibilities for everyone.

Standard financial analysis suggests that Trills would provide the issuer, the Government of Canada, with a budget-stabilizing, moderate-cost debt instrument, and investors with an asset that cannot be replicated with existing assets, allowing investors new portfolio diversification strategies that preserve high returns and lower volatility. The issuer and the investors in Trills would both stand to gain from Trills, another case of win-win through financial innovation and diversification.

Appendix: Valuation of the Trill

Since the Trill is a security that is not now available, its price and return can be only estimated. We present two valuation exercises here, one being the projected valuation of a Trill, the other being the valuation of the Canadian publicly traded equity market, proxied using the Toronto Stock Exchange-Canadian Financial Markets Research Center (TSX-CFMRC) indices for the TSX market. The most recent data from the CFMRC are the monthly closing S&P/TSX index prices and total returns. Analysis of a priced asset facilitates a comparison between the observed value and the estimated value. Presumably, if the valuation technique works well for pricing the TSX index, we can lean on it to price the Trill.

A large variety of methods have been proposed for the valuation of equity, and these are applicable as well to Trills. The best-known methods are based on the Gordon Growth Model of constant dividend growth and constant discount rates. The Gordon Model, which discounts expected future cash flows, defines the price of an asset as equal to the next period's cash flow divided by the discount rate minus the growth rate of cash flows. For example, if the next period cash flow is expected to be \$1, the discount rate is 10 percent and the growth rate of cash flows 5 percent, then the Gordon Model would indicate a price of \$20 ($P = \$1 / (0.1 - 0.05)$).

While the notion of constant discount rates and dividend growth rates is simple to work with, more realistic models of dividends and discount rates have been developed, including models that embed a fixed probability of maintaining the dividend payment at current levels and a probability of raising it.

One early model, based on methods developed by Campbell and Shiller (1988), was used by Shiller (1993), but that method as applied to GDP took no account of changing discount rates.

The Additive Markov Gordon model (see Equation 1 of Yao 1997) and the Geometric Markov Gordon model (see Equation 2 of Yao

1997) are more recent examples of equity valuation models. They still impose constant discount rates, meaning that investor risk aversion and market interest rates are constant, which seems improbable.

Another extension of the Gordon Model, developed by Donaldson and Kamstra (1996), permits predictably changing and auto-correlated dividend growth and discount rates. This auto-correlation can be understood as a fade rate; that is, the speed at which a rate converges to its long-run stable rate. The more auto-correlation, the slower the fade and the higher the value of the asset experiencing a (temporarily) higher-than-average growth in cash flows. We have not fully resolved our differences on the extent to which the volatility of markets can be explained in terms of a rational model, but agree that it is useful to consider such models.

To appreciate the importance of fade rates in valuation, take the example of a firm with two equally likely scenarios for cash-flow growth rates. Under one scenario, the rate decreases from its past average of 10 percent to 7 percent. Under the other, the average rate increases to 13 percent. Once changed, the average rate remains constant.

Before the change in growth rates, the expectation is for an average growth of 10 percent, as it has been before any change. If the discount rate is expected to be 15 percent and the most recent dividend was one dollar, then the classic Gordon Growth Model would yield a price of $\$1 / (0.15 - 0.10)$ or \$20 per share.

However, if we recognize that cash-flow growth rate changes are permanent (an extreme form of auto-correlation, with no fade back to the average), then the Gordon prices should be calculated for each scenario separately and the two prices averaged to get a price that accounts for this auto-correlation. The low cash-flow growth rate case yields a price of $\$1 / (0.15 - 0.07)$ or \$12.50 per share, and the high-rate case yields a price of $\$1 / (0.15 - 0.13)$ or \$50.00 per share,

for an average price of \$31.25. Accounting for the fade rate dramatically changes the price estimate, increasing it by more than 50 percent.

Very similar numbers result if we use discount-rate changes instead of cash-flow growth rate changes. Even more dramatic examples can be constructed if both discount rates and cash-flow growth rates move in opposite directions. While it is straightforward to adjust the Gordon Model for a simple scenario like this, the Donaldson and Kamstra (1996) technique permits extremely complex scenario analysis that is otherwise infeasible, scenarios in which the cash-flow growth rate and/or the discount rate never settle down, and possibly influence each other as well. For more detailed descriptions of all these techniques, see Kamstra (2003).

Regardless, for all of these valuation techniques we need to establish the growth rate of cash flows, the cash flows themselves and the discount rate. Discount rates are often formed as the sum of a short-term, risk-free rate and a risk premium, the approach adopted here. The equity or risk premium is the premium investors demand before the fact, when the decision to invest in risky assets like equities instead of risk-free debt is first made.

A downward-trending equity premium also needs to be incorporated, with a total drop of 100 basis points over the period considered, the last half century. This includes a sudden drop of 50 basis points in the early 1990s. Including this decline in the equity premium is motivated by recent work of Pástor and Stambaugh (2001). The literature on the equity premium is large, continuously growing and much too vast to fully cite here. For recent work, see Bansal and Yaron (2004), Graham and Harvey (2005) and Jain (2005). For excellent surveys see Kocherlakota (1996), Siegel and Thaler (1997), Mehra and Prescott (2003) and Mehra (2003).

The average dividend yield on the TSX index over roughly the last half century has been slightly more than 3 percent, though it has trended down remarkably, now hovering around 1.5 percent. Cash-flow growth has averaged

about 5 percent and has been quite variable, with dividends falling more than 10 percent in some years and growing well in excess of 20 percent in others.

Growth in dividends shows little persistence or predictability, in contrast to one-year T-bill rates, which are highly persistent (i.e., exhibiting a very low fade rate). T-bill rates have averaged just less than 7 percent over the last half century, from as low as almost 2 percent to more than 15 percent. Even incorporating very low-risk premia, simple Gordon Growth Models imply much lower prices for the TSX index, and much higher yields than are seen in the market, so we do not employ these techniques for the pricing of Trills.

Using a risk premium that averages 3.5 percent, starting at 4 percent in the early 1960s and declining to 3.4 percent by 2005 (as implied by Donaldson, Kamstra, and Kramer, 2007 and Graham and Harvey, 2005), incorporating a slow fade rate for discount rates and a very rapid fade for cash-flow growth rates, and using the technique of Donaldson and Kamstra (1996), we find much more reasonable prices and yields than can be produced by the Gordon Growth models. Indeed, these results closely match the actual market prices and yields. (See Figure 1, Panels A and B in the main text.)

Had the Government of Canada issued Trills for the last half century, the growth rate of the cash flow from this asset would have averaged roughly 8.4 percent (nominal) annually, from as low as approximately zero to as high as approximately 20 percent. This annual growth rate is about half as volatile as the TSX index cash-flow growth rates over the same period. As well, the growth rate of this cash flow would be strongly auto-correlated, in contrast to the cash-flow growth rates of the TSX index. Again, using an average risk premium of 3.5 percent, incorporating a slow fade rate for discount rates, a slow fade rate for cash-flow growth rates and the technique of Donaldson and Kamstra (1996), we find a price appreciation of Trills from the 1960s to the present that is even more remarkable than for the TSX index. This growth

is driven largely by two factors: the relatively high growth rate in cash flows (GDP) and the strong persistence in these growth rates. (See Figure 1, Panels C and D in the main text.) A separate but closely related question is whether investors would hold a substantial portion of their portfolio in Trills, if Trills were available. In order to answer this question, we must compare the risk, return and covariance of the return from holding Trills with other risky assets. Consider a three-risky-asset world (the TSX index, long-term government bonds and Trills), plus a risk-free asset (the one year T-bill rate). Over the past half century, the returns to these assets are 11 percent,

10 percent, 12.5 percent and 7 percent for the risk-free asset (the one year T-bill rate). The volatilities of these assets are 16 percent, 11 percent, 16 percent and zero, respectively. The covariances of these assets indicate a small positive correlation between the TSX index and the Trill, zero correlation between long-term bonds and the TSX index and negative correlation between the Trill and long-term bonds. Standard mean-variance produces an optimal portfolio composition of 47 percent of assets in long-term bonds, 17 percent in the TSX index and 36 percent in Trills.

References

- Backus D.K., P. J. Kehoe and E.E. Kydland. 1995. "International Business Cycles: Theory and Evidence." In T.F. Cooley, ed. *Frontiers of Business Cycle Research*. Princeton University Press, 331-357.
- Bansal, Ravi, and Amir Yaron. 2004. "Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles." *Journal of Finance* 59(4): 1481-1509.
- Baxter, M. 1995. "International Trade and Business Cycles." In Gene Grossman and Kenneth Rogoff, eds. *Handbook of International Economics*. Amsterdam: North Holland.
- Borensztein, Eduardo, and Paolo Mauro, 2004, "The case for GDP-indexed bonds." *Economic Policy*, 19(38), 165-216.
- Campbell, John Y., and Robert J. Shiller. 1988. "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors." *Review of Financial Studies* 1:196:228.
- Canada. 2007. "Budget 2007: Aspire to a Stronger, Safer, Better Canada." Department of Finance. Ottawa.
- Donaldson, R. Glen, and Mark J. Kamstra. 1996. "A New Dividend Forecasting procedure that Rejects Bubbles in Asset Prices: The Case of 1929's Stock Crash." *Review of Financial Studies* 9: 333-383.
- Donaldson, R. Glen, Mark J. Kamstra and Lisa A. Kramer. 2007. "Estimating the *ex ante* Equity Premium." Toronto. York University Working Paper.
- Georges, Patrick. 2003. "Borrowing Short- or Long-Term: Does the Government Really Face a Trade-off?" Department of Finance, Canada, Working Paper 2003-16.
- Gordon, Myron J. 1962. "The Investment, Financing, and Valuation of the Corporation." *Journal of Business* 35 (4): 436-438.
- Graham, John and Campbell Harvey. 2005. "The Long-Run Equity Risk Premium." *Finance Research Letters* 2: 185-194.
- Griffith-Jones, Stephany, and Krishnan Sharma. 2006. "GDP-Indexed Bonds: Making It Happen." DESA Working Paper No. 21.
- Jain, Pankaj K. 2005. "Financial Market Design and the Equity Premium: Electronic versus Floor Trading." *Journal of Finance* 60(6), 2955-2985.
- Kamstra, Mark J. 2003. "Pricing Firms on the Basis of Fundamentals." *Economic Review*. Federal Reserve Bank of Atlanta. First Quarter: 49-70.
- Kocherlakota, Narayana R. 1996. "The Equity Premium: It's Still a Puzzle." *Journal of Economic Literature* 34(1): 42-71.
- Kruse, Susanne, Matthias Meitner and Michael Schroder. 2005. "On the pricing of GDP-linked financial products." *Applied Financial Economics* 15: 1125-1133.
- Mehra, Rajnish. 2003. "The Equity Premium: Why is it a Puzzle?" *Financial Analysts Journal* 59(1): 54-69.
- Mehra, Rajnish, and Edward C. Prescott. 1985. "The Equity Premium: A Puzzle." *Journal of Monetary Economics* 15: 145-161.
- Pástor, Lubos, and Robert Stambaugh. 2001. "The Equity Premium and Structural Breaks." *Journal of Finance* 56 (4): 1207-1239.
- Receiver General for Canada. 2007. *Public Accounts of Canada, Vol. 1: Summary Report and Financial Statements*. Ottawa: Minister of Public Works and Government Services.
- Seater, John J. 1993. "Ricardian Equivalence." *Journal of Economic Literature* 31: 142-190.
- Siegel, Jeremy J. 1999. "The Shrinking Equity Premium." *Journal of Portfolio Management* 26(1): 10-17.
- Shiller, Robert. 1993. *Macro Markets: Creating Institutions for Managing Society's Largest Economic Risks*. Oxford University Press.
- Shiller, Robert. 2003. *The New Financial Order: Risk in the 21st Century*. Princeton University Press.
- Yao, Yulin. 1997. "A Trinomial Dividend Valuation Model." *Journal of Portfolio Management* 23 (4): 99-103.

C.D. Howe Institute Commentary© is a periodic analysis of, and commentary on, current public policy issues. James Fleming and Michael Benedict edited the manuscript; Heather Vilistis prepared it for publication. As with all Institute publications, the views expressed here are those of the author and do not necessarily reflect the opinions of the Institute's members or Board of Directors. Quotation with appropriate credit is permissible.

To order this publication please contact: Renouf Publishing Company Limited, 5369 Canotek Road, Ottawa, Ontario K1J 9J3; or the C.D. Howe Institute, 67 Yonge St., Suite 300, Toronto, Ontario M5E 1J8. The full text of this publication is also available on the Institute's website at www.cdhowe.org.

The C.D. Howe Institute launched the Pension Papers in May 2007 to address key challenges facing Canada's system of retirement saving, assess current developments, identify regulatory strengths and shortfalls, and make recommendations to ensure the integrity of pension earnings for the growing number of Canadians approaching retirement. The Institute gratefully acknowledges the participation of the advisory panel for the program:

Advisory Panel: C.D. Howe Institute Pension Papers Program

Co-chairs:

Claude Lamoureux

Former President and CEO of the Ontario Teachers' Pension Plan

Nick Le Pan

Former Superintendent of Financial Institutions, Canada

Members:

Keith Ambachtsheer,
Rotman International Centre for Pension
Management, University of Toronto;
Bob Baldwin;
Steve Bonnar,
Towers Perrin;
Frank Fedyk,
Human Resources and Social Development
Canada;
Peter Drake,
Fidelity Investments;
Bruce Gordon,
Manulife Financial Canada;
Malcolm Hamilton,
Mercer Human Resource Consulting Limited;
Bryan Hocking/ Scott Perkin,
Association of Canadian Pension Management;
John Ilkiw,
Canada Pension Plan Investment Board;

Michael Nobrega,
Ontario Municipal Employees' Retirement
System;
Ellen Nygaard,
Alberta Finance;
Jim Pesando,
University of Toronto;
John Por,
Cortex;
Tammy Schirle,
Wilfrid Laurier University;
Jack Selody,
Bank of Canada;
Terri Troy,
Pension Investment Association of Canada;
Fred Vettese,
Morneau Sobeco;
Barbara Zvan,
Ontario Teachers' Pension Plan.

- July 2008 Banerjee, Robin, and William B.P. Robson. *Greener Future: Why Canadian Workers Need More Robust Business Investment*. C.D. Howe Institute e-brief.
- July 2008 Chen, Duanjie, and Jack M. Mintz. *The Report on 2008 Federal and Provincial Business Tax Policies*. C.D. Howe Institute Commentary 270.
- July 2008 Milne, Frank. *Anatomy of the Credit Crisis: The Role of Faulty Risk Management Systems*. C.D. Howe Institute Commentary 269.
- July 2008 Busby, Colin. *Richer Than We Think: Why Canadians' Purchasing Power Is Up While Economic Growth Is Down*. C.D. Howe Institute e-brief.
- July 2008 Auld, Douglas. *The Ethanol Trap: Why Policies to Promote Ethanol as Fuel Need Rethinking*. C.D. Howe Institute Commentary 268.
- June 2008 Finnie, Ross, and Ian Irvine. *The Welfare Enigma: Explaining the Dramatic Decline in Canadians' Use of Social Assistance, 1993–2005*. C.D. Howe Institute Commentary 267.
- June 2008 Pesando, James E. *Risky Assumptions: A Closer Look at the Bearing of Investment Risk in Defined-Benefit Pension Plans*. C.D. Howe Institute Commentary 266.
- May 2008 Ambachtsheer, Keith. *The Canada Supplementary Pension Plan (CSPP): Towards an Adequate, Affordable Pension for ALL Canadians*. C.D. Howe Institute Commentary 265.
- May 2008 Tomlin, Ben. *Clearing Hurdles: Key Reforms to Make Small Business More Successful*. C.D. Howe Institute Commentary 264.
- May 2008 Shiell, Leslie, and Colin Busby. *Greater Savings Required: How Alberta can Achieve Fiscal Sustainability from its Resource Revenues*. C.D. Howe Institute Commentary 263.
- May 2008 Schirle, Tammy. *Greener Pastures: Understanding the Impact of Retirement Incentives in Defined-benefit Pension Plans*. C.D. Howe Institute Commentary 262.
- May 2008 Wyman, Michael. *Power Failure: Addressing the Causes of Underinvestment, Inefficiency and Governance Problems in Ontario's Electricity Sector*. C.D. Howe Institute Commentary 261.
- April 2008 Laidler, David. "Food and Energy Prices: Why the Bank of Canada Should Remain Focused on the CPI." C.D. Howe Institute e-brief.
- April 2008 Banerjee, Robin and William Robson. "Lifting the Lid on Pension Funding: Why Income-Tax-Act Limits on Contributions Should Rise." C.D. Howe Institute e-brief.
- April 2008 Dachis, Benjamin. "Slicing the Pie: Federal Assistance for Provincial Sales Tax reform." C.D. Howe Institute e-brief.
- April 2008 Brennan, Tim. *Generating the Benefits of Competition: Challenges and Opportunities in Opening Electricity Markets*. C.D. Howe Institute Commentary 260.
- March 2008 Dymond, Bill, and Michael Hart. "Navigating New Trade Routes: The Rise of Value Chains, and the Challenges for Canadian Trade Policy." C.D. Howe Institute Commentary 259.
- February 2008 Poschmann, Finn. "Still High: Marginal Effective Tax Rates on Low-Income Families." C.D. Howe Institute Backgrounder 113.

SUPPORT THE INSTITUTE

For more information on supporting the C.D. Howe Institute's vital policy work, through charitable giving or membership, please go to www.cdhowe.org or call 416-865-1904. Learn more about the Institute's activities and how to make a donation at the same time. You will receive a tax receipt for your gift.

A REPUTATION FOR INDEPENDENT, NONPARTISAN RESEARCH

The C.D. Howe Institute's reputation for independent, reasoned and relevant public policy research of the highest quality is its chief asset, and underpins the credibility and effectiveness of its work. Independence and nonpartisanship are core Institute values that inform its approach to research, guide the actions of its professional staff and limit the types of financial contributions that the Institute will accept.

For our full Independence and Nonpartisanship Policy go to www.cdhowe.org.

C.D. Howe Institute
67 Yonge Street
Toronto, Ontario
M5E 1J8

Canadian Publication Mail Sales
Product Agreement #40008848