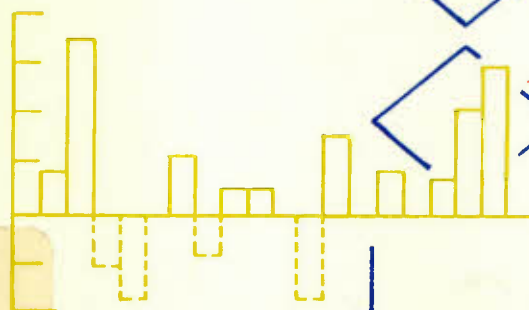


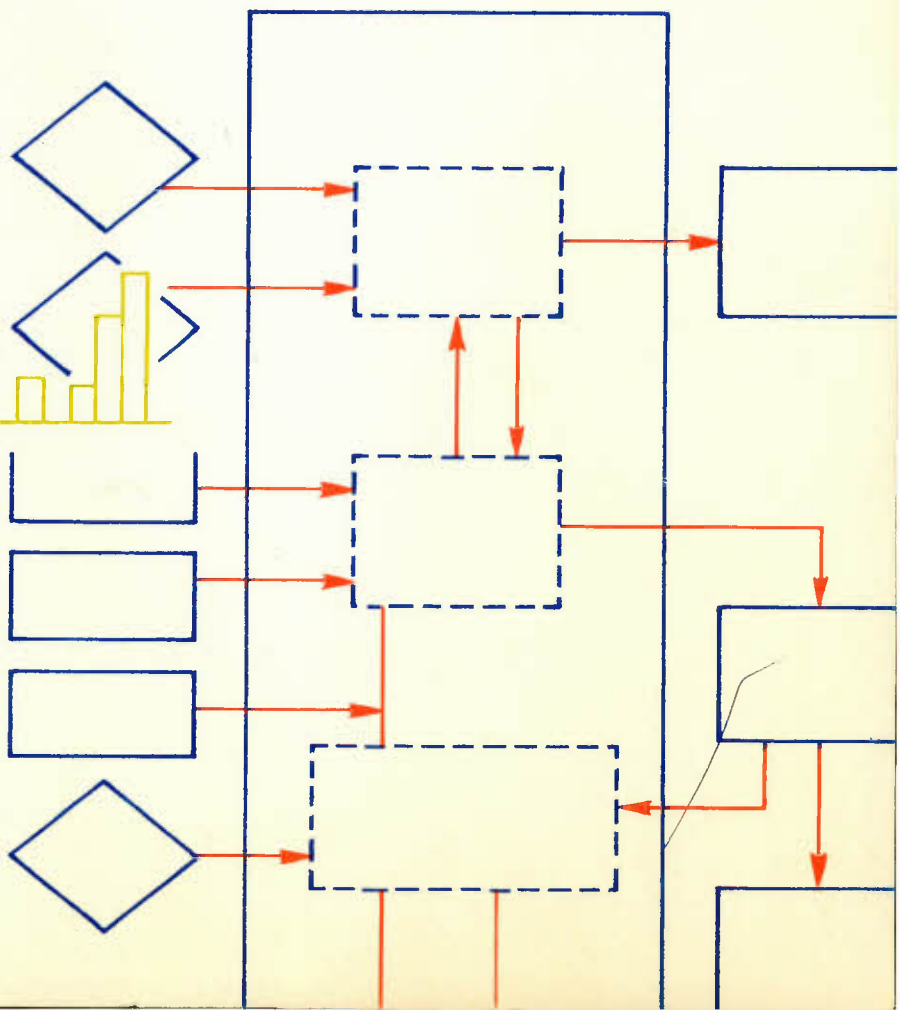
A paper prepared for the
Economic Council of Canada

Un document préparé pour le
Conseil économique du Canada



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DISCUSSION PAPER No. 148

Inflation and the Rates of Return
on Bonds and Equities

by James E. Pesando

Background Paper to the
Sixteenth Annual Review

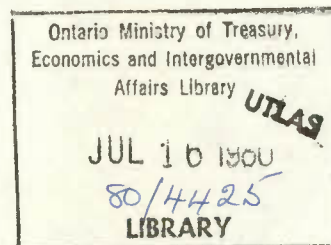
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January 1980

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RÉSUMÉ

Cette étude examine brièvement les données canadiennes relatives aux effets de l'inflation sur les taux de rendement des valeurs à revenu fixe et des actions ordinaires. Son principal objectif, cependant, est de tenter d'expliquer les résultats empiriques des études antérieures. L'étude s'intéresse avant tout au rôle des facteurs fiscaux, et en particulier au manque de neutralité à l'égard de l'inflation que manifestent les systèmes canadiens d'impôt sur le revenu des particuliers et des sociétés.

L'auteur fait remarquer que l'intérêt nominal reflète des hausses de prix prévues dans une proportion d'au plus un pour un. Ce résultat laisse entendre que le taux d'intérêt réel, après impôts, diminue suite à une augmentation du taux prévu d'inflation. L'auteur finit par identifier l'imposition inappropriée des revenus des sociétés en période inflationniste comme étant responsable de ce résultat à première vue surprenant. En effet, il semble que cette imposition limite la mesure dans laquelle les sociétés peuvent faire augmenter les taux d'intérêt nominaux, afin de financer des projets d'investissement intéressants. Bref, ce résultat doit être évalué dans un contexte d'équilibre général plutôt que partiel. Les données confirmant que l'inflation tant prévue qu'imprévue abaisse le taux réel de rendement des actions ordinaires se fondent aussi sur le manque de

neutralité du système fiscal. De fait, le résultat montre que l'inflation, même si elle est prévue, transfère des ressources du secteur privé au secteur public.

L'auteur mentionne aussi un certain nombre de répercussions possibles sur les politiques, y compris les effets que provoque l'ouverture de l'économie canadienne ainsi que le système fiscal actuel aux Etats-Unis.

ABSTRACT

This study briefly reviews the Canadian evidence regarding the impact of inflation on the rates of return on fixed-income securities and common stocks. The main purpose of the study, however, is to seek an explanation for the previous empirical findings. Attention is devoted to the role of tax factors and, in particular, to the non-neutrality of the Canadian personal and corporate income tax systems with respect to inflation.

The evidence that price expectations are built into nominal interest at most on a one-for-one basis is briefly noted. This result implies that the real, after-tax rate of interest declines in response to an increase in the expected rate of inflation. This result, which may be superficially surprising, is traced ultimately to the inappropriate taxation of corporate income in an inflationary climate, which - in turn - limits the extent to which corporations can bid up nominal interest rates in order to finance real investment opportunities. In short, this result must be evaluated in a general rather than a partial equilibrium context. The evidence that both expected and unexpected inflation depress the real rate of return on common stocks is also grounded in the non-neutrality of the tax system. The result, in effect, reflects the fact that inflation transfers resources from the private to the public sector even if it is expected.

A number of policy implications, including those which stem from the open nature of the Canadian economy together with the existing tax system in the United States, are also noted.

I INTEREST RATES AND INFLATION

In early tests of the impact of price expectations on nominal interest rates, researchers assumed (often implicitly) that (1) the role of income taxes could be ignored and (2) price expectations per se exert no impact on real interest rates. Although still faced with the problem of obtaining adequate proxies for the (unobserved) price expectations of market participants, researchers felt comfortable with the proposition that price expectations would be incorporated on a one-for-one basis into nominal interest rates.

The restrictive nature of these assumptions has received considerable attention in recent years, and the fact that economic theory does not predict an exact reflection of price expectations into nominal rates is now well known. The fact that taxes are levied on nominal interest income, for example, suggests that nominal interest rates should rise by more than the increase in the expected inflation in order to preserve after-tax real returns. To the extent that an increase in price expectations, through its effect on the consumption-saving and wealth allocation decisions, serves to depress equilibrium real rates, nominal interest rates would rise by less than the increased in the expected rate of inflation. The former effect is perhaps of special interest since traditional economic analysis attaches quite small welfare costs to a stable and fully anticipated rate of inflation. This traditional analysis loses its validity, however, if the tax system is not completely neutral with respect to inflation, a fact which commands attention in any discussion of the impact of inflation on both bonds and equities.

Pesando (1977) summarizes the evidence from recent studies with both Canadian and United States data, and notes that this evidence is roughly consistent with a one-for-one reflection of price expectations in nominal interest rates. The relevance for Canada of the results obtained in the United States merits emphasis. Although purchasing power parity merits qualification on both theoretical (the existence of non-traded goods) and empirical (it has not proved to be an accurate predictor of short-run exchange rate movements) grounds, its prediction that arbitrage activities in a world of high capital mobility will tend to equalize after-tax real returns across international markets has unquestioned merit. If (1) the net result of conflicting forces is to produce a one-for-one incorporation of price expectations into U.S. interest rates and (2) expected exchange rate movements mirror differences in the expected rates of inflation in Canada and the United States, then arbitrage forces in a world of mobile capital will ensure that interest rates in Canada will also reflect on a one-for-one basis the expected domestic rate of inflation. This result not only motivates the interest in results obtained for the United States, but also highlights - as will be shown - the danger in certain of the tax changes which have been proposed as a means of providing tax relief to Canadian investors.

The discussion proceeds in four stages. In the first, the most recent empirical evidence - and certain technical problems - are briefly noted. In the second, the alternative explanations of why interest rates do not rise sufficiently to preserve the after-tax return of taxable investors are critically reviewed. In the third, the role of uncertainty

with respect to the rate of inflation is noted, together with the implications of the evidence which suggests that both the variance of inflation and the variance of relative prices are positively correlated with the actual rate of inflation. In the fourth and final section, the policy implications of the preceding analysis are summarized.

1. Price Expectations and Interest Rates: the Latest Evidence

Recent studies with Canadian (Pesando (1978a)) and United States (Feldstein and Summers (1978), Friedman (1978), Levi and Makin (1979) and Pearce (1979)) data suggest that the incorporation of expected inflation into both short-term and long-term interest rates is at most on a one-for-one basis (Table 1). Further, the results of Pesando, Feldstein-Summers, Levi-Makin, and Pearce indicate that the responsiveness of interest rates to price expectations may have fallen over time, as the results for the more recent sample periods generate smaller coefficients for the price expectations proxies. This result is clouded, however, by an increasingly important caveat regarding the adequacy of alternative proxies for the nonobservable price expectations of market participants, together with technical complications surrounding the estimation of equations which seek to explain the behavior of long-term interest rates.

With the exception of Levi-Makin, who employ only the recorded inflation forecasts compiled by J.A. Livingston, all of the authors cited above employ proxies for price expectations which presume that economic agents draw only upon information contained in the past history of inflation in

Table 1

THE IMPACT OF PRICE EXPECTATIONS ON INTEREST RATES: THE MOST RECENT STUDIES

Investigator (Year)	Data/Sample Period	Proxy for Price Expectations	Interest Rate	Impact	Durbin-Watson Statistic
Feldstein-Summers (1978)	U.S., quarterly, 1954:1-1976:4	(1) Optimal time series	long-term corporate bond	(1) 0.94	0.13
		(2) Distributed lag		(2) 0.83	0.21
Friedman (1978)	U.S., quarterly, 1960:1-1973:4	Distributed lag [in structural model]	long-term corporate bond	0.64	N.A.
Levi-Makin (1979)	U.S., quarterly, (1) 1950:1-1970:4 (2) 1947:1-1975:4	Recorded price expectations data (Livingston)	6-month commercial paper	(1) 1.04 (2) 0.66	1.27 1.04
Pearce (1979)	U.S., quarterly, 1959:4-1975:4	(1) Optimal time series	6-month Treasury bills	(1) 0.46	N.A. (p=.54)
		(2) Recorded price expectations (Livingston)		(2) 0.64	N.A. (p=.64)
Pesando (1978)	Canadian, quarterly, 1961:1-1976:4 1961:1-1971:2	(1) Distributed lag	long-term Canada bonds	(1) 0.64	0.53
		(2) Distributed lag, variable weights		(2) 0.95	0.96
		(3) Distributed lag		(3) 0.95	0.68

forming that inflation forecasts. The existence of recent shocks which economic agents may have treated as transitory, such as the dramatic increase in oil prices and the depreciation of the North American currencies, together with the extraordinarily high - by historical standards - rates of inflation in most of the 1970s, may have led market participants to discount much of this experience in formulating their long-term price expectations. Pesando provides some formal evidence that may have been the case by employing a variable weight distributed lag procedure, and noting that the pattern of estimated lag weights is consistent with this interpretation. In general, however, the possibility that researchers are not obtaining precise measures of the long-term price expectations of market participants must be acknowledged and the results so obtained must be qualified accordingly. For the short-run price expectations relevant for the determination of the nominal rates on treasury bills and commercial paper, this problem is likely to be of lesser importance. The results obtained by Levi-Makin and Pearce for short-term interest rates, in which the estimated coefficients of the price expectations proxies do not exceed 0.65, are thus especially disturbing to those who argue that tax factors should cause nominal rates to rise by more than an increase in the expected rate of inflation.

The second important caveat, especially with regard to long-term interest rates, arises from the high degree of serial correlation which characterizes the equations designed to explain interest rate levels. As noted by Pesando (1979), long-term interest rates in an efficient market dominated by expectations forces will exhibit random walk characteristics.

The change in long-term interest rates should thus be a random variable which cannot be predicted on the basis of prior information, and thus equations designed to explain the level of long-term interest rates should be characterized by a high degree of positive serial correlation. If equations are estimated in first difference form, however, the result is to increase the relative importance of the "noise" contained in the expectations proxy, or the possible deviation of the proxy from the true (and unobserved) market expectation. The subsequent downward bias in the estimated coefficient of the proxy variable would greatly complicate the interpretation of the results. The high degree of serial correlation in the level regressions, on the other hand, indicates that little weight can be attached to estimated standard errors and hence to the estimated precision of the coefficients of the expectations proxies. In short, the estimates of the impact of price expectations on long-term interest rates must be interpreted with a great deal of caution.

To sum up, and subject to the caveats noted above, interest rates in both Canada and the United States at most reflect on a one-for-one basis changes in the expected rate of inflation. Of importance also is the fact that the responsiveness of interest rates to price expectations does not appear to have increased over time. This result suggests that the decline in after-tax real rates which accompanies an increase in the expected rate of inflation is not a transitory phenomenon which will disappear as lenders/investors readjust their portfolios across a widening range of investment options. Instead, the evidence suggests that the result is grounded in more permanent features of the economic system, and the identification of

these features remains a central concern of this report.

2. Alternative Explanations of the Decline in the After-tax Real Interest Rates When Price Expectations Increase

2.1 Direct Depressing Impact of Price Expectations on Real Interest Rates

Economic theory has identified at least two channels through which an increase in the expected rate of inflation may directly depress equilibrium real interest rates. As noted by Mundell (1963), an increase in the expected rate of inflation will lead to higher nominal interest rates and thus to a reduction in real money balances held by economic agents. Since real money balances are a component of wealth, the result is a lower level of consumption and a correspondingly higher level of saving out of disposable income. The higher saving, in turn will lead cet. par. to a reduction in the equilibrium real rate of interest. Following Tobin (1965), the result of the reduction in real money balances - given the savings rate - is to increase the proportion of wealth that economic agents seek to hold in real capital, thus again depressing the equilibrium real rate of interest. Both of these effects disappear if the demand for money is completely interest inelastic. Empirical studies, however, have unambiguously confirmed the interest sensitivity of the demand for money.

How important are these potential effects? Economists have succeeded in bringing little direct evidence to bear on this issue, although the general presumption is that these effects are not of great empirical importance. Feldstein (1976), for example, estimates in the context of a

neoclassical monetary growth model and assumed values of relevant parameters that the maximum reduction in the real interest rate occasioned by the portfolio effect identified by Tobin is no more than one percent of the increase in the expected inflation rate. Indeed, this maximum effect occurs only in extreme cases where the rise in the expected inflation rate is assumed to completely eliminate the demand for money. The magnitude of the Mundell effect, in turn, depends upon (1) the interest sensitivity of the demand for money, (2) the ratio of real money holdings to total wealth, (3) the responsiveness of consumption (and hence saving) to changes in wealth, and (4) the responsiveness of the real interest rate to incremental changes in the flow of saving. Under reasonable assumptions, the magnitude of this effect will be quite small.

In short, these channels - although theoretically operative - are not likely to be of sufficient importance to explain the failure of nominal interest rates to rise sufficiently in response to an increase in price expectations to preserve after-tax real rates.

2.2 Demand Factors: the Role of the Tax Treatment of Corporate Income

If all investors (lenders) face marginal tax brackets of 50 per cent, then a one-for-one reflection of price expectations in interest rates would imply that a one per cent increase in the expected rate of inflation depresses after-tax real rates by one per cent as well. If corporate income is taxed at 50 per cent, then the real after-tax rate paid by corporations would also fall by one per cent. This result, at least superficially, invites the prediction that interest rates under these circumstances

would rise by twice the increase in the expected rate of inflation so as to preserve the real after-tax yield (cost) to lenders (borrowers). The fact that interest rates appear to adjust by no more than one-for-one has led many observers to look for supply factors, such as the role of tax-exempt investors and limited arbitrage opportunities, to explain this apparent anomaly. If such were the case, however, the corresponding reduction in the after-tax cost of debt capital to firms should be associated with a real investment boom. In fact, a more careful examination of the tax treatment of corporate income, together with the recognition that real investment spending of corporations at the margin is likely to be financed by both debt and equity, significantly alters the naive prediction cited above. The role of tax factors is, of course, of particular importance since tax levers are a tool of public policy.

The most thorough treatment to date of these issues is that of Feldstein and Summers (1978). Their central analytic technique is to convert any changes in tax rules and in the expected inflation rate into the implied change in the long-term interest rate which a firm could pay, given a fixed marginal product of capital. Although their analysis is based upon the tax treatment of U.S. firms, the broad similarity between the taxation of corporate income in Canada and the United States ensures that the analysis has relevance for Canada as well. Of at least equal importance is the result, cited earlier, that in a world of mobile capital, the net impact of price expectations on interest rates in the United States is likely to be mirrored in a corresponding relationship in Canada.

If (1) replacement rather than historic costs are employed to calculate depreciation allowances for tax purposes (and if a similar result is obtained with regard to the tax treatment of inventories) and (2) real investment spending by firms is exclusively debt-financed at the margin, then the interest rate that firms can pay on a real investment with a fixed marginal product will rise by $(1/1-t)$ where t is the tax rate on corporate income. If this marginal rate were 50 per cent, then the maximum potential interest rate that the firm could pay would rise by twice the expected rate of inflation. If the supply of funds to the corporate bond market were perfectly interest inelastic, then the nominal interest rate would indeed rise by this amount. The assumption of an inelastic supply schedule is, of course, unrealistic, but it is a useful device in analyzing the role of tax factors per se and will be retained throughout the discussion.

The above result holds under the joint assumption that (1) the tax treatment is neutral with respect to corporate income, except for the deductibility for tax purposes of the inflation component of interest rates and (2) all real investments are financed at the margin by issuing debt. Consider first the implications of the fact that depreciation allowances are calculated on the basis of historic rather than replacement cost. In effect, this amounts to levying taxes on the accruing increase in the nominal value of a firm's assets which is due to inflation. As Feldstein-Summers illustrate, the present U.S. tax laws - a 48 per cent corporate tax rate together with an effective tax credit of 9 per cent - imply that the maximum potential interest rate that a firm can pay will rise by 1.57 per cent for each one per cent increase in the expected rate of inflation.

This result, although lower than the 1.92 per cent implied by the earlier case, remains high relative to the actual response of interest rates to changes in the expected rate of inflation.

The implications of relaxing the assumption that all real investment spending is financed at the margin by issuing debt are more difficult to calculate. The intuitive reason why the financing by both debt and equity would reduce the maximum potential interest rate, however, is quite straightforward. In determining its optimal capital structure or debt/equity ratio, the firm must weigh the marginal benefit of the tax subsidy associated with an increase in debt financing against the increased riskiness of the firm, as measured by the marginal cost of the increased probability of bankruptcy. (The real costs of bankruptcy reflect the difference between the value of the firm as an on-going concern and the liquidation value of its assets.) Given the tax rules and investor preferences, the firm thus chooses a debt/equity ratio which minimizes its cost of capital. If the firm is in equilibrium, then real investment spending at the margin is financed by the same debt/equity ratio which characterizes the firm's optimal capital structure. In short, if investment spending at the margin is financed by both debt and equity capital, the firm loses a portion of the tax subsidy that is associated with the exclusive reliance on debt capital. (Note also that the firm need not issue new shares in order to maintain its desired debt/equity ratio. Any desired debt/equity ratio can be obtained by a combination of (1) the firm's dividend payout policy (since cet. par. reduced dividend payments imply a higher market value of the firm's outstanding shares) and (2) the firm's debt issue policy.) The maximum potential interest rate that a firm can pay on

a real investment with a fixed marginal product must decline. This decline will be greater if, in addition, the rate of return on equity required by shareholders exceeds the rate of return required by bondholders, as is presumed to be the case.

In their analysis, Feldstein-Summers assume that the ratio of debt to equity capital is fixed at one to two, which reflects the behavior of the nonfinancial corporate sector in the United States over the past decade. They then assume a fixed spread between the required yield on equity and debt, on both a before- and after-tax basis. For a fixed pretax differential in favour of equity of 4 per cent, and again in the context of present U.S. corporate tax regime, the maximum potential interest rate payable by the firm rises by 0.97 per cent in response to a one per cent increase in the expected rate of inflation. For a fixed net-of-tax risk differential of 4 per cent, the corresponding figure is 1.33 per cent for each one per cent increase in the expected rate of inflation. (The difference in these two estimates reflects the more favourable tax treatment of dividends and capital gains relative to interest income.) If the supply of funds to the corporate bond market were perfectly inelastic, then these results would indicate that a rise in the corporate bond rate of 0.97 to 1.33 per cent would accompany a one per cent increase in the expected rate of inflation. In view of the difficulty in choosing an exogenous risk differential between debt and equity capital, and the probable attractiveness of making this spread endogenous, no precise impact of price expectations - even under the infinitely inelastic supply assumption - can be predicted. Clearly, however, the likelihood that market forces could

produce a rise in interest rates of (approximately) two per cent for each one per cent increase in the expected rate of inflation - as implied by the original "naive" perspective on the role of tax factors - is not sustainable. In fact, at least from the demand side of the market, the one-for-one response that is actually observed is no longer surprising.

Although the discussion of the role of the supply of funds is postponed to the next section of this report, there remains another issue with regard to the demand for funds that merits comment. The previous discussion has examined the role of corporate demand for funds and the net impact of tax factors, while ignoring the role of government demand for funds. If, for simplicity, corporate and government bonds are viewed as perfect substitutes by investors, then the relevant demand and supply schedules are those of the joint market for these two types of securities. If the infinitely inelastic supply schedule assumption is retained, is it still satisfactory to presume that the rise in "the" interest rate in response to an increase in the expected inflation rate will be determined solely by the net impact of tax factors on corporate demand for funds? The answer, of course, depends on what assumption is made with regard to the change in the expected inflation rate on the real demand by governments for debt finance. Assume (1) government demand for funds is completely interest inelastic, at least over the range of historical interest rates and (2) real government borrowing needs are unaffected by a change in expected inflation, which is satisfied (as a first approximation) if real government spending and real tax revenues are unaffected. In this case, government demand for funds is both perfectly inelastic and does not shift

in response to a change in the expected rate of inflation. All the demand for funds at the margin represents corporate demand for funds, and the prior analysis with regard to the role of tax factors in determining impact of price expectations on "the" interest rate is sustained. Note also that if (1) the elasticity of tax revenue with regard to inflation exceeds one and/or (2) the government has outstanding long-term debt whose real servicing costs are reduced by an increase in the expected rate of inflation, the net demand for funds by governments will fall and then the total demand schedule will shift leftward. The result would be, again on the assumption of an inelastic supply of funds, a smaller increase in "the" interest rate than that predicted on the basis of an analysis of corporate demand for funds.

To conclude, tax factors - when examined from the perspective of the demand side of the market - do not indicate that interest rates should rise by substantially more than the increase in the expected rate of inflation. To complete the analysis, of course, the role of the supply side of the market must be examined. If interest rates do rise (only) one-for-one with expected inflation, then taxable investors do suffer a real after-tax decline in the real interest rate that they receive. If taxable investors did have an alternative investment vehicle which would guarantee them an unchanged after-tax return and - via arbitrage - were able to force a corresponding increase in interest rates, then the amount of real investment spending by firms would have to decline. This is not, of course, the prediction of the "naive" examination of the role of tax factors cited at the beginning of this section.

2.3 Supply Factors: Tax-Exempt Investors and Limited Arbitrage Opportunities

Clearly, the supply of funds to "the" bond market will have some degree of interest elasticity. This elasticity will reflect (1) the interest sensitivity of the demand for money, (2) the role of arbitrage forces in the context of other investment options (equities, real commodities and so forth), (3) any sensitivity of the personal savings rate, and - perhaps most importantly - (4) internationally mobile capital. The clear implication is that a shift in the corporate demand for funds as a result of a change in price expectations will not produce a corresponding rise in nominal interest rates if the supply schedule does not shift as well. In general, both the slope of the supply schedule and the extent to which it shifts in response to a change in price expectations will play a role in determining the response of interest rates to variations in the expected rate of inflation.

Consider first the shift in the supply schedule which would occur if all investors were tax-exempt. If the before-tax, nominal returns on alternative investment vehicles rose by one per cent in response to an increase of one per cent in the expected rate of inflation, then the supply schedule of funds to the bond market would shift up by one per cent as well. Because the marginal investor would be tax exempt, the interest rate - given the earlier discussion of tax factors and corporate demand for funds - would also rise by approximately one per cent, as is actually observed. Since tax-exempt investors (e.g. pension funds) hold only a part of outstanding corporate and government debt, however, the marginal

investor undoubtedly faces a positive marginal tax rate. In this case, the interest rate would have to rise by more than the increase in the expected inflation rate in order to clear the market, if the after-tax, nominal return on alternative investment outlets rose by one per cent in response to an increase of one per cent in the expected rate of inflation. The existence of tax-exempt investors, in general, may result in the marginal investor being one with a lower tax bracket than might otherwise be the case, but cannot explain why taxable investors as a group must suffer an after-tax decline in the real interest rate when price expectations increase.

Are taxable investors likely to have alternative investment options whose after-tax, nominal returns rise one-for-one with an increase in the expected rate of inflation? As discussed later in this report, empirical evidence suggests that the before-tax real return on common stocks is adversely affected, in both Canada and the United States, by an increase in both expected and unexpected inflation. The result is attributed to the non-neutral taxation of corporate income, which suggests cet. par. an increase in the tax burden - for a given real earnings stream - when the rate of inflation increases. Since nominal capital gains and dividend income are both subject to tax, the clear implication is that the after-tax nominal return equities must rise (if at all) by less than the increase in the expected rate of inflation.

Since much of personal savings in Canada is channeled through financial intermediaries, whose investments to a large extent are limited to fixed income securities and common stocks, the existence of an investment

alternative whose after-tax, nominal return rises in tandem with the expected rate of inflation is suspect. Importantly, from the open economy perspective, the same situation prevails in the United States. Although ultimate savers might in principle eschew these intermediaries in order to invest their funds directly into alternative outlets, such as real estate, there is no strong evidence that such disintermediation is occurring. Further, given the informational and transactional efficiencies of financial intermediaries together with their diversification potential, the tendency for tax incentives - such as those created for retirement income - to require institutionalized saving, and so forth, there can be no strong presumption that such disintermediation will occur if present high rates of inflation continue. Finally, the fact that the after-tax, real return on both fixed-income securities and equities can decline in response to an increase in the expected rate of inflation poses no economic conundrum. To the extent that the elasticity of tax revenue as a whole with respect to inflation exceeds one, the decline in real after-tax returns in the private sector simply mirrors the ultimate transfer of real resources from the private to the public sector.

2.4 A Tentative Conclusion

If nominal interest rise one-for-one with expected inflation, and if there is no significant increase or reduction in the volume of real investment spending by firms, then both the demand and supply schedules for bonds must also be shifting one-for-one with expected inflation. The preceding discussion suggests that this may indeed be the case. A closer

examination of the taxation of corporate income suggests that the combination of (1) the non-neutrality of the tax system with respect to depreciation (and inventory profits arising from inflation) and (2) the need to finance real investment at the margin with both debt and equity capital create a situation in which corporate demand for funds will shift upward by less than $1/(1-t)$ times the increase in the expected rate of inflation. In fact, a one-for-one shift in the demand for funds would appear to be the approximate prediction of this more detailed analysis. Further, the role of tax-exempt investors combined with the limited arbitrage opportunities (in terms of the response of the after-tax, nominal returns on alternative investments) suggests that a one-for-one shift in the supply schedule may well be toward the upper range of the likely supply response. Both observations are consistent with the empirical conclusion that interest rates reflect price expectations at most on a one-for-one basis. Further, this result remains valid in the presence of international capital mobility, given (1) the likelihood that exchange rate expectations reflect - at least in large part - differences in the rates of inflation expected to prevail in the two countries and (2) the empirical evidence that interest rates in the United States appear at most to reflect price expectations on a one-for-one basis as well. The latter result for the United States, in turn, is likely to reflect the same forces as noted above for Canada.

3. On the Role of Inflation Uncertainty

The preceding analysis sought to identify the forces which ultimately determine the extent to which price expectations are built into nominal

interest rates. Cukierman and Wachtel (1979) summarize arguments, both theoretical and empirical, which suggest that relative and absolute price variability are positively correlated with the expected (and actual) rates of inflation. This fact suggests cet. par. that the risk of real investment opportunities varies inversely with the expected rate of inflation. There thus exists the possibility that an increase in the expected rate of inflation, by increasing risk, will cet. par. reduce real investment demand and hence the demand for loanable funds. The result would be cet. par. a reduction in the real interest rate, and hence in the extent to which nominal interest rates respond to a change in the expected rate of inflation. Levi and Makin (1979), using the standard deviation of the implied expected rates of inflation in the Livingston surveys, find evidence that inflation uncertainty has indeed served to depress nominal interest rates, at least in their study of the yields on United States treasury bills and commercial paper.

As discussed later in this report, unanticipated inflation exerts a depressing impact on the real rate of return on equities. Blinder (1977) presents evidence that the real returns to human capital are also adversely affected in the short-run by unanticipated inflation, a result which is not surprising so long as wage contracts are not universally indexed to the cost of living. Obviously, unanticipated inflation depresses the real return on bonds. The result is that, from the perspective of modern portfolio theory, inflation uncertainty corresponds to nondiversifiable risk. The implications of this fact are noted in the later discussion of inflation and the rate of return on equities, but a few observations are

relevant here as well. If firms were to issue index bonds, then the market should price them at a lower ex ante real return than traditional bonds since inflation risk is not diversifiable. The availability of index bonds, in turn, would enable pension plan sponsors to commit themselves to the contractual indexation of pension benefits. This issue is, quite possibly, the most important challenge to the present three-tier (OAS, CPP/QPP, and private pension and other saving) system for providing retirement incomes in Canada. The reason for the non-issuance of index bonds clearly must be explained by supply side factors, as discussed in Pesando (1978b). No satisfactory explanation is available, since the correlation between earnings gross of interest expenses and unanticipated inflation is positive, at least for some subset of firms. This is the requirement that must be met if the variance of the firm's real earnings is to be reduced by issuing index rather than traditional bonds. Aside from innovation or start-up costs (such as the resolution of the tax treatment of such payments, the dissemination of information for market participants and so forth), there appear to be three possible theoretical explanations of the non-issuance of index bonds. First, many firms do experience a decline in real earnings (before interest payments) in response to an unexpected increase in inflation, not only because they hold some nominal assets, but also because of the non-neutralities of the tax system. This fact cet. par. suggests that the variance of their real earnings streams can be reduced by issuing traditional rather than index bonds. Second, since increased relative price variability is associated with increased absolute price variability, the value of indexed bonds to a representative investor is lessened by the

reduced likelihood that the price index to which the bonds are tied would adequately reflect the change in the cost of "his" specific basket of commodities. Third, and perhaps most importantly, potential suppliers of index bonds may form asymmetrical price expectations. For those firms whose earnings variance is not reduced by issuing index rather than traditional bonds, there still exists the possibility of issuing indexed debt at a lower ex ante cost to offset the increased variance. Such firms may, however, presume that the likelihood of very large unexpected increases in inflation greatly exceeds the likelihood of very large unexpected decreases. (Formally, their subjective estimates of the distribution of future inflation are characterized by positive skewness.) If such is the case, and if firms are concerned with the likelihood of extreme outcomes, then cet. par. they are less likely to issue index bonds.

4. Policy Implications

1. The fact that expected inflation has important allocative and redistributive effects, operating in part through financial markets, merits emphasis. Much of the problem can be traced to the non-neutrality of the tax system.
2. The fact that real investment opportunities are (1) financed at the margin by both debt and equity capital and (2) the tax treatment of corporate income is not neutral with respect to inflation suggests that the maximum nominal interest rate that

a firm could pay on a representative real investment with fixed marginal product will rise by far less than $(1/1-t)$ times the change in the expected inflation rate, and may be closer to one-for-one. The key implication of this result is that the decline in the real after-tax interest rate paid by firms when the expected rate of inflation increases cannot be associated with a strong stimulus to investment spending, a result which has been misinterpreted by many analysts.

3. The fact that Canada is a small, open economy and that international capital is likely to be quite mobile suggests that caution be exercised in considering tax reforms designed to ameliorate the after-tax reduction in the real interest rate to taxable investors which accompanies an increase in the expected rate of inflation. The essential point is that to the extent that international arbitrage forces tend to equalize after-tax real returns across countries, the extent to which price expectations in Canada will reflect nominal interest rates must mirror the result which was obtained in the United States. As noted, the evidence at present suggests an approximately one-for-one reflection of price expectations into nominal interest rates.

- 3.1 The recommendation that cet. par. the inflation component of interest income should be neither taxable in the hands of the investor nor deductible to the corporate borrower would - given the other distortions in the tax treatment of corporate

income - result in a decline in nominal interest rates in a closed economy, even if all real investment at the margin were financed by debt (rather than new equity issues and/or retained earnings). For an open economy, however, arbitrage forces would prevent nominal interest rates from falling, and thus lead instead to a decline in real investment spending.

3.2 If, for example, current dollar accounting for tax purposes were permitted for inventory and depreciation expenses, the result for a closed economy would be a rise in the extent to which price expectations are reflected in nominal interest rates. For Canada, however, such would not be the case - and hence the after-tax real return to lenders would not improve - unless parallel reform were undertaken in the United States. The result would, however, be a strong stimulus to real investment spending.

4. The net effect of the present tax system in an inflationary climate is to (i) reduce the real after-tax return to savers, (ii) distort the incentives to both households and firms in terms of saving and real investment decisions, and (iii) redistribute income from savers to the government. Clearly, these distortions have induced (partially) offsetting behavior on the part of economic agents. One can confidently predict, for example, that those savers/investors facing higher marginal tax rates will have realigned their portfolios against bonds and in favour of other

investment vehicles (including, most recently, preferred shares in view of the liberalization of the investment tax credit). At the same time, the \$1,000 interest and dividend income exemption is a (poor) response on the part of the government to the inappropriate taxation of nominal - instead of real - interest and dividend income. The same argument, of course, applies to the recently enacted tax credit for inventories, designed to cushion the tax burden associated with the "illusory" inventory profits created by inflation.

5. A number of explanations have been offered for the non-issuance of index bonds by firms in the private sector. The analysis of tax factors suggests an additional possibility. If market conditions dictate that price expectations be reflected in nominal interest rates on less than a one-for-one basis, which is a result that can be ruled out by neither theory nor empirical evidence, then clearly firms would not choose to issue index bonds - which would bind them to offset on exactly a one-for-one basis all subsequent movements in the general price level.

II INFLATION AND COMMON STOCKS

As summarized by Pesando (1977), time series evidence for both Canada and the United States - based on aggregate indexes of stock prices and returns - supports the claim that both expected and unexpected inflation served to depress the realized real return on equities. Although some observers remain uncomfortable with the results, especially those with respect to expected inflation, no researcher has successfully challenged the validity of the empirical findings. What also merits note, however, is that these inflation variables "explain" only a small fraction of the variance in stock prices and returns. In the studies summarized by Pesando, for example, no more than 10 per cent of the variation in monthly or quarterly returns could be attributed to the impact of expected and/or unexpected inflation.

The most common explanation of this inverse relationship focusses on the non-neutrality of the corporate tax system in an inflationary climate. Recently, observers have pointed to the potentially depressing impact on share prices of the rise in the unfunded liabilities of corporate pension plans occasioned by the recent history of high and/or accelerating inflation. Finally, some observers have proposed that the negative association between stock returns and inflation reflects the inability of market participants to correctly extract the implications of inflation developments for share valuation. By postulating that investors overstate the depressing impact of inflation on the real, after-tax earnings of firms, proponents of this latter view directly challenge the accumulating theoretical and empirical evidence that the stock market is efficient.

In the first two sections of this report, the two explanations of the empirical findings are critically reviewed. This analysis, in turn, raises the issue of market efficiency. A discussion of policy implications concludes this part of the report.

2. The Role of Tax Factors

In any discussion of the impact of inflation on share prices, the distinction between expected and unexpected inflation is central. If an unexpected increase in the price level were to occur, then - for a given before-tax real earnings stream - the tax liability of corporations would increase in view of the fact that depreciation allowances and inventory gains are calculated on the basis of historic rather than replacement costs. (The presumption that the before-tax real earnings stream is unaffected is appropriate if the rise in the price level is due to a monetary (demand) shock, but would merit qualification in the case of a real (supply) shock.) Because the inflation is unexpected, there would be no increase in tax deductible interest payments and hence no reduction in tax liabilities on this front. To the extent that a firm were a net debtor, its shareholders would receive a windfall gain at the expense of its creditors which would - at least in part - operate in the opposite direction to the tax factors noted above. Finally, to the extent that firms hold non-interest-bearing cash balances, there would be a windfall loss to shareholders arising from the reduction in the real purchasing power of these money claims.

Clearly, the above factors could prove sufficient in principle to produce a negative association between unanticipated inflation and the

realized return on an aggregate portfolio of equities. Such would be the case if the net increase in tax liabilities, together with the loss in real purchasing power of cash balances, more than offset any gain due to the debtor position of the representative firm. (As the calculations by Jenkins (1978) emphasize, however, the net effects of these forces is likely to vary substantially not only across firms, but also across the manufacturing, non-manufacturing and financial sectors.) Since unexpected inflation represents new information, the empirical finding of a negative association between unexpected inflation and real returns is consistent with the paradigm of an efficient market responding - in this case - to an adverse and unforeseen development.

To date, no cross-section studies of the impact of unexpected inflation on share prices, appropriately disaggregated on the basis of characteristics which reflect the likely incidence of the non-neutrality of the tax system, have been conducted. The consequence is that the results cited above must be held with less confidence than would be the case if they were buttressed by supporting cross-section evidence. Suppose, for example, that those firms which are likely to be the most adversely affected by unexpected inflation (i.e. those firms with low debt/equity ratios, large inventories, significant cash balances, and large depreciation allowances) were distinguished on an *a priori* basis from those firms which are likely to be less adversely affected. The decomposition of inflation into its expected and unexpected components could be accomplished in a variety of ways, such as setting unexpected inflation equal to the residuals from that time series process which best characterizes the actual history of

inflation. The abnormal returns for individual firms in periods of unexpected inflation, as indicated by the residuals from the capital asset pricing model, would then indicate the market's assessment of the relative impact of unexpected inflation on the prospects for the individual firms. If the magnitude of these effects were consistent with the prior grouping, then support for the standard interpretation would be strengthened. (Note also that the interpretation of the results would not be altered significantly if the inflation shocks were to lead to a change in the expected rate of inflation, since the impact of a change in the latter would operate in the same direction.) More sophisticated variants of this approach are easily envisioned, but the basic point remains unchanged: cross-section evidence could be usefully employed to provide an additional perspective on the results obtained with aggregate time series data.

The fact that the realized real return on common stocks is negatively associated with expected inflation is, at least superficially, somewhat more puzzling. The simplest story would be as follows. When the expected inflation rate increases, the real tax burden of firms - for a given projected stream of real before-tax earnings - increases and share prices fall accordingly. In fact, share prices fall sufficiently to raise the ex ante real return on equities to the (assumed) unchanged initial level. Because researchers work with discrete data, the two effects noted above are likely to be difficult to disentangle and thus researchers are likely to detect a negative association between expected inflation and realized real returns. If, as is popularly presumed, economic agents form price expectations on a basis of past rates of inflation, the almost secular

increase in the rate of inflation in the past decade is likely to have produced a continuous upward revision in the expected long-term inflation rate. This behavior, in turn, could produce the negative correlation noted above. The result is analogous to the manner in which a change in the expected rate of inflation produces a decline in bond prices when the nominal interest rate adjusts upward.

The above story could be extended in a number of ways. As noted earlier, inflation risk - in the parlance of modern portfolio theory - is nondiversifiable and cet. par. those assets subject to greater inflation risk should command higher ex ante returns in the market. Further, empirical studies have indicated the variance of inflation - and hence (in all likelihood) its uncertainty - is positively associated with the expected rate of inflation. An increase in the expected inflation rate may thus be associated with an increase in inflation risk, leading to an increase in the ex ante return on assets such as common stocks. In this case, the decline in share prices which accompanies an increase in the expected rate of inflation would be greater than that suggested in the simple story suggested above. Further, to the extent that this latter effect is operative, it suggests that the ex ante cost of new equity finance increases and cet. par. serves as a disincentive to real investment.

To put the above story in perspective, the impact of a change in the expected rate of inflation on the real tax liabilities of firms must be considered. As before, an increase in the expected rate of inflation will increase the real tax burden of firms by virtue of the historic cost treatments of depreciation allowances and inventory "profits" for tax purposes.

To the extent that a firm has short-term debt or issues new long-term debt, it will benefit from the deductability of the inflation premium in interest rates, which should be treated as the repayment of capital rather than true interest earnings. The firm also benefits, in the case of outstanding long-term debt, from the expected erosion of the real value of the principle, as reflected in the decline in the market value of long-term debt issues. Finally, the decline in the real value of the firm's cash balances also reduces shareholder wealth, although this decline is moderated by the presumed incentive of the firm to reduce its cash holdings.

As before, the preceding forces are sufficient in principle to lead the market to reduce its estimates of share worth in response to an increase in the expected rate of inflation. Evidence on the net impact of these forces on Canadian firms compiled by Jenkins (1978) supports this interpretation. When combined with the discrete interval problem faced by empirical researchers, tax factors would appear to provide a reasonable explanation of the empirical findings with respect to both expected and unexpected inflation.

2. Inflation, Unfunded Pension Liabilities, and Share Prices

As noted by Pesando and Rea (1977), the unfunded liabilities of corporate pension plans have increased sharply during the recent period of high inflation, a result which mirrors that noted for firms in the United States. In view of the depressing impact of high and accelerating

inflation on the real return to portfolios of fixed-income securities and/or common stocks, this result is not necessarily surprising. Further, Oldfield (1977) has provided evidence, using U.S. data, that the existence of unfunded, vested benefits is reflected cet. par. in lower share prices. Although his results are tainted by the inappropriate implementation of a procedure to correct for heteroscedasticity, his results are suggestive of the concern that implicit increases in employer contributions to corporate pension plans are acting as a major depressing influence on share prices in an inflationary climate.

In general, any attempt to empirically determine the extent to which the experience or actuarial deficiencies which have appeared during the recent period of high inflation have depressed share prices of Canadian firms is limited by differences in (1) the pension plans themselves, (2) the funding procedures (accrued versus projected benefits), and (3) the actuarial assumptions used to cost the plans. Data on experience (actuarial) deficiencies and/or unfunded liabilities would simply not be comparable across firms. In principle, the depressing impact on bond and equity returns suggests cet. par. that inflation would increase the cost of such plans, although such cost increases may well be offset by the windfall gain to plan sponsors associated with the purchase of fixed-income annuities at high nominal interest rates.

The potential importance (and offsetting nature) of this latter result merits emphasis. The cost, for example, of purchasing a 15-year (the approximate life expectancy of those retiring at age 65) annuity at an interest rate of 9 per cent is a full 50 per cent smaller than at an

interest rate of 3 per cent. In words, the inflation premium built into nominal interest rates has the effect of reducing by 50 per cent the cost of a fixed-income annuity relative to its cost in a non-inflationary environment. Clearly, the scope for this "windfall" gain to offset potential increases in employer costs arising from reduced real returns is considerable, notwithstanding the tendency for most firms to make ad hoc increases to pensions in force in order to partially offset the erosion in their real purchasing power.

Unfunded actuarial liabilities reflect, in essence, the difference between (1) the present value of future benefits payable under the plan and (2) the sum of the present value of future normal contributions and the assets of the pension fund. To the extent that unfunded actuarial liabilities have increased, the implication is that experience since the prior valuation of the plan has diverged from the assumptions used to evaluate the plan. This fact draws attention to the appropriateness of the actuarial assumptions used to cost the plans. Unfortunately, a legacy of the early 1970s has been the use of higher interest rate assumptions (or higher interest rate relative to wage increase assumptions) by actuaries and their clients in the costing of defined benefit plans. The erroneous association of the higher nominal interest rates available in the marketplace with higher real returns led, in effect, to the understatement of true pension costs. As noted by Meyers (1978), the same mistake appears to have occurred in the United States. Thus the large increases in unfunded liabilities encountered by many plans in recent years (which have been used by plan sponsors to bolster the claim that the indexing of pension benefits is too expensive) can be traced in large part to the use

of inappropriate cost assumptions which made such "cost overruns" inevitable.

If this is the case (and ignoring the possible shifting of such "increased" employer costs for employees in the form of lower current wage settlements), would the emergence of these large actuarial deficits depress share prices and thus contribute to the observed relation between equity returns and inflation? If the stock market is efficient in its processing of this type of information, then the predictable nature of these "cost overruns" would suggest that their reflection in stock prices would have occurred earlier. If pension benefits were liberalized and the true increase in costs understated by virtue of the revision of actuarial assumptions, then this actual reduction in shareholder wealth should have been immediately reflected in lower share prices. (To the extent that increased actuarial deficits were associated with an unanticipated decline in real returns, such would not - of course - be the case.)

This latter observation draws attention to a final and important issue, the extent to which market participants are able to see through the "inflationary veil" and correctly assess the economic value of equities. If this were not the case, then the distortions in the level and (perhaps) structure of equity prices would be accompanied by the real resource costs of a capital market which failed to provide appropriate signals with regard to the allocation of financial capital. Proponents of the view that the market is efficient, a proposition which has substantial theoretical and empirical support, would tend to discount such concerns. On the other hand, some have argued - for example - that the market has given insufficient attention to the advantage to firms of the deductability for tax purposes of nominal interest payments. The result is that the market may be undervaluing share prices, with attendant implications.

Can tests be designed to determine whether the market efficiently processes information and thus sees through the "inflationary veil"? In principle, the answer is affirmative. Consider first the claim that the market, in the aggregate, fails to attach significant weight to the full deductability of interest payments. If this proposition can be equated with the claim that the market fails to correctly assess the importance of this factor across firms, then it can be tested by cross-section comparisons of the market's valuation of share prices. In principle, this could be accomplished in the context of the dividend valuation model employed by Oldfield (1977) to address the question of the impact of unfunded, vested benefits on share prices. Although the data requirements would be more demanding, the same strategy could be employed to determine cet. par. if the shares of these firms which employed actuarial assumptions which understated true pension costs were appropriately discounted by the market. Clearly, for those concerned with the possibility that the stock market fails to discount distortions caused by inflation, the importance of conceptualizing and implementing an appropriate set of empirical tests merits emphasis.

3. Policy Implications

1. The empirical finding of a negative relationship between real equity returns and inflation is explicable, at least in part, by the non-neutralities of the tax system. If these distortions to the tax system were removed, by using replacement costs in calculating depreciation allowances and inventory profits and by eliminating the deductability of the inflation component of interest payments,

the "inflation hedge" properties once attributed to equities may to a large extent be restored. The importance of such changes in reducing the variation in equity returns should not, however, be overestimated. As noted, no more than 10 per cent of the variation in equity returns can be explained by expected and/or unexpected inflation.

2. Parallel to the immediate depressing impact on share prices of an increase in the expected inflation rate must be a corresponding positive impact on the prices of those assets whose tax treatment in an inflationary climate is more favourable. These relative price effects, of course, reflect the new equilibrium price structure determined by wealth-holders as they seek to realign their portfolios in response to the revision in their inflation expectations. The obvious example of an asset whose tax treatment is more favourable is the principle residence. A change in expected inflation cet. par. should produce an increase in the current price of housing, and also - via derived demand - land. This proposition, which lends itself to empirical investigation, suggests that the tax system has contributed to the recent rise in housing prices. This increase, given the cash flow or "tilting" problem associated with traditional debts instruments in an inflationary climate, clearly exacerbates the problem of financing home purchases. This problem, in turn, ostensibly remains a major concern of public policy.

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