INFLATION AND CORPORATE TAXATION
IN AUSTRALIA

Chris Ryan*

Research Discussion Paper

9011

December 1990

Research Department

Reserve Bank of Australia

*I am grateful to Malcolm Edey and Marilyn Faithfull for helpful comments and suggestions. The views expressed herein are those of the author and do not necessarily reflect the views of the Reserve Bank of Australia.

ABSTRACT

This paper reviews the effects of inflation and taxation on the financing of corporate investment, and on the allocation of investment among alternative assets. Two tax distortions were of particular importance during the 1980s: the non-taxation of capital gains and the double taxation of dividends. These were important in encouraging corporate leverage and asset acquisition. It is argued that despite their substantial removal in the 1985 and 1987 tax reforms, some distortions associated with the interaction of the tax system with inflation remain. In particular, capital gains continue to be treated favourably, and inflation continues to influence investment decisions through its interaction with the treatment of depreciation and nominal interest flows.

TABLE OF CONTENTS

INFLATION AND CORPORATE TAXATION IN AUSTRALIA

Chris Ryan

1. INTRODUCTION

For much of the past decade, Australian corporate behaviour was influenced by a tax system which contained important biases favouring debt-financed asset acquisition. Of particular importance were two features of the tax system which have subsequently been reformed: the treatment of capital gains (which were untaxed prior to 1985), and the double taxation of dividends prior to the introduction of dividend imputation in 1987. Other distortions arising from the interaction of the tax system with inflation were also important.

The aim of this paper is to review the effects of these distortions and to consider the extent to which they have been removed by the 1985 and 1987 reforms.[1] The paper begins by reviewing some facts on Australian corporate financial structure in the 1980s, noting in particular the growth of leverage and of takeover activity. It then presents a formal analysis of the pre- and post-reform tax systems in order to assess their effects on corporate financing decisions and on the allocation of investment spending. The paper will argue that:

- aggregate leverage of the corporate sector roughly doubled during the 1980s, but does not appear to have increased recently;

- the growth of leverage was strongly encouraged by the pre-imputation tax system, although this direct tax bias towards debt has now been removed;

- the non-taxation of capital gains created a strong bias towards asset acquisition. This was reduced but not eliminated by the introduction of the real capital gains tax;

---

1 A related paper by Willmann (1990) provides detailed calculations of the amounts of tax involved.

- there are a number of distortions arising from the interaction of inflation with the tax system which have not been overcome by recent tax reforms. In particular, under the present tax system, inflation erodes the real value of depreciation allowances and hence penalises investment in plant and equipment. Also, the interaction of inflation with the tax treatment of nominal interest receipts and payments probably exerts an influence on real interest rates and the real exchange rate; and

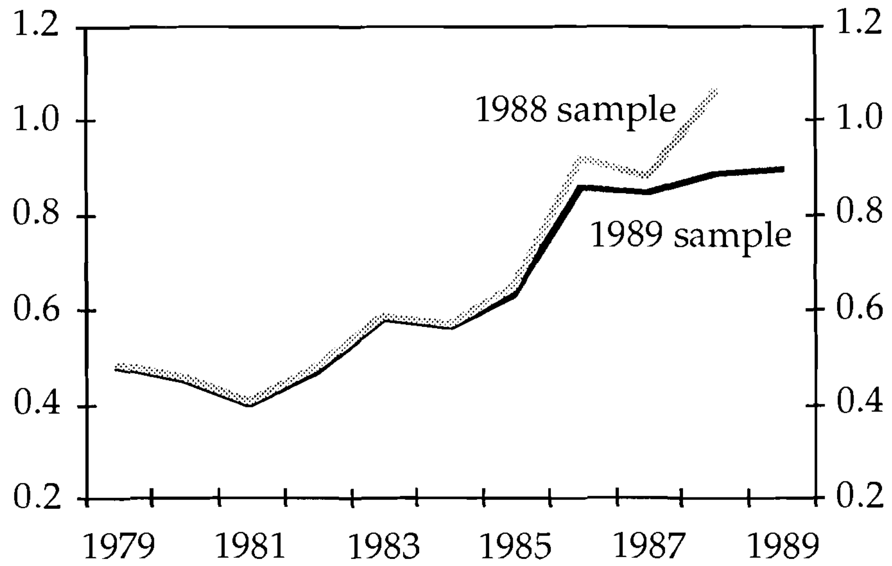
- the incorporation of inflation into nominal interest rates increases the time needed to break even which may discourage investment in general and longer term projects in particular.

The above conclusions are consistent with Macfarlane's (1989, 1990) observations about the role of tax-inflation interactions in encouraging the boom in corporate borrowing and asset acquisition during the 1980s, although it seems clear that the tax system was not the only factor at work. They also support Freebairn's (1990) view that inflation continues to distort corporate incentives under the present tax system.

2. SOME FACTS

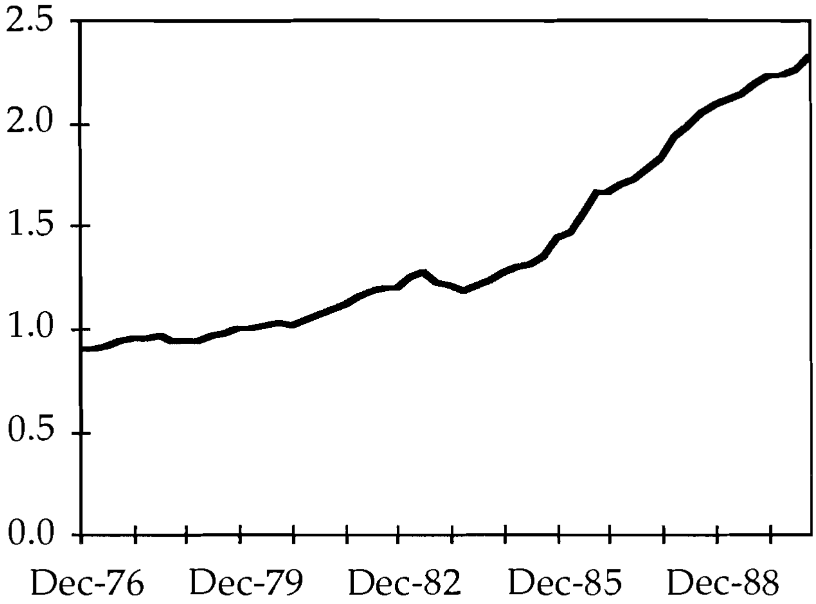
It is widely accepted that, prior to the introduction of dividend imputation in 1987, the type of corporate taxation system operating in Australia was one which gave a strong advantage to debt over equity financing. On its own, this would suggest an incentive for firms to have higher leverage than would otherwise be the case, although it would not necessarily explain a steadily rising level of leverage, as in fact occurred during the 1980s (see Figure 1, and the Appendix for a description of the data). To explain this, it would also have to be argued that the system is inherently slow to adjust, or that firms came only gradually to the view that they were under-geared relative to the incentives built into the tax system. There is some evidence for this in the fact that there was no immediate step down in leverage after the tax advantage was removed.

Figure 1: Debt/Equity
Year ended June



Another way of presenting this information is to show the growth of business credit outstanding to Australian financial institutions (Figure 2). This aggregate has grown almost continuously as a ratio to nominal GDP since the mid 1970s and showed particularly rapid growth between 1983 and 1989, roughly doubling over this period.

Figure 2: Corporate Debt:GDP



The growth of leverage was far from uniform across companies and across industries (see Tables 1 and 2). Table 1 shows how the aggregate was influenced by the behaviour of a relatively small number of companies. When the top ten contributors to the rise in leverage are excluded from the aggregate, the increase is much smaller.

Table 1: Contributions to Leverage

Debt/Equity Ratio	1980	1989
Aggregate	.45	.90
Aggregate less top 10 contributers	.48	.60

While there were indeed incentives to gear up, the behaviour of some of these ten companies can now be seen to have departed from sound management policies.

There were also some important variations in leverage across industries (Table 2). Three groups in particular experienced very large increases in debt, mainly as a result of leveraged takeovers or asset acquisition. These were the entrepreneurial investors, media, and diversified resources groups. Again, the aggregate excluding these groups showed a much more modest increase in leverage.

Table 2: Leverage by Sector (D/E Ratio)

	1980	1989
Entrepreneurial investors	0.88	2.37
Media	0.52	2.82
Diversified resources	0.30	1.08
Aggregate excluding above three groups	0.48	0.66
Aggregate	0.45	0.90

Table 3 illustrates the increase in corporate takeover activity which occurred in the late 1980s. The source of these data (Corporate Adviser (1990)) attributes much of the increased activity to "financial restructuring or opportunistic purchasing rather than growth related strategies based on the offeror's existing business activities" (op. cit., p.5). In other words, companies were perceived to be undergeared in relation to the incentives toward high gearing contained in the tax system.

Table 3: Takeovers: Bids and Outcomes

	1984	1985	1986	1987	1988	1989
No. of bids	126	140	142	205	289	179
Value ($b)	n.a.	n.a.	14.0	17.0	18.0	16.5
No. actual takeovers	72	92	80	135	174	112
Value ($b)	n.a.	n.a.	4.8	11.1	10.3	8.9

Source: *Corporate Adviser* (1990)

Against this background of rising leverage during the past decade, it is of interest to consider in more detail the nature of the tax biases that have affected corporate leverage, and the extent to which those biases have been removed by recent tax reforms. These issues are examined in the next section.

3. THE LEVEL OF INVESTMENT AND THE CHOICE OF FUNDS

(i) Imputation

A simple exposition suggests that full imputation has eliminated the basic source of tax bias towards debt. Under full imputation, the payment of a dividend of d implies an imputation credit of $dt^c/(1-t^c)$, where t^c is the corporate tax rate. Personal tax is levied on the sum of these two amounts at rate t^m, and total tax payable is then reduced by the amount of the credit. This results in a net dividend (after personal tax) of:

$$d - [(d + \frac{dt^c}{1-t^c})t^m - \frac{dt^c}{1-t^c}] = d(\frac{1-t^m}{1-t^c}) \qquad (1)$$

The net dividend is equivalent to the amount that would be received if corporations paid no tax at all, with dividends then being subject to the normal laws of personal income taxation. This equivalence can be seen by noting that if there were no corporate taxation, all earnings after interest could be distributed, rather than a fraction $(1-t^c)$ of that amount. Hence, $d/(1-t^c)$ would be received which, after personal taxation, leaves the amount derived above.[2]

[2] In the absence of corporate taxation, d could be (p-i) where p and i denote earnings before interest and tax (EBIT) and interest repayments respectively. In the presence of taxation d is limited by $p-(p-i)t^c-i=(p-i)(1-t^c)$.

For a given dividend payment, imputation has increased the net dividend received. The obverse of this is that imputation has increased the cost to shareholders of a reduction in dividends payable. Consequently, the cost to shareholders of debt repayments has risen. In fact, it now equals the cost of equity finance. To see this, suppose the firm uses one dollar of debt to finance an investment. The tax deductibility of interest payments means this debt reduces dividends payable by $i(1-t^c)$ dollars only. Prior to imputation, this would have cost shareholders $i(1-t^c)(1-t^m)$ dollars only. Equation (1) shows that it now costs shareholders $i(1-t^m)$ dollars. But this would be the (opportunity) cost to shareholders of providing the dollar themselves. Hence, shareholders are indifferent between debt and equity. Moreover, this result is not directly affected by inflation: the net cost to shareholders of either type of finance is $i(1-t^m)$, regardless of i.

(ii) An Intertemporal Model of Investment and its Funding

It will be useful to formalise the above exposition in a fully intertemporal model, which can then be used to address a broader range of questions. This can be done along the lines proposed by King and Fullerton (1984) in a prominent contribution to the literature on tax biases in corporate finance. King and Fullerton proposed two methods to calculate the percentage difference between the real pre-tax rate of return on the marginal investment and the real after-tax interest rate. If this difference, known as the effective tax rate, is independent of the source of finance, the tax system is said to be neutral with respect to the financing decision.

In their "fixed-p" method, the real pre-tax return on the firm's investment (p) is assumed to be exogenous. One then solves for the real after-tax interest rate (s) which would imply the investment is of marginal worth. The problem with this method is that the resultant s

---

Note that personal tax = $d(\frac{t^m - t^c}{1-t^c})$. Hence, if t^m is less than t^c the "correct" amount of tax is negative, which is not allowed. To overcome this, the credit can be offset against any income.

can differ according to the type of finance used (and, by definition, does so whenever the system is non-neutral). Consequently, it can imply that companies face different real interest rates when they invest in equivalent projects but with different types of funds.

The alternative "fixed-r" method assumes the real interest rate is exogenous and common to everyone, but implies that p can differ according to the means of finance. This begs the question of why the firm ever uses more than one source of funds, i.e. whichever source results in the lowest p. For example, under the classical tax system, with no imputation, the original shareholder in a company would always prefer debt. However, this problem can be overcome by introducing uncertainty into the model. The fixed-r method also allows one to make explicit assumptions about overseas influences on domestic interest rates. Finally, it allows a more straightforward analysis of the effects of the tax system on the allocation of investment, i.e., examining how the tax system affects the required rate of return on a particular type of investment, given the cost of funds. Hence, it is this method which is adopted in the present paper.[3]

The version of the fixed-r model presented below reflects Scott's (1987) criticism of King and Fullerton's fixed-r model. Scott argued that, assuming the firm's objective is to maximise the present value of all net payments to existing shareholders, the marginal project is that for which the present value of the cost of the project to existing shareholders equals the present value of the benefit of the project to those shareholders. Hence the appropriate discount factor is the shareholder's opportunity cost - $i(1-t^{m})$ - regardless of the means of financing the project.

Assuming full imputation and ignoring depreciation, three financing options (debt, equity and retained earnings) can be considered.

---

[3] The BIE (1990) adopted King and Fullerton's fixed-p method. While aware of the relative merits of each model (which it referred to in its Appendix B) the Bureau considered the fixed-p method more suitable for its purposes. Nonetheless, the Bureau's conclusions concerning the funding decision were broadly in line with those of this paper.

(a) Debt finance: The firm borrows and invests one dollar and every period distributes all that it can to existing shareholders.

The investment yields a constant real rate of earnings before interest and tax (EBIT) of p, which in nominal terms inflates at rate π. Imputation implies the net dividend to shareholders is $[(1-t^m)/(1-t^c)] \times$ 100% of whatever is left after the firm pays tax and interest. Shareholders are indifferent between the investment going ahead or not when p is such that the net present value of cash flows from the investment is zero:

$$\int_0^\infty [pe^{\pi t} - (pe^{\pi t} - i)t^c - i](\frac{1-t^m}{1-t^c})e^{-i(1-t^m)t}dt = 0 \quad \textbf{(2)}$$

which implies:

$$p = [i(1-t^m) - \pi]/(1-t^m) \equiv p^* \quad \textbf{(3)}$$

This condition simply states that the real rate of earnings before interest and taxes must equal a certain multiple of the real after-tax interest rate. This has two interesting consequences. First, inflation can only be neutral for the level of investment if it does not affect real after-tax rates of interest; and secondly, when inflation is positive, marginal investments will always yield negative initial cash flows (compensated by positive cash flows in later periods).[4]

(b) Equity finance: The firm finances the investment by issuing one dollar of equity to existing shareholders and again distributes all that it can in each period.

---

[4] This explains why p* is independent of the degree of imputation; partial imputation would reduce the early losses as well as the latter gains. However, the present value of all returns from an investment which earned more (or less) than p* each period would be linear in the degree of imputation. Furthermore, the degree of imputation affects the marginal condition for equity financing.

In this case, there are no repayments of interest and no interest deductions from tax. The shareholders, by using either savings or a tax deductible loan, incur a cost of $i(1-t^m)$ each period on the dollar they provide to the firm. Hence shareholder indifference requires p to be such that:

$$\int_0^\infty \{[pe^{\pi t} - pe^{\pi t} t^c](\frac{1-t^m}{1-t^c}) - i(1-t^m)\}e^{-i(1-t^m)t}dt = 0 \qquad \textbf{(4)}$$

The left hand side of (4) can be rearranged to be identical to the left hand side of (2), implying that the marginal investment is the same as with debt, and must therefore also earn a return of p^*. In other words, the required rate of return on investment is unaffected by whether it is funded by debt or equity. The intuition is exactly the same as in the simple exposition: the net cost to shareholders of either type of fund is $i(1-t^m)$ each period.

(c) Retained earnings: The firm finances the investment by retaining one dollar of earnings from previous investments.

It might seem that because retained earnings represent a form of equity financing, the results for this case should be the same as those applying to the issue of new equity. This is not strictly correct. Consider a firm which distributes profits and then immediately raises an equivalent amount by issuing equity. The shareholders will not be indifferent between this and simply retaining the profit from the start, unless the personal and corporate tax rates are equal; the direction of preference will depend on which tax rate is the larger.

More formally, we can note that at any time period t in the future, a dollar of retained earnings generates $pe^{\pi t}(1-t^c)(\frac{1-t^m}{1-t^c})$ dollars for the shareholders. However, the dollar deprived shareholders of $(1-t^m)/(1-t^c)$ dollars, which would have returned $(\frac{1-t^m}{1-t^c})\, i(1-t^m)$ dollars in each future period if invested at interest.

Hence the marginal investment is such that:

$$\int_0^{\infty}[pe^{\pi t}(1-t^c)(\frac{1-t^m}{1-t^c}) - (\frac{1-t^m}{1-t^c})\, i(1-t^m)]\, e^{-i(1-t^m)t}dt = 0 \tag{5}$$

which implies:

$$p = p^*(\frac{1-t^m}{1-t^c}) \tag{6}$$

When financed out of retained earnings, the required rate of return on an investment relative to p* thus depends on the relative sizes of the personal and corporate tax rates. This reflects the fact that shareholders sacrifice one dollar to provide new equity and $(1-t^m)/(1-t^c)$ dollars to forego dividends and "provide" retained earnings. If t^m exceeds t^c, the required return on the firm's investment is lower than for the other forms of finance, and hence the tax system can be said to favour retained earnings. If t^m is less than t^c, the reverse is true. Which of these cases holds at the margin is in fact not obvious. Although the top marginal tax rate exceeds the corporate tax rate under the present system, a great deal of personal investment is conducted through superannuation funds, which enable individuals to attain lower marginal tax rates for their investments.[5]

---

[5] There are two assumptions in the above analysis which require explanation. The first is that no earnings are retained once an investment, however funded, is underway. The retention of subsequent earnings would represent a new investment decision but the general conclusions concerning debt and equity versus retained earnings would be unaltered because this new decision would be based on the same principles as the initial decision.

The second (apparent) assumption is the irrelevance of capital gains tax on equity. Given all investments are assumed to break even, there are no capital gains or losses. Altering the model so that a retained dollar is assumed to be invested in debt or new equity's marginal investment shows that the decision to use retained earnings or external finance still depends on the relative

(iii) Can there still be optimal leverage and how would it have changed with imputation?

The exposition of the previous sub-section ignored the distinction between issuing equity to existing shareholders or new shareholders. This was made possible by the assumption that all investments break even: existing shareholders were not concerned with the prospect of diluted profits or concentrated losses.[6] Dropping this assumption does not affect the neutrality result *if* existing shareholders are capable of providing new equity (either by drawing on savings or making tax deductible loans). To see this, suppose a firm could borrow \$10 from the bank or \$1 from each of its existing ten shareholders. In either case, the net present value of returns to each shareholder is $(p/p^*)-1$ (from the general solutions to equations (2) and (4)). As before, the reason is that the cost of either type of fund is $i(1-t^m)$.

If existing shareholders are incapable of providing new equity and it must be issued to outsiders, the fact that investments do not always

---

magnitudes of t^m and t^c: substituting p* into (5) implies a net benefit (loss) of $(t^m-t^c)/(1-t^c)$.

6 The present value of the dividend paid to new shareholders must be such that they are indifferent between buying shares or an interest bearing asset. Hence the amount existing shareholders are deprived of - the payment to new shareholders - is the same as what existing shareholders are deprived of if they buy the shares themselves. Formally:

$$\int_0^\infty [pe^{\pi t} - pe^{\pi t}t^c - d^{new}]\left(\frac{1-t^m}{1-t^c}\right)e^{-i(1-t^m)t}dt = 0$$

and

$$\int_0^\infty [d^{new}\left(\frac{1-t^m}{1-t^c}\right) - i(1-t^m)]e^{-i(1-t^m)t}dt = 0$$

which combine to reproduce (4) i.e. the critical value for p is again p*.

break even means that, despite imputation, risk-return considerations continue to apply to the firm's funding decision. The higher the leverage of a firm, the greater the mean and variance of returns accruing to shareholders. If creditors bear none of the burden of variations in EBIT and shareholders are small in number, each shareholder has to bear a relatively large part of the burden of changes in the rate of EBIT. If the shareholders are risk averse, there will be some degree of leverage which optimises the risk-return tradeoff.

To see this, suppose the firm's investments yield a stochastic real rate of EBIT (p) with expected value $\mathcal{E}(p)$ and variance σ^2. The net present value to each of E shareholders of a one dollar investment in a company with debt of D is given by:

$$q = \int_0^\infty \frac{\{p_t(D+E)e^{\pi t} - [p_t(D+E)e^{\pi t} - iD]t^c - iD\}}{E} \left(\frac{1-t^m}{1-t^c}\right) e^{-i(1-t^m)t} dt - 1 \quad \textbf{(7)}$$

and has a distribution characterised by:

$$\mathcal{E}(q) = (1 + D/E) \left(\frac{\mathcal{E}(p)-p^*}{p^*}\right) \quad \textbf{(8)}$$

$$\mathrm{Var}(q) = (1+D/E)^2 \sigma^2 Z \quad \textbf{(9)}$$

where for our purposes, Z can be regarded as exogenous.

The optimal degree of leverage is then determined by maximising, with respect to D/E:

$$\mathcal{E}(q) - 1/2\, R\mathrm{Var}\,(q) \quad \textbf{(10)}$$

where R is the coefficient of relative risk aversion. The result is:

$$D/E = [(\frac{\mathcal{E}(p)-p^*}{p^*})/R\sigma^2 Z] - 1 \qquad \textbf{(11)}$$

If the investment were *certain* to break even ($\mathcal{E}(p)=p^*$, $\sigma^2=0$) the right hand side of equation (11) would be undefined. This is consistent with the result that shareholders would not care what leverage was adopted. If the investment were only *expected* to break even ($\mathcal{E}(p)=p^*$, $\sigma^2>0$) the right hand side of equation (11) would equal -1: shareholders would cancel their risk by insisting the firm invest all equity in an interest-bearing asset. This reflects the fact that $\mathcal{E}(p)$ must exceed p^* to compensate for risk.

In general, however, the optimal degree of leverage is an increasing function of:

- higher expected rates of return ($\mathcal{E}(p)$);
- lower real after-tax interest rates (and hence lower p^*);
- reduced risk aversion (R); and
- reduced volatility of returns (σ^2).

Equation (11) can be contrasted with the classical tax system, in which $(1-t^m)/(1-t^c)$ is replaced by $(1-t^m)$. In this case, optimal leverage - $(D/E)^{cl}$ - can be expressed as:

$$(D/E)^{cl} = \frac{(D/E)+t^c}{1-t^c} \qquad \textbf{(12)}$$

which is clearly much greater than the post-imputation optimum.[7]

---

[7] An alternative demonstration of the impact of imputation is its impact on the expected market value of the firm:

$$\mathcal{E}(mvf) = D+E(\mathcal{E}(q)+1) = (\mathcal{E}(p)/p^*)(D+E)$$

The main conclusions to be drawn from this section are:

- there is no longer a direct tax bias towards debt and away from equity;
- there is a relatively minor tax distortion between debt and equity on the one hand and retained earnings on the other; and
- for reasons other than imputation, an optimal debt equity ratio may still exist but this ratio would be considerably less than the optimum prior to imputation.

4. THE EFFECTS OF INFLATION

This section discusses four distorting effects of inflation on corporate activity. Each occurs despite the presence of imputation. Uncertainty is ignored so as to focus on inflation's interaction with the tax system.

(i) Inflation and Interest Rates

The above analysis has taken the nominal interest rate as given, and has shown that a necessary condition for inflation to be neutral in its impact on investment is that the real after-tax interest rate is invariant to inflation. If this condition were satisfied, and inflation had no other distorting effects on the system, then the fact that the tax treatment of interest is based on nominal rather than real rates would not distort investment decisions. Nominal interest rates could simply rise to maintain the equilibrium real after-tax interest rate.

Under imputation, transfers between debt and equity have no effect on the expected market value of *aggregate* equity and debt. (The original Modigliani-Miller (1958) theorem concerning the value of the firm was based on the same intuition. Their arbitrage explanation is essentially the same as the assumption that the opportunity costs to shareholders of debt and equity are equal.) Under the classical system, however, the value of the firm could be increased by substituting debt for equity:

$$\varepsilon(mvf^{cl}) = D+E(\varepsilon(q)+1)(1-t^{c}) = (\varepsilon(p)/p^{*})(D+E)(1-t^{c}) + Dt^{c}$$

The following argument suggests that this kind of distortion-free outcome is in fact not possible. Consider an economic system which includes the following two equilibrium conditions:

$e = \pi - \pi^*$ (Purchasing power parity) **(13)**

$i = i^* + e$ (Interest rate parity) **(14)**

where e is the rate of change of the nominal exchange rate, and the asterisk denotes a foreign variable. Suppose we start from an equilibrium with $\pi = \pi^*$ and the domestic (real) interest rate equal to the world (real) interest rate. If the domestic inflation rate then rises (by $\Delta\pi$), it is impossible for the above two conditions to be satisfied simultaneously with a constant real after-tax interest rate. There must be either a reduction in the domestic real after-tax interest rate (of $t^m\Delta\pi$), or a real exchange rate appreciation, or some combination of the two.

It is often argued that such distortions can be overcome by moving to a tax system based on real, rather than nominal, interest receipts and payments. Appropriate modification of the intertemporal model shows this is not quite true. In fact, unless t^m equals t^c it is not possible to have a tax system which corrects this problem and at the same time is neutral with respect to the choice between debt and equity financing. The reason for this is that the benefit to lenders arising from tax indexation of interest receipts would be πt^m whereas the direct cost to firms of tax indexation of interest payments would be πt^c.

To demonstrate these results rigorously, we can rewrite the marginality condition using an imputation factor of $[i-(i-\pi)t^m]/[i-(i-\pi)t^c]$ rather than $(1-t^m)/(1-t^c)$.[8]

---

[8] Cost of equity = cost of debt <=> dividend paid = $i-(i-\pi)t^c$

Return on equity = return on interest <=> net dividend received = $i-(i-\pi)t^m$

$$\text{Imputation factor} = \frac{roe}{coe} = \frac{i-(i-\pi)t^m}{i-(i-\pi)t^c}$$

The marginal conditions are then found by rewriting (2) (debt), (4) (new equity) and (5) (retained earnings) as:

$$\int_0^\infty \{pe^{\pi t}-[pe^{\pi t}-(i-\pi)]t^c \; -i\}(\frac{i-(i-\pi)t^m}{i-(i-\pi)t^c})\, e^{-[i-(i-\pi)t^m]t}dt = 0 \qquad \textbf{(15)}$$

$$\int_0^\infty \{[pe^{\pi t}-pe^{\pi t}t^c]\,(\frac{i-(i-\pi)t^m}{i-(i-\pi)t^c})-[i-(i-\pi)t^m]\}\, e^{-[i-(i-\pi)t^m]t}dt = 0 \qquad \textbf{(16)}$$

$$\int_0^\infty \{pe^{\pi t}(1-t^c)\,(\frac{i-(i-\pi)t^m}{i-(i-\pi)t^c})-(\frac{i-(i-\pi)t^m}{i-(i-\pi)t^c})[i-(i-\pi)t^m]\}\, e^{-[i-(i-\pi)t^m]t}dt = 0 \qquad \textbf{(17)}$$

The solutions for the required real rate of EBIT are:

$$p = (i-\pi)(\frac{1-t^m}{1-t^c})[\frac{(i-\pi)(1-t^c)+\pi}{(i-\pi)(1-t^m)+\pi}] \equiv p^{**} \text{ for debt and/or new equity finance} \qquad \textbf{(18)}$$

and:

$$p = (i-\pi)(\frac{1-t^m}{1-t^c}) \text{ for financing by retained earnings} \qquad \textbf{(19)}$$

These solutions show that indexation of interest, combined with an appropriately modified imputation system, would be ideal if t^c equalled t^m. If so, the marginal condition would be that the real earnings rate must equal the real interest rate regardless of the inflation rate or the source of funds. And neutrality of inflation with respect to its effect on the level of investment would be preserved by maintaining real pre-tax interest rates rather than real after-tax interest rates as required under the non-indexed system. This would solve the problems referred to earlier whereby inflation distorts real after-tax interest rates and/or the real exchange rate.

It should be noted in concluding this sub-section that provided t^m is sufficiently close to t^c, these ideal results would at least hold as an approximation. A rise in inflation which results in an equal rise in nominal interest rates would have a relatively small effect on investment. (If t^m exceeds t^c, the effect would be positive because the benefit to lenders would exceed the cost to borrowers. The reverse would hold if t^c exceeds t^m.) Thus indexation would be likely to substantially reduce the distortions associated with a nominal-interest tax base, even if they were not entirely eliminated.

(ii) Inflation and Capital Depreciation

A widely recognised problem with the corporate taxation system is that depreciation allowances are based on historical cost rather than replacement cost. With positive inflation, this usually means that the real value of depreciation allowances understates true depreciation, with the degree of understatement being larger the longer the lifetime of the asset (and the higher the inflation rate)[9]. It is often concluded from this argument that there is a tax bias away from assets with long lifetimes. This is true up to a point but for assets with very long lifetimes (very low rates of depreciation) this bias must become economically unimportant as depreciation itself becomes a relatively unimportant factor in the investment decision.

To see these points in the context of the model developed so far, consider an asset which depreciates at a rate δ, and hence has nominal earnings growth of $(\pi\text{-}\delta)$ rather than π. Defining the present value to

---

[9] There have been offsetting influences arising from various accelerated depreciation provisions and investment allowances. These are discussed in detail by Willmann (1990), who notes that in some cases these more than fully compensated for inflation. However, this does not negate the basic point made in this section that, because the depreciation rules are based on historical cost, a rise in inflation always reduces the attractiveness of an investment.

shareholders of depreciation allowances as A,[10] the solution to the required (initial) real rate of EBIT is given by rewriting equation (2) as:

$$\int_0^\infty \{pe^{(\pi-\delta)t}-[pe^{(\pi-\delta)t}-i]t^c-i\}(\frac{1-t^m}{1-t^c})e^{-i(1-t^m)t}dt + A = 0 \qquad \textbf{(20)}$$

$\Rightarrow p = [p^* + \delta/(1-t^m)][1-A]$ where, as before, p^* is the rate required in the absence of depreciation **(21)**

The first term in (21) reflects the inherent economic advantage of assets whose rate of depreciation (δ) is low. The second term reflects the tax bias towards rapidly depreciating assets (A high).

Figure 3 plots the solution to equation (21) against the asset's half life given an inflation-nominal interest rate combination of 7% and about

---

[10] Suppose that, although economic depreciation is exponential, the Tax Office has chosen a statutory lifetime (L) which implies that deductions of (1/L) for each of L years have the same present value as would exponentially declining deductions. (Hence both *present* values fall short of the actual historical cost, let alone the replacement cost.)

$$\int_0^L (\frac{1}{L})e^{-i(1-t^m)t}dt = \int_0^\infty \delta e^{-\delta t}e^{-i(1-t^m)t}\,dt \Rightarrow L= 2/\delta \text{ approximately.}$$

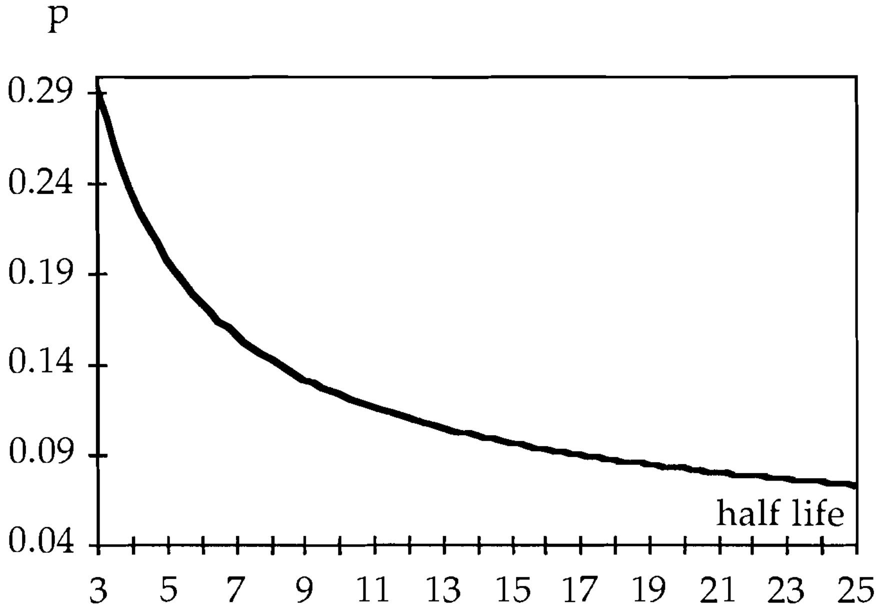
i.e. 1/L for each of L periods is equivalent to exponentially declining deductions beginning with 2/L. (See King and Fullerton (1984) for a similar approximation.) Note that this equivalence does not contradict the Tax Office's actual alternative of linear diminishing value deductions beginning with 1.5/L.

Reflecting the May 1988 decision concerning investment in plant and equipment, the firm is then allowed to deduct (1.2/L) for each of (L/1.2) years, thereby raising the present value of what shareholders receive to an amount defined as A:

$$A = \int_0^{(2/\delta)/1.2} t^c(\frac{1.2}{2/\delta})(\frac{1-t^m}{1-t^c})e^{-i(1-t^m)t}dt.$$

15% respectively.[11] The economic advantage of low depreciation always outweighs the tax bias because of the distinction between historical and replacement cost and the fact that any tax deduction only compensates the firm at the rate of tax. Thus the required real rate of earnings falls with asset longevity.

Figure 3: Required Pre-depreciation Rate of Return



As noted above, one may think that for given real after-tax interest rates, slowly depreciating assets suffer the most from inflation; the gap between historical and replacement cost widens most and distant deductions are particularly heavily discounted. But the viability of an asset which does not depreciate at all is obviously unaffected by distortions to the real value of depreciation allowances. At the other extreme, an asset which depreciates immediately is similarly

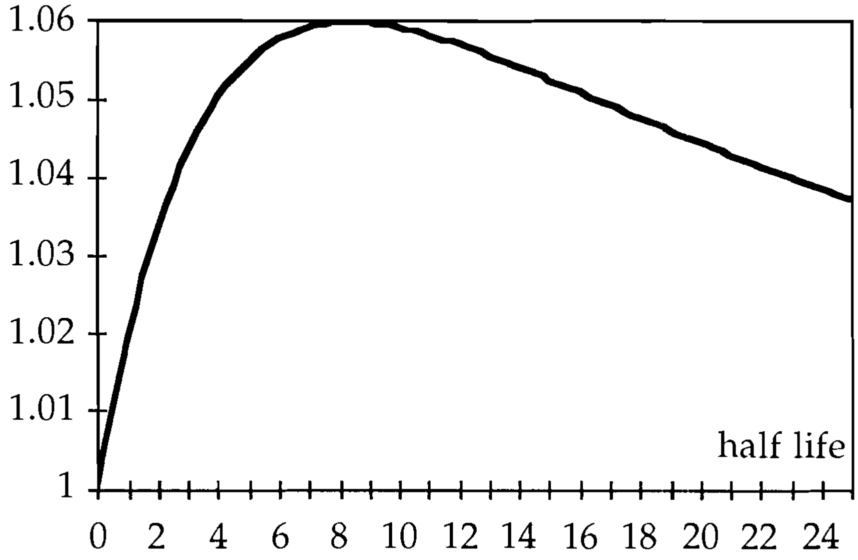
---

11 The half life is the time taken for the asset to lose half its real value under exponential depreciation. This is given by ($e^{-\delta t} = 1/2 \Rightarrow t = (\ln 2)/\delta$). The inflation, nominal interest rate combination was chosen so that if $t^m = t^c = .39$, the real after-tax interest rate is 2% = .1475 (1-.39) -.07.

unaffected by such effects of inflation. This suggests that the distortion arising from the interaction of inflation and depreciation is least for assets with either extremely short or extremely long lifetimes: inflation has its most deleterious effects on assets which depreciate at a moderate rate.

Figure 4 shows that, strictly speaking, this is true. It shows the ratio of required real pre-depreciation rates of return, assuming inflation rates of 7 and 4 per cent respectively. (So as to focus on the depreciation distortion, it is assumed that inflation does not erode the real after-tax interest rate - a constant 2% - and, as in Figure 3, that corporate and personal tax rates are equal.) Two important conclusions emerge from this graph. First, the interaction of inflation and depreciation always penalises investment (ie requires a higher real, pre-depreciation return), whatever the depreciation rate of the asset involved. Secondly, this penalty is greatest for assets of medium life. The exact definition of medium will depend on the parameters of the tax system - in the above calculations, medium is a half-life around 6-12 years.

Figure 4: Depreciation & the Effect of Inflation



Realistically, most plant and equipment has a half-life of less than 6-12 years. Consequently, it is fair to focus on the rising part of the curve and conclude that increases in inflation make one less inclined to invest in fairly slowly depreciating plant and equipment than otherwise. In fact, this assertion is quite conservative. Equation (21) shows that, with real after-tax rates assumed constant, Figure 4 depends only on the depreciation allowances. Moreover, this is true whether economic depreciation is exponential or straight-line. Assuming straight line allowances, rather than their approximation as used above, shows that the peak is still 1.06 and it occurs at an assessed life of 24 years. This is beyond the assessed life of virtually all plant and equipment.[12] On the other hand, buildings clearly have lives well in excess of this, and probably fall in the part of the curve where relative bias is reduced as the asset life is lengthened. Furthermore, buildings probably benefit more from the subject of the next sub-section than do plant and equipment.

(iii) Inflation and Capital Gains

Prior to the introduction of capital gains tax in 1985, the tax system gave a clear advantage to assets which yielded their income in the form of capital gains. Capital gains taxation has in large part removed this advantage but, because the tax is levied only on the real component of capital gains, they remain more favourably treated than other forms of income which are assessed on a nominal basis. Quite apart from issues of tax avoidance associated with the artificial conversion of income into capital gains, this treatment of capital gains will tend to encourage the allocation of investment towards the kind of assets which appreciate in value, relative to assets which yield a stream of income.

---

[12] Figure 4 suggests the effect of inflation is relatively small; interpreting the curve as the ratio of the two present values of all future gross earnings (discounted equally at the social discount factor) implies a distortion which peaks at 6%. Nevertheless, Freebairn (1990) also concluded there is a bias away from middle-lived assets. Willmann (1990) quantified the adverse effect of inflation on taxable corporate income due to the tax treatment of depreciation and concluded there is a bias towards short-lived assets. That result is due to separating the effects of inflation and depreciation on the present discounted values of allowances.

To take the most extreme comparison, suppose a firm can invest one dollar in an asset which produces no income at all but rises in value because it is expected to produce income in the future. If the nominal value of this asset is inflating at rate π^a, as distinct to general inflation of π^g, then shareholders will be indifferent to purchasing the asset and holding it for T periods if π^a is such that:

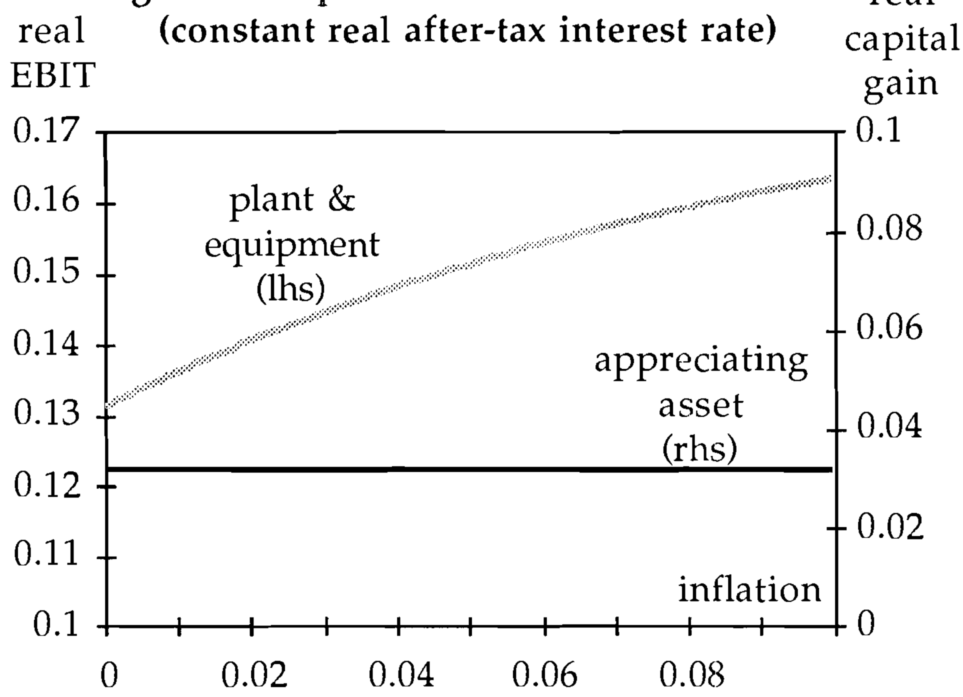
$$[(e^{\pi^a T}-1)-(e^{\pi^a T}-e^{\pi^g T})\,t^c\,](\frac{1-t^m}{1-t^c})e^{-i(1-t^m)T}$$

$$-\int_0^T i(1-t^c)(\frac{1-t^m}{1-t^c})e^{-i(1-t^m)t}\,dt = 0 \qquad \textbf{(22)}$$

The first term represents the present value of the net return to shareholders after the asset has been sold, the loan repaid, and tax paid on the real capital gain. The second term represents the net cost of interim interest payments (note that interim tax is - it^c each period).

Figure 5 focuses on the distinction between the treatment of this asset and a depreciating income-producing asset by assuming real after-tax interest rates are not eroded by inflation and that $t^m = t^c$. If the asset is intended to be held for five years, then its purchase is viable if it appreciates at a real rate of 3.2% per annum, regardless of the inflation rate. On the other hand, the depreciating income-producing asset must earn an initial real rate of EBIT of around 15-16% at current inflation rates. Its feasibility falls as inflation rises because of the reduced real value of depreciation allowances.

Figure 5: Required Real Returns & Inflation
(constant real after-tax interest rate)

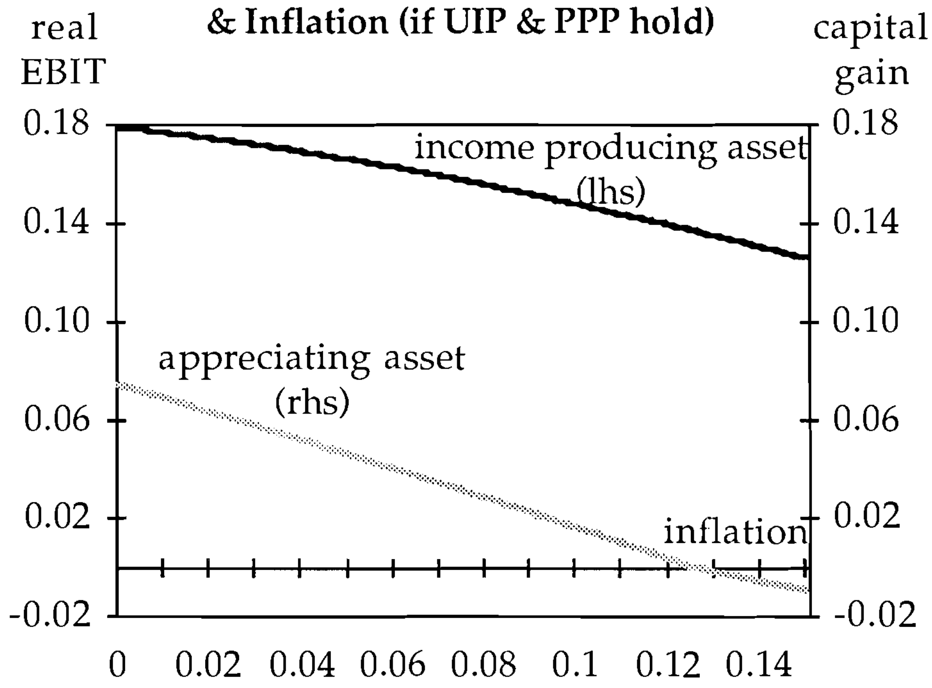


If changes in inflation erode real after-tax interest rates, the incentive to acquire appreciating assets rather than depreciating income-producing assets is even greater: because of the failure of interest rates to fully adjust to inflation, the lack of income in the interim is less costly. Figure 6 illustrates this. Falls in the required real rate of appreciation are proportionately much greater than falls in the required (initial) real rate of EBIT.[13]

[13] Nominal interest rates are assumed to be always 8 percentage points above the inflation rate which, for t^m=.39, implies real after-tax interest rates of about .05-.39π.

The treatment of capital gains is asymmetrical; an asset's value must fall below its actual purchase price before a deduction is granted. For the purposes of Figure 6, equation (22) has been modified accordingly ($0<\pi^a<\pi^g \Rightarrow$ the term for capital gains tax is dropped). The effect is to make the grey line fall a little less rapidly after it crosses the x-axis. Note that if the asset held for capital gain produced any income during the holding period, its attractiveness would be even greater.

Figure 6: Required Real Returns & Inflation (if UIP & PPP hold)



The immediate effect of the tax incentives to purchase appreciating assets is to raise the price of the existing stock of such assets. As π^a rises above π^g and is expected to continue rising, the incentive becomes even greater. As shown in Section 3(iii), those who are confident they can buy and sell at a substantial profit may well prefer to fund their speculation with debt rather than equity, even post-imputation. This argument was even stronger for most of the 1980s. Macfarlane (1989) argued that it was a major influence on the rise in debt over the 1980s.

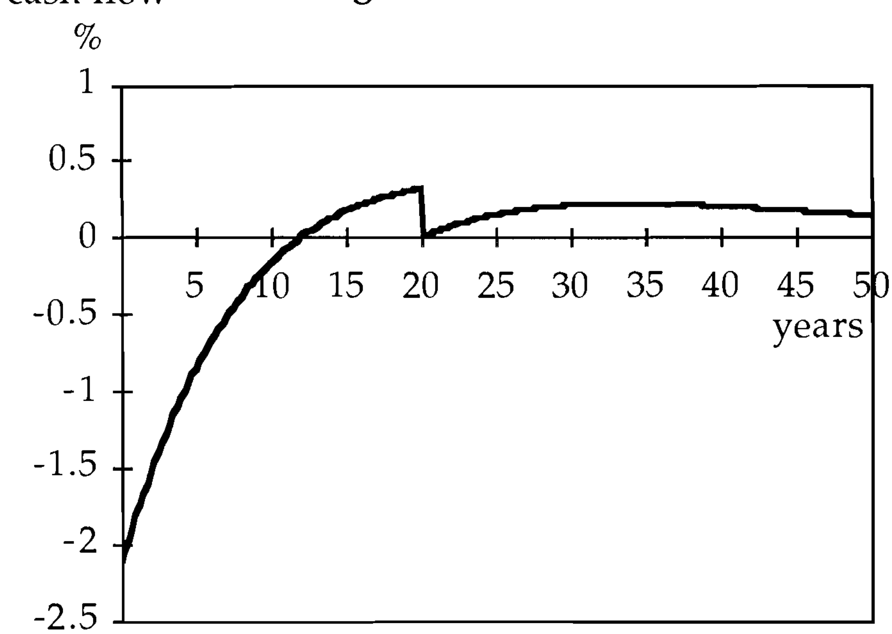
Of course, the major difficulty with asset speculation is that it does not generate steady cash flow. However, the next sub-section shows that even investment in an asset which produces a steady stream of real earnings (and no capital gain), over a period of stable interest rates and inflation, can cause cash flow problems.

(iv) Inflation and Cash Flow

As noted earlier, inflation generally involves deferral of the cash flow on an investment. If inflation is higher than the depreciation rate, the typical pattern is one of losses in early periods which, in present value terms, are matched by gains in later periods. These losses and gains are exacerbated by inflation. In the absence of credit rationing or liquidity constraints, such a cash flow pattern is not regarded in the academic literature as a problem, since any cash needs could be met by borrowing. But this is unrealistic as a practical proposition and the deferral of cash flow tends to reduce the incentive to invest, particularly for assets with long lifetimes.

The implied pay-back periods can be surprisingly long. Suppose inflation is 7%, the nominal interest rate is about 15% and the asset depreciates very slowly, having a half life of about 17 years. Figure 7 shows the time path of the discounted net return to shareholders assuming that the project is marginal in terms of net present value. (The step down reflects an assumption of straight line depreciation allowances for 20 years, implying relatively rapid deductions and hence a smaller deficit at first than otherwise.) Clearly, it takes a long time for gross earnings to exceed tax and interest obligations.

Figure 7: Cash Flow



Indexation of the tax treatment of interest receipts and payments in the manner discussed earlier would not solve this problem as earnings would still inflate while interest costs were constant. Indexation of the capital component in loan agreements would solve the problem but their use does not appear to be widespread.[14]

5. CONCLUSIONS

Australia's corporate structure entering the 1990s reflects in large part the corporate decisions made over the past decade. These were strongly influenced by a tax system that favoured debt, in combination with expectations of rising asset values which ultimately proved to be unrealistic. Biases in the corporate tax system have been much reduced by recent reforms, especially the introduction of dividend imputation and capital gains taxation. However, the paper has

---

[14] It should be noted than when an asset is depreciating more rapidly than inflation, the typical cash flow pattern is reversed, with early profits being followed by losses. To be of marginal worth, the rapidly depreciating asset must earn high nominal returns early, before its gross income-earning capacity is eroded by depreciation.

argued that a number of distortions remain. These include biases affecting the allocation of investment spending among assets of different lifetimes, biases favouring assets which yield their income as capital gains, and some (minor) biases affecting the funding decision. The distortions to investment are exacerbated when inflation rises. The paper has not discussed the administrative complexities involved in any attempt to achieve comprehensive inflation-adjustment of the corporate tax system, and it does not advocate that such an attempt be made. Rather, it is intended to highlight the costs of inflation, even under a tax system that has already undergone substantial reform.

In assessing the economic significance of these results, it is worth emphasising the partial-equilibrium nature of the model which has been used. To isolate the corporate sector, it has been necessary to take the interest rate as given, rather than modelling its determination in an economy-wide equilibrium. Because of this, the paper probably understates the importance of inflation-induced distortions as implications for the real exchange rate have been ignored.

APPENDIX: DATA

Gross debt excludes non-financial debt such as trade creditors and provisions for such items as deferred income tax. Equity is the book value of shareholders' equity (share capital, reserves, retained profits) less intangible assets, priority interests and preference capital, on which firms are obliged to pay dividends.

With the exception of convertible securities such as notes and debentures, which are included in equity, debt represents the firm's interest bearing liabilities and equity represents the firm's non-interest bearing liabilities.

The sample includes some firms that came into public existence during the period in question and completely excludes those which went out of public existence during the period. Hence it would be misleading to graph the levels of debt and equity separately - to do so would overstate the rise in the respective levels. The rise in the ratio of the two will be understated if those firms which ceased to exist during the 1980s were typically highly leveraged. But this is likely to be of second order importance.

A comparison of the 1989 sample with the 1988 sample illustrates this point. Apart from the observation for 1987/88, the two series are very similar. Most of the difference between the two observations for 1987/88 (0.95, down from 1.06) is due to the subsequent dropping out of highly geared companies.

While the amount of intra-corporate sector lending may have risen markedly over the period, there are no compelling reasons to believe the amount of corporate lending to those outside the corporate sector grew disproportionately. Hence movements in aggregate gross debt should be fairly representative of movements in aggregate net debt.

Banks have extremely high debt to equity ratios as deposits are regarded as debt. Consequently they were deleted from the sample.

REFERENCES

Bureau of Industry Economics (1990), "Does the Australian Tax System Favour Company Debt?", Business Income Taxation Paper 4, Canberra.

Carmichael, J. (1990), "Inflation: Performance and Policy", in S. Grenville, ed., *The Australian Macro-economy in the 1980s,* Reserve Bank of Australia, pp.288-342.

Chisholm, A. and J.W. Freebairn (1988), "Measuring the Income Tax Wedge on Business Investments in Australia - An Application of the King-Fullerton Model", Centre of Policy Studies Discussion Paper Series D134.

Copeland, T.E. and J.F. Weston (1983), *Financial Theory and Corporate Policy,* 2nd Edition, Addison Wesley, New York.

Corporate Advisor (1990), "Analysis of Takeover Activity: January-December 1989".

Economic Policy Advisory Committee (1990), "Trends in Corporate Debt", Council Paper No. 41.

Freebairn, J.W. (1990), "Effective Real Tax Rates on Some Australian Investments", EPAC Background Paper No. 3.

Gruen, D.W.R. (1990), "The Effect of Steady Inflation on Interest Rates and the Real Exchange Rate in a World with Free Global Capital Flows", paper prepared for the 9th Pacific Basin Central Bank Conference on Economic Modelling, Bangkok, 21 - 25 January 1991.

King, M.A. and D. Fullerton (1984), "The Taxation of Income from Capital", NBER Working Paper No. 1058.

Macfarlane, I.J. (1989), "Money, Credit and the Demand for Debt", Reserve Bank of Australia Bulletin, May, pp.21-31.

Macfarlane, I.J. (1990), "Credit and Debt: Part II", Reserve Bank of Australia Bulletin, May, pp.27-34.

Modigliani, F. and M.H. Miller (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment", *American Economic Review*, Vol. 48, No. 3, pp.261-297.

Officer, R.R. (1986), "Some Observations on the Effect of Company Financing and Investment of the Proposed Imputation Company Tax System for Australia", University of Melbourne, Graduate School of Management, W.P. No. 8.

Officer, R.R. (1987), "The Proposed Imputation System for Company Tax and its Likely Effect on Shareholders, Financing and Investment", University of Melbourne, Graduate School of Management, W.P. No. 6.

Officer, R.R. (1989), "The Change from a Classical to a Full Imputation System of Company Taxation in Australia: Implications for Dividend and Financing Policies of Companies", University of Melbourne, Graduate School of Management, W.P. No. 29.

Scott, M.F.G. (1987), "A Note on King and Fullerton's Formulae to Estimate the Taxation of Income from Capital", *Journal of Public Economics* , Vol. 34, No. 2, pp.253-264.

Willmann, H. (1990), "Some Calculations on Inflation and Corporate Taxation in Australia", Reserve Bank of Australia Research Discussion Paper No. 9012, December.