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THE EFFECTS OF INFLATION: A REVIEW WITH SPECIAL REFERENCE TO AUSTRALIA

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THE EFFECTS OF INFLATION: A REVIEW WITH SPECIAL REFERENCE TO AUSTRALIA*

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ABSTRACT

This paper, prepared as a background document to the Conference on *The Effects of Inflation in Australia*, aims to provide both a guide to the extant literature and a broad indication of the impact inflation appears to have had in Australia. In performing the latter task we have taken data from various sources, sometimes articles written for other purposes. Therefore, our investigation is best viewed as the charting of general trends; hopefully, somewhat more precise conclusions will be forthcoming from the Conference.

Section 2 of the paper provides a view of the traditional discussion on the effects of inflation, concentrating upon an analysis of the celebrated Fisher effect. The reason for the emphasis given to this effect lies in its crucial role in almost all theoretical work on the impact of inflation. Section 3 outlines the framework of the paper. Basically, we work with the national accounts divisions of households, corporate trading enterprises, corporate financial enterprises and government. In each case we consider the range of activities engaged in by representatives of each sector, both from income/outlay account and balance sheet perspective, analysing what theory and evidence is available relating inflation and the level of activity. These enquiries form sections 4 to 7. Section 8 closes the paper by looking at the economy as a whole and examining the inter-sectoral redistributions that have been attendant upon inflation.

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The Effects of Inflation : A Review with Special Reference to Australia

A.R.PAGAN AND P.K.TRIVEDI

1. INTRODUCTION

"The more the evidence in the case is studied, the deeper will grow the public conviction that our shifting dollar is responsible for colossal social wrongs and is all the more at fault because those wrongs are usually attributed to other causes. When those who can apply the remedy realise that our dollar is the great pickpocket, robbing first one set of people, then another, to the tune of billions of dollars a year, confounding business calculations and convulsing politics, and, all the time, keeping out of sight and unsuspected, action will follow and we shall secure a boon for all future generations, a true standard for contracts, a stabilized dollar".

Irving Fisher, *Stabilizing the Dollar in Purchasing Power*, 1918.

"By a continuing process of inflation, Governments can confiscate, secretly and unobserved, an important part of the wealth of their citizens. By this method they not only confiscate, but they confiscate arbitrarily; and, while the process impoverishes many it actually enriches some".

J.M.Keynes, *Inflation and Deflation*, 1919.

"...Imperfectly anticipated inflation - the only kind we have - generates massive redistribution of wealth between some borrowers and some lenders, some buyers and some sellers. From a very lofty point of view, these are still transfers, not a net burden on society as a whole. But that does not make them good. Moreover, in the public mind these transfers come to look like a net loss : The gainers attribute their gains to their own perspicacity, energy and virtue; the losers attribute their losses to inflation".

R.M. Solow, *The Intelligent Citizen's Guide to Inflation*, 1975.

"Prolonged and intense inflation upsets many habits of economic life, confronting consumers with price increases and price dispersions that send them shopping; making them doubt their ability to maintain their living standards, downgrade the value of their career jobs and long-term savings; and forcing them to compile more information and to try to predict the future - costly and risky activities that they are poorly qualified to execute and bound to view with anxiety. The recognition by the consumer that economic institutions are gravelydisturbed by inflation is an appreciation of reality - not money illusion".

A.M. Okun, *Inflation : Its Mechanics and Welfare Costs*, 1975.

"A major cause of our present economic turmoil has been high and varying inflation;...a stable price level, a steady dollar, is an indispensable factor of production in a prosperous industrial economy. It may help to list briefly some of the reasons for this view:

—— production planning requires budgets for future purchases of inputs — labour, materials and plant: and for future sales of outputs. Inflation wrecks these budgets; unit values of inputs and outputs escalate unpredictably and unevenly, and huge trading losses can emerge with little warning;

—— in the face of such conditions, most businesses react by contracting the planned scale of operations to reduce the risk of loss. This is one of the mechanisms by which inflation creates unemployment. In some other industrial countries, this process has gone further than in Australia;

—— in the uneven shifts of prices, business management cannot rely on relative market price movements or on the normal accounting records to guide business decisions. Informed business judgements become very much more difficult."

H.M. Knight, *Beyond the Short-Run Prospect*, 1976.

Australia has now almost had a decade of high inflation and few prognostications for the first half of the 1980s would envisage any substantial reduction in the current level. Policy during the latter half of the 1970s was directed very much toward a reduction in inflation; a pre-occupation that earned itself the soubriquet "the inflation first strategy". There have been many critics of some aspects of this strategy, with Hughes (1980) and Nevile (1980) being the most trenchant and substantial. The latter is of particular interest as it canvassed what the actual effects of inflation had been upon the major aggregates of consumption and investment, deriving some striking conclusions. It was not however, and was not intended to be, a precise documentation of the effects that inflation has had upon the Australian economic framework, but it did point to the fact that the effects were poorly understood and that policy might be better designed if this understanding could be enhanced.

The paper aims to provide a review of the theoretical and empirical work done on the effects of inflation. It does not aim to be a fully

2. AN OVERVIEW OF THE TRADITIONAL LITERATURE ON THE EFFECTS OF INFLATION

The literature on the costs of inflation has usually emphasized the distinction between *anticipated* and *unanticipated* inflation and it is usually argued that the costs are different in the two cases. Representative examples of this literature are Flemming (1976) Ch.X (anticipated inflation), Ch.XI (unanticipated inflation), Solow (1975), Phelps (1972, 1973) and Cagan and Lipsey (1978). A secondary distinction, not wholly neglected but frequently less emphasized, has been between *uniform* and *nonuniform* inflation; Jaffee and Kleiman (1977) discuss the implications of this category.

Anticipated Inflation

Traditionally the literature has concentrated heavily on the effects of fully anticipated inflation, initially in the context of a completely "indexed" economy. More recently emphasis has shifted to economies in which a number of magnitudes, especially those relating to the tax system, are fixed in nominal terms and hence interact with anticipated inflation to produce real effects. This later development has been seen by many writers, for example, Cagan and Lipsey, as a major departure from the earlier tradition. Moreover, there is now a much younger but vigorous development in the literature which attempts to analyse the real effects of nonuniform inflation by concentrating on the connections between variability in relative prices, uncertainty, and savings and investment decisions. Contributions to this development include Okun (1971), Fischer (1981) and Friedman (1977).

A central proposition in the discussion of real effects of anticipated inflation concerns the "almost neutrality" of fully anticipated inflation in certain circumstances. This proposition rests upon the

celebrated "Fisher effect". The ubiquity of the Fisher effect in some form or other justifies its discussion at the outset of this paper, for it is impressive to see how many propositions regarding the effects of anticipated inflation depend on the Fisher effect in one form or another.

The pure Fisher effect (as opposed to the tax-adjusted Fisher effect discussed later) is developed in the context of a model in which savings and investment depend upon the real rate of return to the lenders and borrowers respectively. It is assumed that savings are related positively to the real rate of return and investment negatively. All investment is debt financed. Thus the real rate of return is determined in goods market by the long term factors of thrift and productivity in the truly classical fashion. If the lender is repaid the principal and the interest at the end of a period during which inflation occurs at a fully anticipated rate π, then the nominal interest rate i, which must be paid to ensure that the loan and the return are fully indexed, is given by the so-called exact Fisher formula

$$i = r + \pi + r\pi.$$

When such a rate is paid, the real rate to the lender and borrower is unaffected. Treating r as a constant it is readily seen that $di/d\pi = 1 + r$. If, as is quite usual, the term $r\pi$ is omitted to yield the approximate Fisher formula $i = r + \pi$, then $di/d\pi = 1$ and the nominal interest rate adjusts fully to leave the real rate unchanged.

In the sense that the above adjustment leaves unchanged the real equilibrium savings and investment, fully anticipated inflation is seen to have no real consequence. A slight modification to this analysis was introduced by Tobin (1965) who pointed out the existence of a channel through which the real return could change as a consequence of fully

anticipated inflation. This simply results from the presence of some non-interest bearing liquid assets whose real return declines as a consequence of inflation, causing the holders to substitute real for monetary assets in their portfolios thereby bringing about a fall in the real rate. The resulting effect on capital stock is thought to be "small". (Sidrauski (1967) demonstrated, in the context of a monetary intertemporal optimising model, that the steady-state capital stock did not depend upon the inflation rate, while Fischer (1979) has shown that the rate of accumulation of capital on the transition path does depend on the inflation rate).

The traditional view of inflation is therefore easily summarized. Suppose that all inflation is perfectly anticipated, that it is uniform, all agents have demand and supply functions not exhibiting money illusion, and that there is no uncertainty, distortionary taxes or costs of price changes. In such circumstances all relative prices remain unchanged so that the equilibrium quantities transacted would remain the same. Inflation then has no real effects; any observed effects in an actual economy must come from a failure of the assumptions underlying this perfect model.

Even though there are no real effects in the above description there is a welfare loss essentially because inflation acts like a tax. This loss arises from the fact that some monetary assets bear a zero rate of interest - in Australia, M1. Because nominal interest rates on competing assets will rise with inflation the demand for these money balances will decline, and a loss in consumers' surplus results. Graphically the situation is depicted below where i_0 is the pre-inflation nominal interest rate, i_1 is the post-inflation interest rate and M is the demand for real balances.

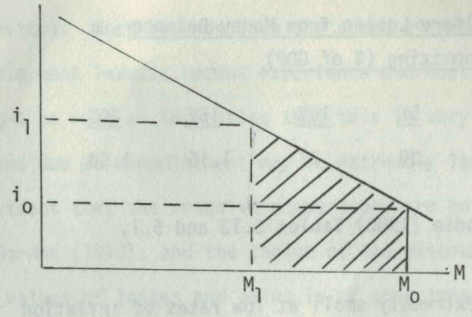

Figure 1

Following Bailey (1956) the shaded area is taken as a measure of the welfare loss to the economy deriving from the inflation-induced rise in the nominal interest rate from i_o to i_1. An approximation to the shaded area would be

$$i_1(M_o-M_1) - \tfrac{1}{2}(M_o-M_1)(i_1-i_o) \qquad (1).$$

Generally the first term is assumed to dominate the second and it can be written as

$$M_1 E\, \Delta i \qquad (2)$$

where E is the interest elasticity of real balances and $\Delta i = i_1-i_o$ is the change in nominal interest rates. Taking M to be M1 for Australia, the long run interest elasticity appears to be around - .5 - see the papers by Adams and Porter (1976), Norman and Purvis (1975) and Pagan and Volker (1981). Allied with the hypothesis that $\Delta i = \Delta \dot{p}$, where $\dot{p}$ is the rate of inflation, and a ratio of M_1 to GDP from 1970-79 of .154, the welfare loss, expressed as a percentage of GDP, can be computed for various rates of inflation i.e. the losses are relative to a zero rate of inflation.

TABLE 1

One-Period Welfare Losses from Money Balance Economizing (% of GDP)

Inflation Rate	1%	5%	10%	15%	20%
Loss	.07	.39	.77	1.16	1.54

Source: Norton and Brodie (1980) Tables S.13 and 5.1.

These losses are extremely small at low rates of inflation and prima facie suggest that the traditional welfare costs of inflation may not be great. Of course these are only one period costs. In a similar exercise for the US Friedman (1969) treated them as a perpetuity and discounted the returns at 5%. Feldstein (1980) has argued that this is a substantial under-statement of the loss because the demand curve will shift out as the economy grows and, if the growth rate of the economy exceeds the discount rate, the losses may even be infinite. He discusses various objections to such a position including the fact that the marginal utility of consumption declines in the future, due to income increases; his paper also references a number of qualifications that need to be made to the above measurement.

Basically, interest in measuring the welfare cost of inflation was stimulated by an attempt to trade-off inflation and unemployment. Both Minford and Hilliard (1977) and Feldstein (1980) argue that the unemployment costs are lower since only a *temporary* increase in unemployment purchases a *permanent* reduction in inflation; this being recognised as the view of inflation set out in, for example, Phelps (1972). Feldstein regards the fact that the losses above grow as weighting the case heavily in favour of increasing unemployment. This does not seem at all clear since the temporary increase must be in the *rate of unemployment*, so that the losses associated with this

option also grow with GDP in the transition period (assuming constant productivity). Much depends upon the speed of response of inflation to unemployment levels; recent experience and Australian empirical work might be read as indicating that this is very slow and therefore the losses due to unemployment may be extremely large. Nevertheless, it is evident that the relative comparisons are not as clear cut as set out in Gordon (1973), and the choice of the discount rate in computing present values of losses and gains is of some importance. See Hall (1976) and also Phelps (1978).

We shall next consider how the almost-neutrality-of-fully-anticipated-inflation type propositions are modified when we allow for taxation. Simplest discussions along these lines allow for a common, constant marginal tax rate, say τ , which applies to all borrowers and lenders so that the real after-tax cost of funds to the borrower and the real after-tax return to the lender are both $i(1-\tau) - \pi$. If savings and investment schedules exhibit "regular" properties mentioned before, once again equilibrium real return, savings and investment would be unchanged, but now the response of the nominal interest rate to fully anticipated inflation would be $di/d\pi = 1/(1-\tau) > 1$ if $0 < \tau < 1$.

Under the Australian tax-laws lenders and borrowers are not treated symmetrically. Corporate borrowers can offset the nominal interest payments on debt but others have tax-exempt interest income. For example, certain institutions such as superannuation funds and charities have tax-exempt status which may also be acquired to a certain extent by those households who hold their interest-bearing deposits in the names of their dependents. Also there is the obvious fact that, under a progressive tax system, not only do lenders have differing marginal tax-rates but that their average tax rate may in fact differ from the corporate tax rate. Therefore, in considering the impact of anticipated inflation on lending

and borrowing it is more appropriate to postulate differential tax rates between lenders and borrowers.

One of the simplest models of lending and borrowing with differential tax rates is that of Gandolfi (1976) and it is a modification of the standard Fisher effect model. Given such a model it is straightforward to show (1) that differential tax rates lead to a divergence between the real after-tax cost of borrowing and the real after-tax return to lending, the difference going to the tax collector, and (2) that fully anticipated inflation increases the divergence between the cost of borrowing and the return to lending and affects the equilibrium savings and investment decisions, thereby producing real effects. It is possible for equilibrium savings and investment to rise or fall, depending on the relative inflation-induced shifts in savings and investment. In this case it is not possible to give a simple expression for the inflation-induced change in the nominal interest rate. The model does predict the direction and the range of change, viz.

$$1 < \frac{di}{d\pi} \leq \frac{1}{1-\tau^*}$$

where τ^* = max (lender's marginal tax rate, borrower's marginal tax rate). Assuming $\tau^* = .50$, it is clear that the tax-adjusted Fisher effect can be as large as 2. The above bounds result remains valid even when equity as well as debt finance is introduced into the models.

The usefulness of this theoretical prediction follows from the fact that, in all intertemporal economic decisions, (such as investment in fixed capital, storage of inventories, portfolio decisions, the choice of financial structure of firms), one needs to know something about the magnitude of $di/d\pi$, the precise analytical expression for which can be quite complex; see, for example, Feldstein, Green and Sheshinski (1978).

Empirical investigations of the Fisher effect are numerous; see Levi and Makin (1978), (1979), for references to the American literature. Two recent Australian contributions are by Poole (1981) and Volker (1980). Given the nonobservability and possible nonconstancy of the real rate of return, the differential responses of different interest rates (itself an interesting topic for investigation) to the unobserved anticipated inflation rate, and lags in the adjustment of interest rates to the anticipated rate or those in the adjustment of the anticipated rate to the actual rate of inflation, empirical testing is far from easy. The Australian studies show a very slow response of interest rates to inflation; Poole (whose approach is very close to that of Fama (1975)) estimates $di/d\pi = 1.28$; the interest rate variable used by Poole is the 90-day commercial bill rate.

In some ways the literature on the Fisher effect is a microcosm of the modern discussion on the effects of inflation. Here the traditional distinctions are eschewed in favour of a concentration upon the *interactions* of inflation with institutional features of an economic system which is inadequately adapted to inflationary conditions. Institutional constraints and imperfect adjustment to inflation with their resulting effects on resource allocation now feature more prominently in most discussions, as do the possible effects of inflation-generated uncertainty. Cagan and Lipsey (1978) appear to regard this as the major shift in the discussion of the effects of inflation since the mid-1960s (see Cagan and Lipsey, Ch.1).

Unanticipated Inflation

In dealing with the effects of unanticipated inflation the literature concentrates on (1) income and wealth redistributions arising from non-indexed debt-credit instruments and nominal contracts, (2) labour supply and output effects of the type arising in the discussions

of short-run Phillips curve and (3) resource allocative effects arising from uncertain future prices. We shall not deal in detail with any of these at this stage since such a treatment is given elsewhere in the paper. Rather, we concentrate on identifying the principal issues.

The major issues in the income redistribution area concern the wage-lag hypothesis according to which profit-earners gain from an unanticipated inflation and the changes in the size distribution of before- and after-tax incomes. Bach and Stephenson (1974), Foster (1976) and Blinder and Esaki (1978) provide a guide to the issues and the literature. Wealth redistributions from net creditors to net debtors within and between sectors and between different age groups are also discussed by these authors. Our discussion of these issues is contained in sections 4, 5, 7 and 8.

The vast literature on the Phillips-curve deals with the employment and output effects of unanticipated inflation and its thrust does not need reiteration in this paper. Interested readers are referred to the recent Australian survey by Hagger (1976).

The literature on inflation and uncertainty is of a more recent vintage and it deals with the connections between the inflation rate, its variability and the variability of relative prices. Okun (1971) put forward the hypothesis that a high level of inflation was associated with greater variability of inflation. Several interpretations of variability are possible including (a) the variance of unanticipated inflation; (b) cross-section variance of inflation rate;and (c) the variance of relative prices around the mean inflation rate; see Pagan *et al.* (1981) for further elaboration. A great deal of recent activity in this area follows Friedman's 1977 Nobel Prize lecture in which he tentatively put forward an hypothesis relating variability of inflation with uncertainty, and increases in uncertainty with output/employment

reduction. Several recent contributions have attempted to empirically measure the output costs of inflation uncertainty; see, for example, Mullineaux (1980), Levi and Makin (1980). There is also a growing literature on inflation and relative price variability but as yet very little has been published on either the causes or the effects of greater relative price variability associated with high inflation rates; for a recent Australian reference see Clements and Nguyen (1980).

3. THE STRUCTURE AND FRAMEWORK OF THE PAPER

Although the traditional view provides a perspective upon the likely sources for the effects of inflation, some further structure to the search is needed. There would be many ways of achieving this: our preference has been to adopt as our primary focus the four major groupings of agents in the economic process as set out in the national accounts (see Fischer and Modigliani (1978) for an alternative):

1. Households - as persons and as unincorporated trading enterprises
2. Corporate Trading Sector
3. Corporate Financial Enterprises
4. Government.

In dealing with these groups, interest centres upon the extent to which behaviour is modified by the presence of an exogenous rate of inflation. As such, the investigation is a partial equilibrium one; only after the behavioural responses are identified is it feasible or meaningful to investigate how the interactions of the sectors determine an inflation rate. This is of course a traditional mode of analysis in macroeconomics, as witnessed (say) in the book by Turnovsky (1977).

Four questions can be posed which are useful in setting the milieu within which the analysis and discussion proceeds:

1. What theory is available concerning the impact of inflation upon economic decisions?
2. How are institutions likely to adapt to inflation?
3. How have Australian institutions and agents adapted to inflation?
4. What differences emerge between agents' responses within a given sector?

The last of these questions stems from a recognition that none of the sectors above consist of homogeneous units and it may be that,

even if inflation has no impact upon a sector in aggregate, it may have major intra-group effects. This is particularly likely for the household sector, for which it was traditionally argued that those units in the group on fixed incomes would lose substantially by inflation - again through a failure of relativities to be maintained. As will become evident in this review far greater attention has been paid to the inter rather than the intra group effects; to some extent this arises from the greater availability of data but also perhaps because there was always a qualitative appreciation of the intra group effects and a tendency to ignore the inter-sector ones. The 1970s, however, produced evidence of the importance of the latter.

Agents not only vary in their behavioural responses but also undertake a variety of decisions that are affected by inflation in very different ways. Because of this, it is useful to begin the analysis of any sector by an enumeration of the items appearing in that sector's income and outlay account and balance sheet. Attention can then be paid to how each item is likely to vary with inflation. Besides providing a consistent way of structuring discussion, this methodology is often very insightful, as the accounting identities existing between stocks and flows means that an effect of inflation upon one account has certain consequences for the other.

The following four sections of this paper deal with each of the above four sectors. Following this, section 8 provides a view of the inter-sectoral redistribution of income and wealth that is a concomitant of inflation.

4. THE EFFECTS OF INFLATION UPON THE HOUSEHOLD SECTOR

The income and outlay account of the household sector consists mainly of the following items (using the terminology of the National Accounts).

Outlay	Income
Consumption	Wages, Salaries and Supplements
Investment in Dwellings	Dividend and Interest Receipts
Investment by Unincorporated Trading Enterprises	Unincorporated Enterprise Income
Taxes	Income from Dwellings
	Transfers

As evident from the above account, the household sector is very heterogenous, incorporating decisions of both a "personal" and "business" nature. Because of the different nature of these activities, and sometimes their treatment by the tax authorities, it will generally be necessary to deal with them separately.

On the outlay side the item accorded greatest attention has been that of consumption. Observers have established a correlation between the ratio of consumption to disposable income - the consumption ratio - and inflation for many countries, a relation documented in Howard (1978). Many theories have been advanced to explain this phenomenon, and a comprehensive account of these has been provided by Williams (1979). In the sub-section dealing with this item below, only the most successful of these explanations are dealt with.

Although a lot of attention has been paid to consumption, there has been an increasing tendency to examine household expenditure upon

residential investment. This concern has been evident mainly in the U.S. where interest payments on mortgages are tax deductible and inflation has seen the emergence of a wide range of mortgage instruments. Hendershott (1980) surveys some of this literature.

On the income side of the account, two major items have been of interest. Firstly, there is the likelihood that inflation has affected the level and distribution of real income and wealth, both before and after tax. Generally, it would be expected that the pre-tax level of real income would be maintained in the face of inflation for those groups engaged in market activities, but that the after-tax level might decline as a result of a progressive income tax system. An analysis of this is deferred until section 7 of the paper. This leaves the need to analyse the effects of inflation upon the distribution of real income and the possibility that transfer incomes are not indexed for inflation. Both of these questions have produced a number of studies in recent years: for the first a basic reference would be Bach and Stephenson (1974).

Secondly, it is possible that the interaction of inflation and a progressive tax system has led to an increasing degree of understatement of incomes; the growth of the illegal or underground economy. The mechanism leading to this event is quite apparent, and most research has focussed upon rather ingenious ways of measuring its extent; some references being Feige (1979), Gutmann (1977), Macfee (1980) and Tanzi (1980b).

In the following sub-sections a much more detailed analysis of inflation upon the categories mentioned is provided. Following upon this analysis is a discussion of the balance sheet effects.

4.1 Consumption Effects

The first item of expenditure, consumption, has been extensively researched in recent years. High inflation rates in many countries have coincided with a fall in the ratio of consumption to income, an outstanding exception being the U.S. where a fall in the ratio early in the 70s has been reversed since 1976. For Australia a sharp fall occurred in the early 1970s - as evidenced in Table 2 - with only a moderate subsequent recovery. Opinion varies over when the major fall took place but the consensus at the RBA Conference on Applied Economics (1979) seemed to favour 1973/4.

There is abundant evidence that the consumption ratio did rise in Australia with the advent of inflation; the earliest systematic investigations being Evans and Higgins (1972), Bonyhady and Caton (1976) and Freebairn's two papers (1976) and (1977). Bonyhady and Caton were cautious in their assessment as it was not possible to document a rise in the savings ratio from the Flow of Funds Accounts available at that time,but recently revised statistics on the Flow of Funds Household sector do now support it. Although there has been some dissent, by and large the profession and policy-makers seem to have accepted that the consumption ratio variations were in some way "caused" by inflation. What has been in dispute is the exact mechanism whereby this came about.

Williams (1979) has provided a comprehensive survey of the many ways that the consumption ratio might be changed, and there is little point in going over such ground again. Instead, by using the long-established "life cycle" approach to consumption behaviour, it is possible to isolate the role of inflation in affecting the real wealth of households. This orientation is very useful in that it enables an exposition of those studies that have been most successful, both here and abroad, in explaining the observed variations in the consumption

ratio.

The essential characteristic of the life cycle hypothesis for our purposes is the idea that consumption is related to life-time resources rather than income. Such a philosophy also underlies Friedman's permanent income hypothesis. In one variant of the life-cycle hypothesis discussed by Modigliani (1977), the aggregate level of the equilibrium level of consumption services C_t is determined by

$$C_t = \alpha YL_t + \delta W_{t-1} \qquad (3)$$

where YL_t is current period (constant price) disposable labour income, W_{t-1} is the real value of net worth available at end of period t-1. Ignoring any distributional effects of any impact upon YL_t of inflation, the coefficient δ is known to depend upon the real rate of interest (r) - see Modigliani and Brumberg (1955) - and Modigliani (1977) argues that δ is well approximated by $\delta_o + kr_t$. In this linearization the sign of k is indeterminate, depending upon the relative strengths of the substitution and income effects, but in what follows it is implicitly assumed to be positive so that the income effect dominates.

Replacing δ in (3) with this linear approximation yields

$$C_t = \alpha YL_t + \delta_o W_{t-1} + kr_t W_{t-1} \qquad (4)$$

It should be stressed that (4) is not an explanation of observed consumption expenditures but rather that of the equilibrium or desired levels of services from consumer goods. As such it differs from measured consumption in two ways. Firstly, the national accounts estimate the expenditure on durables in a period rather than the service flow from the stock of durables. Secondly, actual consumption behaviour is likely

to deviate from the equilibrium levels in (4). Both of these aspects are ignored here; durables are only about 30% of total consumption, and, as Nevile (1980) observed, most of the reduction in the consumption ratio comes from the non-durable part.

Continuing with (4), write the real interest rate as the difference between a nominal rate of interest (i) and a rate of inflation ($\dot{p}$), so that (4) would be

$$C_t = \delta_o W_{t-1} + k i_t W_{t-1} - k \dot{p}_t W_{t-1} + \alpha Y L_t \qquad (5)$$

If all assets and liabilities bear the same rate of interest total income is, by definition, $Y_t = YL_t + i_t W_{t-1}$. Assuming that YL_t is a constant fraction, c, of Y_t (5) could be simplified to

$$C_t = \delta_o W_{t-1} + k (1-c) Y_t + \alpha c Y_t - k \dot{p}_t W_{t-1} \qquad (6)$$

$$= \delta_o W_{t-1} + \beta Y_t - k \dot{p}_t W_{t-1} \qquad (7)$$

Division of (7) by Y_t would yield a consumption ratio

$$\frac{C_t}{Y_t} = \delta_o \phi_t + \beta - k \dot{p}_t \phi_t \qquad (8)$$

where ϕ_t is the net worth to income ratio (W_{t-1}/Y_t). In the steady state all quantities above would be constant giving a constant (C/Y).

(8) illustrates a possible origin of any correlation between the consumption ratio and the rate of inflation and, ignoring complications coming from dynamic adjustments, it corresponds closely to the equations estimated in Freebairn (1976), (1977). In fact many explanations of consumption behaviour use the rate of inflation as a regressor in an equation explaining the consumption ratio; a procedure seen to be correct provided ϕ_t is constant over time. Anstie *et al.*(1981) work with $\dot{p}_t \phi_t$ as a regressor, constructing estimates of ϕ for the household

sector but, as ϕ was fairly constant over the period of inflation, both approaches yield essentially the same results.

Prima facie this relation seems to establish a connection between inflation and consumption behaviour, and this has been the interpretation placed upon such studies by most Australian commentators. Care has to be exercised with such an interpretation. Let us consider another way of re-writing (5). Define "adjusted income" Y^*_t as the sum of labour income YL_t and the real return on wealth r_tW_{t-1} ; this contrasts with the national accounts definition $Y_t = YL_t + i_tW_{t-1}$ which includes the nominal interest receipts from wealth. Assume that YL_t is now in constant proportion to Y^*_t . Then (5) could be written

$$C_t = \delta_o W_{t-1} + \gamma Y^*_t \qquad (9)$$

and consumption would be related to adjusted income Y^*_t rather than actual income Y_t. This is the idea employed by the Bank of England (1978), Taylor and Threadgold (1979), Hendry and von-Ungern Sternberg (1980) and Jump (1980). Some of these articles emphasize that Y^*_t is the Haig-Simons definition of income, which could be consumed whilst holding real wealth constant. Jump argues the case very strongly for some adjustment to be performed to Y_t in order to offset the spurious rises in income resulting from the high nominal interest rates induced by inflation; the receipts from these high rates must be re-invested if households are not to consume their real wealth.

The derivation above points to the fact that consumption depends upon the real rate of interest; only if this varies with the rate of inflation will inflation have an effect upon consumption behaviour.[1] But the traditional consumption ratio (C/Y) will decline with inflation as

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[1] This assumes that YL_t is invariant to inflation.

the denominator is artificially inflated by nominal interest receipts. This is the argument given by Anstie *et al.* (1981) for why the consumption ratio is a poor measure of the impact of inflation upon consumption, and they compute the ratio C/Y*. As is evident from Table 2 a different perspective on the effects of inflation are thereby obtained.

TABLE 2

Original and Adjusted Consumption Ratios

	1966/7-1972/3	1973/4	1974/5	1975/6	1976/7	1977/8	1978/9	1979/80
Original	.910	.876	.840	.847	.853	.855	.873	.889
Adjusted	.945	.957	.941	.935	.917	.908	.927	.944

Source: Anstie et al.(1981) Table 6. The ratios are of consumption to non-farm disposable income.

The derivation above has been gone into at some length since, as Table 2 shows, it is capable of explaining the reduction in the measured consumption ratio. It not only provides a qualitative transmission mechanism that focusses upon the capital losses sustained by households in an inflationary period, but seems capable of a quantitative explanation of observed behaviour. The perspective it offers is that any examination of the impact of inflation upon consumption must pay attention to the behaviour of real interest rates; if the two relative prices making up this quantity do not rise uniformly there will be some real effects. Of course the above development is too simplified, ignoring the role of taxation. Bringing this into account makes r_t the after-tax rate of interest and, even if the before-tax real rate of interest is constant, there may still be real effects if nominal interest receipts are taxed. It is not entirely clear whether, in the past, much of this income was taxed but, in an era of less regulated interest rates, policy will need to

examine the wisdom of taxing such nominal rather than real quantities.

Although the explanation detailed above - that inflation has reduced the real value of net worth and stimulated saving - is perhaps the most widely accepted one, an earlier proposal - finding expression in Australian studies in Evans and Higgins (1972) and Davey (1975) - was that consumers were subject to money illusion, setting budgets in nominal terms. The idea in fact goes back to Koopmans (1942). Evans and Higgins use the following consumption function (ignoring dynamics).

$$\frac{PC}{PY} = \alpha + \beta \frac{PY}{P^*Y^*} \qquad (10)$$

where PC is nominal consumption, PY is nominal income and P*Y* is previous peak income. This implies

$$\frac{C}{Y} = \alpha + \beta \left(\frac{Y}{Y^*}\right)(1+\dot{p}) \qquad (11)$$

if, for example, P* was the previous period's price level. Thus the implications of budgets being set in nominal terms are very close to those discussed earlier, with the rate of inflation effectively entering as a regressor. However, it should be apparent that the *rate of inflation* enters because of the use of the "ratchet" effect in consumption. If one only had nominal consumption being related to nominal income as in

$$PC = \alpha + \beta(PY) \qquad (12)$$

$$\therefore\ C = \frac{\alpha}{P} + \beta.Y \qquad (13)$$

and it is the price level that appears in the consumption function. Davey estimates a form such as (13). As Johnston and Looker (1979) point out the money illusion idea is an alternative viewpoint of the usual links of inflation and it is important to attempt to discriminate between it and the "wealth effect" hypothesis; such a task still remains to be done.

One way to summarize the "wealth effects" argument above is to observe that income is measured incorrectly, as it fails to correct for the spurious rise in interest receipts. There are other ways in which disposable income in the national accounts might be incorrectly estimated. One of these centres around "Income from Dwellings."[2] By definition this is gross rent less maintenance, rates, taxes and depreciation. Depreciation is imputed on the basis of the historic cost of the building. Therefore, it fails to increase with inflation and results in an overstatement of the true income from dwellings. This feature was pointed out by Covick in the *Australian Bulletin of Labour*, Dec. 1980, and was put forth as one of the causes of the fall in the measured consumption ratio. On the basis of some rather rough computations of depreciation at replacement cost, Anstie *et al.* (1981) argue that the effect is not large enough to explain the observed drop in the consumption ratio. A more refined analysis is available by utilizing a recent study of replacement cost depreciation in the national accounts - Bailey (1981).

TABLE 3

Current Cost Depreciation and Income Measures

	1966/7-1972/3	1973/4	1974/5	1975/6	1976/7
Deprec.% Dis.Inc.	2.15	2.28	2.38	2.47	2.56
Dis.Income Hist.Cost to Dis.Income Rep.Cost	1.0099	1.0127	1.0146	1.0158	1.0167

Source: Bailey(1981). Table 27 of Appendix A for Current Cost Depreciation on Private Dwellings.

From Table 3 there is an obvious (and progressive) overstatement of income. In 1976/7 it is some .41% points higher than in 1966/7-1972/3.

[2] The same point also holds for "Income from Unincorporated Enterprises".

This is effectively the .4% given by Anstie *et al.* Moreover, this is likely to be the major adjustment, as the long asset lives of dwellings means that the move from historic to replacement cost depreciation is much more substantial for this component than it is for the shorter-lived plant and equipment items. Therefore the conclusion that depreciation adjustments are not a complete explanation of consumption ratio movements would still seem valid.[3]

Mention of current cost depreciation raises the spectre of real capital gains upon dwellings and equity to offset any capital losses on financial assets. Table 4 gives the real capital gains (the nominal gains less the inflation rate of the consumer deflator) for (i) new houses, (ii) land, (iii) houses and land combined and (iv) equity.

TABLE 4

Real Capital Gains on Dwellings and Equity (%)

	Av.1966/7 -1972/3	1973/4	1974/5	1975/6	1976/7	Av.1972/3 -1976/7
New Houses	0	13.34	7.03	- 2.21	- .01	4.7
Land	8.4	22.79	-17.65	- 5.26	23.41	5.0
Houses and Land	2.45	16.52	- 1.67	- 3.12	7.06	4.5
Equity	6.2	-40.8	-48.5	29.9	-13.5	-18.23

Real capital gain = rate of inflation in asset price less the rate of inflation of the Consumer deflator.

Source: Houses and Land from Filmer & Silberberg (1978). Equity from Table 6 of Anstie *et al.* (1981).

It is possible to incorporate capital gains upon equity and dwellings into the earlier framework by increasing adjusted income by the amount of any real capital gains. Notice, however, that in a comparison of consumption ratios in periods such as pre and post 1972/3, it is necessary

[3] Table 1, Appendix F of Bailey(1981) provides current and historic cost depreciation for equipment. For 1976/7 the ratio was 1.45. This compares with an equivalent ratio of dwellings of 2.82.

that real capital gains in both periods be different if the adjustment is to matter. Thus the question is not whether there are real capital gains on any asset in a particular period, but whether they are larger than in the past. Table 4 casts doubt on this proposition for dwellings; all the differential being due to the price of new houses rising faster than the consumer deflator. Equity has of course recovered since 1976/7, but the gyrations exhibited in the asset prices would hint strongly that households are likely to react fairly slowly to any real capital gains made on either asset. Nevertheless the possibility that such relative price changes can affect consumption behaviour has been documented for a number of studies - Bosworth (1978), Shiba (1979) and Downs (1980)[4] - and must always be borne in mind in considering inflation effects upon consumption.

4.2 Residential Investment

The second major item in the outlay account is residential investment. As owner-occupied dwellings involve the consumption of housing services, a determinant of the demand for such dwellings is the price of such services relative to other goods. This price is the implicit rental price of housing services R_H, obtained by computing the net costs to the owner-occupier of consuming such services. The formula for this is quite complex - see Rosen and Rosen (1980) - involving the expected capital gain, depreciation, maintenance expenditures, taxes and any mortgage deductibility. Filmer and Silberberg (1979) give it as

$$R_H = P_I[(1-f)\bar{r} + (1-\bar{x}h)if] + (1-b)L+\bar{M}-\bar{r}H + \bar{T}-\tilde{\rho}P_I - H \qquad (14)$$

where

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[4] See also the article "Soaring Housing Values Help Consumers to Thwart Economists", *Australian Financial Review*, Wed. April 1, 1981.

P_I = asset price of new investment

$\bar{M}$ = maintenance expenditures (including insurance)

$\bar{T}$ = transactions costs at sale and purchase

L = property taxes

f = proportion of the initial cost of the asset financed at a rate of interest (i) which is less than the rate of return received by investing funds in alternative activities (i.e. the loan to equity ratio).

H = subsidies to housing (Home Savings Grant)

$\bar{x}$ = tax rebate of x cents in the dollar on a proportion h of interest payments

b = rebate of b cents in the dollar on land taxes

$\bar{r}$ = after tax opportunity cost of capital (nominal)

$\tilde{\rho}$ = expected capital gain over a planning horizon less the depreciation rate (δ).

The impact of inflation upon the rental price of housing services is best understood by ignoring all taxes and subsidies and assuming that $\bar{r} = i$, whereupon it becomes

$$R_H = P_I(i-\tilde{\rho}) + \bar{M} + L + \bar{T} \qquad (15)$$

and it is apparent that a balanced inflation would leave the relative price of housing services to other consumer items unchanged. However, if there are real capital gains on housing or if interest rates fail to adjust to inflation, it is apparent that housing services will become cheaper relative to other consumer goods.[5] When tax deductibility of nominal interest payments is introduced even a balanced inflation is no longer neutral as (for f=1, $\bar{M}=\bar{T}=H=0$)

$$R_H = P_I[(1-\bar{x}h)i - \tilde{\rho}] \qquad (16)$$

and R_H rises by less than the nominal rate of interest i.

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[5] This conclusion applies to any durable as the rental price is computed in the same way, but no attention is paid here to such relative price shifts.

Table 5 records the ratio of R_H to the consumer price index over the period 1966/7 to 1976/7. It would have been better if the ratio had been to the C.P.I. excluding rent, but this was not available.

TABLE 5

Relative Price of Housing Services (Index,1966/7 = 100)

	1967/8	1968/9	1969/70	1970/1	1972/2	1972/3	1973/4	1974/5	1975/6	1976/7
CPI	104.2	101.5	102.1	108.4	94.5	55.3	73.9	80.2	88.0	89.0
Rent	102.8	97.4	93.3	95.4	82.5	48.2	67.6	75.1	80.8	83.2

Source: Filmer and Silberberg (1978). Data Appendix Tables 1.12 and 2.1 (supplied by authors). The Income tax rate is assumed to be that corresponding to the seventy-fifth percentile of net income.

Inflation clearly led to a striking reduction in the cost of housing services relative to other goods; in fact the reduction apparent in Table 5 understates that which occurred as the capital gains were restricted to be no greater than 10% per annum and Table 4 reveals this to be inaccurate for the period 1973/4 to 1976/7. Moreover,no account has been taken of the fact that the income from housing is untaxed.

A related decision households must make is that of tenure choice. As rents are likely to rise with inflation there is a possibility that inflation can provide an incentive to own rather than rent. This phenomenon is consistent with Australian experience as Table 5 demonstrates. Much of this advantage comes from the failure of mortage rates to adjust to inflation and the lack of any taxation of real capital gains, illustrating well how institutional features can create quite severe distortions in an inflationary environment.

It would seem to follow from the trends evident in Table 5 that residential investment should have experienced substantial growth in recent years. Table 6 therefore presents the ratio of residential

construction to the value of GDP originating in the "ownership of dwelling sector" - a measure intended to provide some guide to the behaviour of the marginal capital output ratio - and the ratios of dwelling investment to non-dwelling and plant and equipment investment.

TABLE 6

Residential Investment Ratios

	1968/9	1969/70	1970/1	1971/2	1972/3	1973/4	1974/5	1975/6	1976/7
(1)	1.04	1.06	.96	.96	.96	.91	.66	.71	.74
(2)	1.32	1.38	1.17	1.30	1.59	1.57	1.25	1.63	2.08
(3)	.66	.71	.63	.69	.75	.71	.58	.63	.69

(1) = Ratio of constant price private gross fixed capital expenditure on dwellings to constant price value of GDP originating in the ownership of dwelling sector.

(2) = Ratio of constant price private gross fixed capital expenditure on dwellings to constant price private expenditure on non-dwelling construction.

(3) = Ratio of constant price private gross fixed capital expenditure on dwellings to constant price private expenditure on equipment investment.

Source: Norton and Brodie (1980) Tables 5.3a,5.11.

Far from there being an expansion of residential investment, it is apparent that this item of expenditure has been depressed over most of the 70s, although it has held up better than investment in non-dwelling construction. One possible explanation is that the average rates of return found in Table 5 are a poor guide to the marginal returns upon which new investment decisions are based, particularly if this new investment is located at the periphery of urban centres so that the commuting costs are important.

An alternative explanation might derive from the observation that both 1970 and 1974/5 saw marked rises in nominal mortgage interest rates - see Norton and Brodie (1980) Table 3.1. This is the basis of arguments explaining a similarly depressed residential *investment* market in the U.S. by Kearl (1979). He argued that the attraction of low implicit rental costs is offset by the high initial mortgage payments coming from higher nominal interest rates. This initial payment on a standard mortgage is

$$P_I[1-(1+i)^{-J}]^{-1} \ell - i \qquad (17)$$

where ℓ is the loan to value ratio and J is the amortization period. The possibility that such a factor could be significant originates in the tradition of lending institutions' specifications of a constant

nominal repayment rather than a constant *real* repayment. In regressions Kearl finds that the first period cost and a measure of the "tilt" of the mortgage are important explanatory variables in determining the asset price of housing, and these work in the opposite direction to the rental price in inflationary periods. It would be interesting to investigate whether this is true for Australia as well.

4.3 Inflation and Distribution Effects

It is commonly believed that one of the deleterious effects of inflation is that it is accompanied by a redistribution of wealth and income. There are two types of effects that need to be considered. Firstly, as the income and expenditure components vary with income class, e.g. transfers are highest at the lowest income classes, it may be necessary to treat each income group separately in order to properly assess the incidence of inflation upon different income groups.

A number of studies have attempted to identify the effects of inflation on the economic position of particular groups of agents, e.g. the "poor", and the pensioners. Hollister and Palmer (1972) considered the trade-off between relative improvement in job prospects in tight labour markets and the costs of inflation. Hollister and Palmer, Minarik (1980) and Muellbauer(1974) have considered whether non-uniform inflation may have raised the "poor man's price index" relatively more, by raising the price of "necessities" relatively more. The question is considered by constructing constant utility price indexes (which allow for substitution) by Muellbauer and by constructing fixed weight price indices of necessities by Minarik. There is a dearth of such studies in Australia. Construction of price indices based on weights other than the average expenditure weights may improve our understanding of the incidence of inflation especially in times of nonuniform inflation. Two recent studies by

Clements and Nguyen (1980) and Clements and Izan (1981) suggest that inflation in Australia over 1959-1980 was accompanied by significant changes in relative prices. To reiterate, the effects of nonuniform changes in prices on welfare of particular vulnerable groups should be studied.

A possible inflation-induced erosion in the value of social security benefits is frequently a matter of social concern. The basic rates of pensions and benefits have been related to the rate of inflation but some real increases have also occurred. The rate of increase was greater than that of prices between 1971 and 1975. In October, 1977, twice yearly automatic indexation of basic rates of pensions and benefits was introduced, but this was altered in October 1979 to provide annual, rather than twice yearly increases and a year later this was amended yet again to reintroduce the twice yearly indexation of pensions and benefits subject to indexation. See Department of Social Security Annual Report 1979-80.

A second effect relates to the capital gains and losses incurred by households as a consequence of inflation. Many studies have been made of this for particular countries, e.g. Bach and Stephenson (1974) for the U.S., Niida (1978) for Japan and Parkin (1975) for the U.K. An adequate assessment requires balance-sheet data classified in a number of ways, and there is a paucity of such data in Australia. Nevertheless, some general appreciation of these effects is available. Recall from the discussion of consumption that the inflation-induced income losses sustained by households in any given period is $(i-\dot{p})W_{-1}$ where i is the rate of return on the asset. For financial assets i is the nominal rate of interest, but for assets such as equity and housing it will include a capital gain component. Expressed as a fraction of disposable income, this capital loss is seen to be

proportional to the ratio of the value of that asset to disposable income. Therefore, the greater this ratio, the greater the *potential* for capital losses (and gains) to be available from inflation. Notice that the capital losses and gains are *proportions* of income and not absolute values as in some studies. Such a measure seems more meaningful. Whether the potential becomes an actuality depends upon the composition of the portfolio. Assets such as property and equity are likely to be more "inflation proof" than fixed interest securities and bank deposits. Therefore, the two crucial parameters are the ratio of net worth to income and the extent to which portfolios are "exposed". Table 7, derived from the data in Podder and Kakwani (1976)(itself based on the Edwards, Drane and Gates study of Consumer Finances), provides various asset/income ratios for income deciles. Reece(1977) provides a similar table classified by net worth.

TABLE 7

Average Asset Income Ratios by Deciles of Income Distribution

Decile	Net Worth	Home & Property	Cash & Bank Deposits	Insurance and Superannuation
1	-.129	.304	.088	.045
2	1.240	.999	.293	.161
3	2.562	3.170	.247	.263
4	3.855	4.492	.364	.519
5	4.619	4.889	.425	.623
6	5.089	4.508	.592	.790
7	5.471	4.310	.593	1.003
8	5.965	3.824	.635	1.369
9	6.817	3.061	.654	1.584
10	9.326	4.016	.859	2.078

Source: Appendix

Table 7 is very revealing in indicating that the potential for capital losses (and gains) increases with income. Examining the degree of exposure, and assuming that losses are largely associated with cash, deposits and insurance, it is apparent that the degree of exposure also increases with income. With property exhibiting real capital gains it seems that the principal beneficiaries of inflation are those in the middle of the income distribution, where a high property to income ratio exists. Probably one can summarize the implications of Table 7 by observing that, even though low-income households do have a much larger proportion of their assets in cash and deposits (the proportions for deciles 1, 2 and 5 being 17.5,17.6 and 6.7 for example) their lower assets/income ratios means that they have lower losses in *proportion* to their incomes. One has to recognise that the data upon which Table 7 is based is now some fourteen years old, making it unlikely that it is representative of the situation today. However, as many of the capital losses on financial assets were sustained at an early stage of inflation, it may give a reasonable picture of the historical rather than future effects.

It is not obvious that the re-distributive effects should be examined by income classes; a common suggestion being that a redistribution from younger to older age groups is an important effect. Some data from the Macquarie survey is assembled in Table 8 .

Again there is little evidence that, over most of the age range, inflation would affect groups very differently; certainly if there are real capital gains on property the over-30s would benefit more, but any capital losses on liquid assets is fairly uniformly spread, with the over-60s the major losers.

TABLE 8

Asset-Income Ratios by Age Distribution

	Under 30	30-39	40-49	50-59	60+
Net Worth	1.280	2.071	3.050	3.475	5.505
Home & Property	1.469	2.044	2.434	2.320	3.480
Bank Deposits & Cash	.198	.180	.236	.286	.654

Thus what data there is does not support the idea that inflation has major effects within the household sector in terms of its effects upon income. However, it is important to recognise one major qualification to this in a longer time frame. As mentioned previously, the feature of nominal constant repayments on loans means that the repayments/income ratio rises sharply with inflation for those on low incomes. This has the effect of pricing low income earners out of home ownership and so restricting the range of assets available to them. Consequently, as inflation progresses the proportion of assets devoted to property for lower income earners is likely to decline, and their degree of exposure is likely to rise even if their net worth to income ratio remains constant. It would be of some importance to policy to assess whether this actually has occurred, but the solution to it clearly lies in attempting to modify the system to something approaching constant real repayments. Policy to date has been concerned with the deposit gap - a very real phenomenon - but perhaps one that isinvariant to inflation, in the sense that it will tend to be a constant proportion of income.

4.4. The Illegal Economy

One of the reasons given for the growth of the underground economy is"...the rising inflation rate, which has pushed individuals into higher

tax brackets, and provided an incentive to seek alternative sources of income that are not detected by the taxmen". (CBA, 1980, p.9). There are of course a variety of other factors, and it may well be impossible to disentangle the separate influences. Nevertheless, it is worth briefly considering the argument advanced in the Commercial Bank of Australia (CBA) Economic Review (September, 1980) that an index of the size of the illegal economy is available by examining the behaviour of the ratio of notes and coin to demand deposits. This argument rests on the idea that transactions in the underground economy are cash-based and avoid the use of cheques. Therefore, a growing illegal economy would be associated with a switch from demand deposits to notes and coins.

In the CBA's analysis the ratio chosen was that of total notes and coin to total demand deposits, although the argument would seem more applicable to households. For this reason Table 9 provides ratios on a household rather than economy-wide basis.

Table 9 supports the CBA's conclusion that an increasing proportion of M1 assets are being held in cash. In fact the results for the household sector recorded in this table are more striking than the aggregate ratio utilized by the CBA : the aggregate ratio rising from .3 to .43 (in 1978/9) as compared with a rise above from around .45 to .74. One of the difficulties with such a comparison however is that the growth of Bankcard facilities would have probably had a greater impact on cheque accounts than on cash balances, and this substitution would lead to a rise in the ratio. It is also relevant that the ratio of demand deposits to total financial assets (as defined in Table 11) has fallen from .074 in 1968 to .058 in 1978; a reduction that has not been absorbed by increasing cash balances. Nevertheless, the movements in the ratios of Table 9 do seem correlated with the years of high inflation.

TABLE 9

Notes and Coin and Demand Deposits - Households

Year	(1)	(2)	(3)	(4)	(5)
1966	784	1,783	640	.440	.359
1967	875	1,939	(n.a)	.451	(n.a)
1968	968	2,072	780	.467	.376
1969	1,066	2,179	850	.489	.390
1970	1,182	2,219	940	.533	.424
1971	1,337	2,285	1,100	.583	.481
1972	1,458	2,452	1,230	.594	.502
1973	1,688	3,187	1,460	.530	.458
1974	2,011	3,367	1,770	.597	.526
1975	2,402	3,464	2,130	.694	.615
1976	2,795	4,128	2,440	.677	.591
1977	3,150	4,421	2,810	.712	.635
1978	3,517	4,772	3,140	.737	.658
1979	3,954	5,688	3,520	.695	.619

(1) Notes and Coin in hands of Public, 30 June of year.

(2) Demand Deposits held by Households, 30 June of year.

(3) Notes and Coin held by Households, 30 June of year.

(4) Ratio (1)to (2)

(5) Ratio (3) to (2)

Source: (1) RBA Statistical Bulletin

(2) RBA Statistical Bulletin - Trading Bank Deposits classified by Industry, sum of persons plus non-company holdings

(3) F. Pellarini, Comert (1978).(Updated to 1980 private communication).

4.5 Balance Sheet Composition

A simplified version of the balance sheet of households as persons is as follows.

Balance Sheet Structure of the Household Sector

Assets	Liabilities
Notes and Coin	Advances from the Banking System
Bank Deposits	Advances from Other Financial Institutions
Deposits with Other Financial Institutions	
Government Securities	
Debentures, Notes and Deposits	
Equities	
Dwellings/Land	
Consumer Durables	
Other Assets (Paintings etc.)	

On the liabilities side the major item (for the personal sector) is mortgages. As this is connected with the purchase of the asset dwellings, it is not unreasonable to concentrate upon the asset side of the balance sheet alone. Fundamentally, it would rest upon the relative rates of return of different assets. Table 10 presents the pre-tax nominal rates of return on various assets; for dwellings (held as a landlord) the return is after tax (the tax rate appropriate to the 9th decile).

A number of interesting facts emerge from Table 10. Firstly, interest rates upon most financial assets have risen only about three percentage points in contrast to the (at least) five percentage points rise in the inflation rate; for these assets the Fisher effect is not

TABLE 10

Rates of Return on Various Assets

	1972	1973	1974	1975	1976	1977	1978	1979
(1) Savings Bank Deposits	3.86	4.25	6.0	6.0	6.0	6.0	6.0	6.0
(2) Savings Bank Investment A/c	5.06	5.00	7.0	8.0	8.0	8.0	7.50	7.25
(3) Trading Bank Fixed Deposits	4.76	5.4	7.0	8.8	8.8	9.2	9.2	8.8
(4) Debentures (> 5 years)	7.53	8.5	11.2	13.4	11.4	11.3	10.5	11.2
(5) Local & Semi-Government Securities (7-9 yrs)	5.93	6.3	10.0	9.7	10.2	10.7	9.5	10.4
(6) Special/ Savings Bonds	5.26	5.8	8.0	9.0	9.2	10.0	9.0	9.25
(7) Superannuation + Assurance	5.81	5.91	6.49	7.01	6.98	7.15	7.27	
(8) Equity (Dividend yield + Capital Gain)	18.50	-3.41	-21.37	1.84	34.15	5.63	15.76	23.58
(9) Dwellings	3.92	9.31	11.60	11.19	10.26	7.91		

Sources: Series (1)-(6). Tables 3.21, 3.21, 3.20, 3.22, 2.28 and 2.27 of Norton and Brodie (1980).

(7) Ratio of Imputed Interest from Australian National Accounts to Reserves in RBA Flow of Funds Supplement.

(8) Table 3.19 of Norton and Brodie (1980).

(9) Filmer and Silberberg (1978), Table 2.4 Data Appendix. This is a real rate of return.

in evidence for this period, and this failure constituted the source of real capital losses discussed in the analysis of consumption behaviour. Secondly, some assets have shown a very small increase in their rates of return - debentures, insurance and superannuation payments, and equities. The performance of the latter has been studied more extensively by Saunders and Tress (1981). Of course the small effective tax rates levied upon insurance and superannuation payments means that the after-tax rates of return may be much closer. Thirdly, dwellings have been a remarkably good investment (these are post-tax rates of return).

Some care has to be exercised with the above ex-post comparisons. Inflation can change the risk characteristics of assets when perceived ex ante, and this factor must be taken into account in any analysis of actual choices. A simple example can be used to illustrate this point. Consider an asset paying a nominal rate of return of $i\%$ per year over a fixed period, during which the mean expected rate of inflation is $\dot{p}^*$ but the variance of the anticipated rate of inflation around this mean is σ^2. In such an instance, the asset is riskless only if there is no inflation; in the presence of inflation the expected mean return is $i - \dot{p}^*$ and the variance is σ^2. Choosing between this asset and another that is risky in an inflation-free world but which is inflation-proof, will generally require an explicit account of households' attitude to risk. Partial analyses have been provided by Bookstaber (1980), Boonekamp (1978) and Feldstein (1980c) and a general formulation of the capital-asset pricing model in the presence of uncertain inflation can be found in Friend *et al.* (1976). Generally, the solutions are found to depend on the correlation between the nominal returns to an asset and the rate of inflation. For assets such as building society deposits, characterized by a potentially short holding period, the variance of returns is likely to be low and it may well be optimal to choose these assets in the face of an uncertain inflation rate in preference to assets, such as equity,

that exhibit a higher covariance with the rate of inflation.

In the light of the rates of return shown in Table 10 it is interesting to observe the financial asset portfolio behaviour of households over the period 1968-1979. This is shown in Table 11.

From Table 11 there has been a remarkable stability in many of the portfolio shares devoted to particular assets. Three trends are prominent. Firstly, there has been a continuing decline in the proportion of portfolios devoted to equity. This movement is even apparent if market values are used; based on values in Anstie et al. (1981) the share declines from 24.26% in 1968/72 to 14.26% in 1979. Secondly, within the category of savings bank deposits there has been a substitution from those at call to savings investment accounts. Finally, both building societies and credit unions deposits have become attractive assets. These trends could be interpreted as an attempt by households to maintain liquidity but improve on the rate of return on their assets. In fact, using the interest receipts from government securities, debentures and deposits in the national accounts, the rate of return on these assets is found to have risen from 5.52% in 1968/9 to 9.17% in 1978/9. Nevertheless, the stability of many of these ratios in the face of substantial inflation is a phenomenon that requires explanation and some work could usefully be done on it.

4.6 Unincorporated Enterprises

Unincorporated enterprises make investment decisions and hire labour. There is not a great deal of information concerning the nature of these decisions, and data on these activities is very limited. Because many of the factors are common to the corporate trading sector, a detailed discussion is left until the following section, where some comments will be made about the differences between the situations faced by incorporated and unincorporated enterprises. Within the class of unincorporated enterprises

the effects of inflation upon the Australian farm sector have been set out in some detail by Freebairn (1981), and a number of papers have appeared concentrating upon the U.S. equivalent e.g. Melichar (1979).

TABLE 11

Share of Total Household Portfolio of Financial Assets (Book Values)

	1968-72	1973	1974	1975	1976	1977	1978	1979
L.O + Superannuation	25.71	25.33	24.68	23.58	24.40	24.20	24.39	24.27
Savings Deposits	21.37	22.19	17.83	17.07	14.82	14.16	13.81	
Savings Investment Account	(n.a)	(n.a)	3.92	7.77	7.97	8.32	8.41	
Fixed Trading Deposits	6.85	6.05	6.95	8.81	8.60	9.06	9.17	9.61
Government Securities	6.58	4.88	4.82	4.15	4.78	5.55	6.01	6.30
Equity	13.46	11.31	10.22	8.87	7.41	5.70	4.82	3.89
Building Societies Deposits	2.36	4.88	5.44	5.36	5.75	6.47	6.73	7.03
Debentures, Notes, Deposits	7.95	9.32	10.12	9.38	9.52	9.83	10.08	9.82
Credit Unions	.39	.74	.89	1.01	1.26	1.41	1.56	1.82

Source: F. Pellarini (1978). Updated to 1980, private communication.

5. INFLATION AND THE CORPORATE TRADING SECTOR

It is perhaps in the area of the corporate trading sector that the greatest amount of work has been done in evaluating the effects of inflation. Below are listed the income and outlay account, the capital account and the balance sheet for this sector; the expanded number of accounts is needed in order to deal adequately with the range of decisions taken by corporate traders.

Income and Outlay Account

	Income	Outlay
(i)	Gross Operating Surplus	Interest Paid on Liabilities
	Interest Received on Financial Assets	(ii) Income Tax Payable
	Dividends Received on Equity	(iii) Dividends Paid
		Undistributed Income
		Depreciation

Capital Account

	Gross Accumulation	Finance of Gross Accumulation
(iv)	Investment in Equipment	Depreciation Allowances
	Investment in Structures	Undistributed Income
	Increase in Value of Stocks	Funds Borrowed
		Stock Valuation Adjustment
		New Issues

Balance Sheet

Assets	Liabilities
Plant and Equipment, Structures	(v) Equity
Stocks	(vi) Financial Liabilities
Financial Assets	
Land and Other Real Assets	

Issues that have arisen can be briefly described in terms of the items numbered above.

(i) The measurement of gross operating surplus is complicated by the difficulty of valuing stocks in inflationary periods. Section 5.1 looks at the Australian literature on this.

(ii) Questions of taxation involve two separate issues. First, there is the problem of defining income for a corporation. A large accounting literature has risen on this, being surveyed in Mathews (1975) but other discussions can be found in Diamond (1975), Aaron (1976), King (1975), Shoven/Bulow (1975, 1976), Swan (1978). Much of the controversy has centred around whether income should preserve the business as a going concern - the *entity* definition of income - or just the equity of shareholders - the *equity* definition. Section 5.2 analyses this distinction, paying particular attention to the appropriate definition of income for a *tax base*. Second, under either definition it is clear that inflation has conflicting effects upon the existing tax base: income is raised by the requirements that F.I.F.O accounting for stocks and historic cost depreciation be employed but is reduced by the tax deductability of nominal interest payments on debt. Section 5.2 details the outcome of these tendencies in Australian experience.

(iii) With income measured incorrectly it is possible that dividends may be paid out of debt issue, which would infringe on most companies' charters. There has been extensive discussion of this in the U.K. e.g. see Lawson and Stark (1981), the references cited there and Moore's reply in the same issue.

(iv) Investment decisions are dependent upon the rate of return to investment and the cost of finance. Each of these may be affected by the interaction of taxation rules and inflation, and much research

in the U.S. - surveyed in Feldstein (1980) - points to a reduction in investment coming from inflation. Australian evidence is examined in section 5.3. Section 5.4 considers the related issue of whether inflation induces capital-labour substitution.

(v) Inflation in a world without taxation and uncertainty would be reflected exactly in the price of equities. In practice this does not seem to have occurred and a large literature has been spawned on the reasons for this - Feldstein (1980a), (1980b).

(vi) Inflation might be expected to affect the financial structure of companies. Tax deductability of interest payments on debt would most likely increase the gearing ratio, but any increase in uncertainty would act in the opposite direction. Section 5.6 canvasses the issues.

(vii) Much of what has been written on the impact of inflation upon corporate decisions has tended to ignore the various types of uncertainty that affect corporations. Section 5.5 details some of these, particularly as they relate to inflation.

5.1 Profit Behaviour Under Inflation

It is the impact of inflation upon the components of the above accounts that have been the source of most work upon the effects of inflation. Consider the first income item, gross operating surplus (G.O.S). By definition this is equal to the value added in production less the wage bill. As such it depends upon the selling price of product, the quantity sold and the prices and quantities of raw materials and labour. Recent years have witnessed substantial rises in the prices of certain raw materials, and any investigation of the actual variation in gross operating surplus should take this into account; however, there has been no attempt to argue for such relative price changes as a necessary concomitant of inflation. Theories concerning the variation of gross operating surplus with inflation have largely concentrated upon the failure of selling prices to adjust fully and rapidly to wage

rises, a phenomenon made much of in the Mathews Report (1975). Empirical evidence for this occurrence does seem strong in the short-run and it is frequently used to form price forecasts by economic commentators - e.g. see INDECS(1980, p.30). A theoretical explanation for such a rigidity was provided by Sheshniski and Weiss (1977). They explore a model in which there are real costs associated with nominal price changes, and study the effects of a steady anticipated inflation on the frequency and size of price changes. Price adjustments occur at discrete intervals and, in the interval between price changes, gross operating surplus per unit of product would fall. Of course, as the contracts literature emphasises gross operating surplus might rise as wages may take time to adjust to price level changes.

Because it is difficult to specify the exact dependence, although the direction might be regarded as established, most studies have been empirically oriented. Nevile (1975), (1980), has been the major contributor in Australia while Kessel and Alchian (1960) looked at the U.S evidence. Nevile's approach was to regress the ratio of gross operating surplus (GOS) to non-farm GDP against the rate of inflation, finding that the rate of inflation was a significant regressor. A number of objections might be made to this work. Firstly, it is not clear why inflation should lead to a permanent reduction in the profit share; essentially supporting arguments only favour a transient reduction. In terms of specification it would be necessary to estimate models of the form

$$\frac{G.O.S}{GDP} = b_o\dot{p}_t + b_1\dot{p}_{t-1} + \ldots + b_m\dot{p}_{t-m}$$

with the restriction $\sum_{j=o}^{m} b_j = o$. Secondly, the definition of gross operating surplus in the national accounts excludes the pure appreciation in the value of stocks arising from the use of F.I.F.O. accounting.

There has been some dispute over whether the definition of gross operating surplus, which excludes the pure price appreciation in stocks (the Stock Valuation Adjustment (S.V.A.)) is a proper measure of profits (see Haig (1973), (1980), (1981) and Hall (1958). The debate is seen most clearly with the aid of an example given by Swan in Hall (1956, p.56). Suppose a firm begins a period with one unit of stock, sells it during the period and replaces it at cost C. Suppose the cost of the previous period had been C-D and that the mark-up is M. Profits are obviously M. Consider however two different pricing policies. In one prices are a mark-up upon "historic" cost C-D and in the other case a mark-up on replacement cost C. The F.I.F.O.based profit measures in both cases are:

	Case I	Case II
1. Sales	C+M-D	C+M
2. Purchases	C	C
3. Closing Stock	C	C
4. Opening Stock	C-D	C-D
Profit = (1)-(2) + (3)-(4)	M	M+D

It is apparent that, if prices are set on the basis of replacement cost as in Case II, F.I.F.O. computed profits are too high by the amount D - the pure price appreciation in the value of stocks. This reasoning leads to the deduction of the S.V.A. from reported profits. If, however, prices are set on the historic cost basis the F.I.F.O. profits are accurate. Hall observes (in 1956) "...little information is available about the pricing policies of companies" but the dispute should be resolvable without too much trouble. In fact the argument presented in Swan's note was that L.I.F.O and F.I.F.O would give identical profit figures *because different prices would be set under the different accounting systems;* an assumption hard to reconcile with the preference of companies for a L.I.F.O. system for tax purposes. After all, if profits were identical under both systems, there is nothing to be gained

by a switch (although the result quoted in Feldstein (1980b) that some $7b. extra in taxes had been paid by firms voluntarily failing to switch from FIFO to LIFO might be taken as supporting evidence for this assumption). Lest it be thought that the debate is not of importance, one should mention that Haig finds no relation between the ratio ((G.O.S. + SVA)/GDP) and the rate of inflation. It is more than a little surprising that he finds *no* relationship, as such a lack of correlation would lead to the inference that wage changes are passed on within the quarter. A closer examination of this whole question is called for.

5.2 Income Definitions Under Inflation

That it is important to obtain a correct measure of income under inflationary conditions as a guide to correct decision-making and investing has been recognised by accountants for many years - for Australia see the book by Mathews and Grant (1958) which seems to have been stimulated by the inflationary episode associated with the Korean war. In recent years this concern has been reflected in debate over the appropriate definition of income for a tax base, as in the Mathews Report (1975) and Swan (1978). Generally, it would not be expected that the concept of income for decisions would coincide with that for a base, and it is therefore useful if we explore the two major definitions of income in an algebraic framework, as a prelude to later analysis.

Let

E = nominal value of equity
D = nominal value of debt
Y_C = gross operating surplus less interest payments on debt
DI = disbursements
DR = depreciation based on the replacement value of assets
K = stock of all assets (constant price)
Q = replacement price of a unit of K
P = price of consumption goods
$\dot{q}, \dot{p}$ = rates of change in Q and P
I = nominal value of investment

Variables in the previous period are always distinguished with "-1" as a subscript.

First we need to consider the identity determining the value of assets. The nominal value of investment includes the capital gains obtained upon stocks - the stock valuation adjustment (S.V.A.) - and therefore the identity determining the nominal value of assets (in words) is

Value of assets at time t = value assets at time (t-1) + capital gains on assets + Gross nominal investment - Stock valuation adjustment - Depreciation (at replacement values)

In symbols

$$QK = Q_{-1}K_{-1} + \dot{q}Q_{-1}K_{-1} + I - S.V.A. - DR \qquad (18)$$

Observe that, to avoid double counting, it is necessary that the S.V.A. be subtracted from I, as the capital gains on stocks are already included in $\dot{q}Q_{-1}K_{-1}$.

Second, gross investment must be financed. The sources of funds are borrowings (ΔD), new issues (NI), gross operating surplus less disbursements and interest payments and the stock valuation adjustment (S.V.A.). It should be remembered that gross operating surplus differs from the accounting idea of gross profits because the S.V.A. has been deducted, and this needs to be added back to preserve the capital account uses and sources of funds identity.

$$\therefore \quad I = NI + \Delta D + Y_c + S.V.A. - DI \qquad (19)$$

Combining (18) and (19)

$$QK = Q_{-1}K_{-1} + \dot{q}Q_{-1}K_{-1} + NI + \Delta D + Y_c - DI - DR \qquad (20)$$

Basic to the Mathews Report is a definition of corporate income as the level of disbursements to shareholders that would maintain the level of operations of the company with unchanged debt and zero new issues; that is, corporate income is that value of DI (DI*) which equates K and K_{-1}

(or QK and QK_{-1}), constraining ΔD and NI to zero. Then from (20)

$$DI^* = Y_C - DR \tag{21}$$

i.e. income would be gross operating surplus less depreciation (at replacement values) less interest payments.

Perhaps the best description of the concept of income above is that it is *entity based;* it focusses solely upon the preservation of the entity in real terms without the need for extra debt financing, and is based more on a managerial than owner concept of income. This orientation does seem strange, as the corporation is owned by shareholders and is legally required to protect their interests; it would therefore seem only logical that these interests appear in the definition of corporate income. This is effectively Swan's (1978), (1980a)complaint with the Mathews Committee. He proposes that income be defined as that level of disbursements which maintains the real value of the shareholder's equity. To isolate the differences begin by dividing (20) with the consumption deflator - the relevant price index for shareholders who are interested ultimately in consumption.

$$\frac{QK}{P} = \frac{QK_{-1}}{P} + \frac{\dot{q}Q_{-1}K_{-1}}{P} + \frac{\Delta D}{P} + \frac{NI}{P} + \frac{Y_C}{P} - \frac{DI}{P} - \frac{DR}{P} \tag{22}$$

The value of debt is

$$\frac{D}{P} = \frac{D_{-1}}{P} + \frac{\Delta D}{P} \tag{23}$$

and, from the balance sheet identity $E = QK - D$,

$$\frac{E}{P} = \frac{QK}{P} - \frac{D}{P} = \frac{Y_C}{P} - \frac{DI}{P} - \frac{DR}{P} + \frac{\dot{q}Q_{-1}K_{-1}}{P} + \frac{Q_{-1}K_{-1}}{P} - \frac{D_{-1}}{P} \tag{24}$$

$$\therefore \frac{E}{P} - \frac{E_{-1}}{P_{-1}} = \frac{Y_C}{P} - \frac{DI}{P} - \frac{DR}{P} + \frac{\dot{q}Q_{-1}K_{-1}}{P} + \frac{E_{-1}}{P} - \frac{E_{-1}}{P_{-1}} \tag{25}$$

$$= \frac{Y_C}{P} - \frac{DI}{P} - \frac{DR}{P} + \frac{\dot{q}Q_{-1}K_{-1}}{P} - \frac{\dot{p}E_{-1}}{P} \tag{26}$$

$\frac{E}{P} - \frac{E_{-1}}{P_{-1}}$ defines the change in the purchasing power of equity and the level of disbursements setting this to zero is

$$\frac{DI^*}{P} = \frac{Y_c}{P} - \frac{DR}{P} + \frac{\dot{q}Q_{-1}K_{-1}}{P} - \frac{\dot{p}E_{-1}}{P} \tag{27}$$

i.e

$$DI^* = Y_c - DR + \dot{q}Q_{-1}K_{-1} - \dot{p}E_{-1} \tag{28}$$

Therefore, comparing (21) and (28), an *equity* based measure of income differes from an entity-based one through the addition of any capital gains upon assets (which include stocks) and a purchasing power adjustment for equity. Observe that, for a balanced inflation in which $\dot{q} = \dot{p}$ and full equity financing so that $Q_{-1}K_{-1} = E_{-1}$, the two measures of income are identical. Thus the difference between them lies in the possibility of unbalanced inflation and the presence of debt. The importance of this observation is most clearly seen in a balanced inflation ($\dot{p} = \dot{q}$) wherein

$$\dot{q}Q_{-1}K_{-1} - \dot{p}E_{-1} = \dot{p}(Q_{-1}K_{-1} - E_{-1}) = \dot{p}D_{-1} \tag{29}$$

and $\dot{p}\,D_{-1}$ are *inflation-induced capital gains upon debt accruing to equity holders*.

The debate between Swan and Mathews has been acrimonious and this is not the place to adjudicate it. However, at least one feature of it needs to be emphasized. Under the Mathews proposal nominal interest payments are tax deductible; under the Swan proposal (with a balanced inflation) it is apparent from (29) that only the real interest payments upon debt ($(i-\dot{p})D_{-1}$) would be deductible. It is hard not to sympathize with Swan's position on this matter, as a good deal of the interest payments of companies reflect the inflation premium and there seems little reason to ignore the fact that this inflation premium has, as its counterpart, a reduction in the real value of debt. In fact, Mathews did recognise

the force of this argument in Appendix F of the Report where it is said "...to the extent that companies and other enterprises claim cost of sales and depreciation adjustments, net interest payments be reduced for tax purposes in accordance with the rate of inflation as measured by a general purchasing power index". From the numerical examples of that Appendix, this modified Mathews approach would be to deduct $\max(0,(i-\dot{p})D_{-1})$ from the tax base, giving the Swan measure if the real interest rate is positive but not increasing income if the real interest rate was negative. The idea was unfortunately rejected in section 15.29 of the report because of "the lack of a general capital gains tax levied on an accrual basis".

An obvious question is whether the differences between the various income concepts is large. Swan (1980) has provided some evidence on this, and his material is re-arranged in Table 12. The data used for replacement values of the capital stock are those of Hawkins (1979); these estimates are closer to the recent ones made by Bailey (1981) than the alternative values in Swan taken from the N.I.F. data base.

TABLE 12

Derivation of Inflation Adjusted Corporate Trading Income

	CI	HD	SVA	DR	$\dot{q}Q_{-1}K_{-1}$	$\dot{p}E_{-1}$	Eq.Y_c	Ent.Y_c	App.FY
1969/70	2986	1191	181	1351	596	598	3005	2826	3101
1970/1	2991	1318	214	1521	1025	960	3067	2788	3249
1971/2	3105	1488	353	1760	1381	1176	3391	2833	3466
1972/3	3710	1599	539	1927	1285	1218	3988	3382	3967
1973/4	3986	1766	1180	2165	4348	2400	6715	3587	4819
1974/5	3744	1984	1664	2757	6806	4475	6966	2959	4680
1975/6	4264	2279	1731	3254	5786	5693	5113	3276	5207
1976/7	5287	2561	1319	3721	5114	4785	5775	4122	5934
1977/8	5691	2805	1120	4170	4114	4615	4975	4341	5988

Source: P. Swan (1980) Table 4,5,6.

CI = before-tax company income from National accounts; HD = depreciation at historic cost; SVA = stock valuation adjustment; DR = depreciation at replacement cost; $\dot{q}Q_{-1}K_{-1}$ = capital gains on assets; $\dot{p}E_{-1}$ = purchasing power adjustment for equity; Eq.Y_c = Equity Income = CI+HD+SVA-DR+$\dot{q}Q_{-1}K_{-1}$-$\dot{p}E_{-1}$; Ent.Y_c = Entity income = CI+HD-DR; App.FY = Income computed as in Appendix F of Mathews = Entity Income + Interest Payments - max(0, interest payments - $\dot{p}D$)

The differences between the various measures are very striking from 1973/4 onward, which was the period of rapid inflation. With a given tax rate, it is apparent that there would be substantial year-to-year changes in tax payable on an equity definition, unless inflation were constant and uniform. Such variability could cause cash flow problems for many companies, and the use of this as a base would probably require more frequent rate changes than with other bases. "Appendix F" income overcomes much of this variability and demonstrates how important it is to account adequately for nominal interest payments in any tax base.

It is possible to utilize the information of Table 12 to examine the question of whether the corporate trading sector is over-taxed in times of

inflation. As mentioned in the prelude to section 5, there are conflicting forces at work; the failure to allow S.V.A. and replacement cost depreciation tends to increase the tax burden, whereas the interest deductability of nominal interest payments reduces it. Table 13 provides evidence on these effects through the effective tax rates on each income definition.

TABLE 13

Effective Rates of Tax (%)*

	(1) Entity Def.	(2) Equity Def.	(3) Appendix F Def.
1969/70	46.2	43.5	42.1
1970/1	47.6	43.3	40.9
1971/2	45.7	40.9	40.0
1972/3	53.1	45.0	45.2
1973/4	60.1	32.1	44.8
1974/5	80.0	33.1	49.3
1975/6	78.7	50.4	49.5
1976/7	68.7	49.1	47.7
1977/8	65.5	57.2	48.3

* Ratio of corporate tax payable to incomes as defined in Table 12.

On an entity basis the effective tax rate has risen sharply with inflation. It is this basis that CEDA (1979) use in their assertion that the company sector has been severely overtaxed in recent years. Neither of the other definitions reveal quite the same degree of overstatement, although for particular years there is some evidence of it. As column (3) indicates, it is the full deductibility of interest payments in the entity definition which leads to the large rise in the effective tax rate on that basis, but it is hard to accept that this full deductibility is a reasonable

way to construct a tax base. Therefore, although one is inclined to the view that the effective tax rate has risen with inflation, the rise is by no means as substantial as some of the business literature would suggest.

The above computations highlight the difficulties of establishing an appropriate tax base under inflationary conditions, and it has therefore been suggested that a simpler approach might be to allow immediate expensing: a cash-flow basis for income. Swan (1980) has provided some analysis of this while Jorgenson and Sullivan (1981) have considered a range of other options.

5.3 Investment Effects - Preliminary Analysis

Corporate investment is a volatile component of GDP and one that has shown depressed behaviour in many economies since the advent of high inflation. Here some care needs to be exercised in that the rapid growth of equipment leasing over the same period has meant a reduction of investment attributed to the trading sector but a concomitant increase in the financial sector. Considerations of leasing are deferred until later, and it is implicitly assumed that investment is by use rather than by ownership.

What are the determinants of investment behaviour? Empirical research to date in Australia has not been spectacularly successful in answering this on a quarterly basis, as the most systematic treatments (Higgins, Johnston and Coghlan(1976) and Hawkins' survey (1979)) demonstrate. Nevertheless, it is worthwhile outlining the three major approaches to the study of investment.

(i) The accelerator model. The equilibrium capital stock K^* is assumed to be in constant ratio α to the level of output X. Equilibrium net investment

(NI) is then equal to the change in K*.[7]

$$\therefore \quad NI = (K^*-K^*_{-1}) = aX - aX_{-1}. \qquad (30).$$

Inflation has no impact in this model as the capital output ratio is taken to be constant.

(ii) The neo-classical model. Jorgenson, in a series of articles in the 1960s, e.g. see (1965), formulated a theory based upon a neo-classical model of the firm. In this model the equilibrium level of capital stock K* is defined as that level which equates the marginal revenue product of capital services (MRP_K) to the rental cost of capital services (services are taken as proportional to stock). To derive the MRP of capital Jorgenson selected the Cobb Douglas production function for which

$$MRP_K = \frac{\alpha PX}{K} \qquad (31)$$

where PX is value added. With the user cost of capital defined as c, the rental price for a unit of capital services is $P_I.c$ where P_I is the price of a unit of new investment goods. The equilibrium capital stock K* then equates MRP_K and $P_I.c$

$$\therefore \quad K^* = \frac{\alpha PX}{P_I.c} \qquad (32)$$

and net investment is determined by $\alpha(K^*-K^*_{-1})$. It is apparent that this theory can be regarded as an accelerator model in which the equilibrium capital-output ratio $(K^*/X) = \alpha(P/P_I.c)$ varies with the ratio of unit value added to the rental cost of capital; it is in this way that factor substitution enters.

The effect of anticipated inflation upon K* can be analysed by considering the expression $dc/d\pi$. The theoretical and applied literature provides numerous cost of capital formulae incorporating many institutional factors regarding patterns of financing and the tax treatment of cost of borrowing, depreciation and investment allowances and so forth. Yet it is insightful to begin with the simple Jorgensen-style formula:

$$c = (i(1-\tau) - \pi + \delta)(1-\tau Z) \qquad (33)$$

The first factor measures the real after-tax cost of borrowed funds (all debt finance is assumed) plus the depreciation cost δ, assumed invariant. The term τZ in the second factor measures the present value of tax-savings resulting from a \$1 of investment on which depreciation is allowed. Suppose that depreciation is on historic cost basis. Let f_t be the proportion of the historical cost written off in period t, and tax life is N years then

$$Z = \sum_{t=o}^{N} f_t(1+i(1-\tau))^{-t} \qquad (34)$$

and

$$\frac{dc}{d\pi} = [(1-\tau).\frac{di}{d\pi} - 1] (1-\tau Z) - \tau[i(1-\tau) - \pi + \delta] \frac{dZ}{di} . \frac{di}{d\pi} \qquad (35)$$

If $\frac{di}{d\pi} < (1-\tau)^{-1}$, then the first term is negative causing the cost of capital to decline in the face of anticipated inflation. Now $\frac{dZ}{di} < 0$, so that the decline in the cost of capital can be wholly or partly offset if $\pi < i(1-\tau) + \delta$. Thus we see that, whereas the full deductibility of nominal interest payments, when the full Fisher effect does not operate, tends to reduce the cost of capital, depreciation on an historical cost basis tends to increase the cost of capital. The sum of the two effects is ambiguous in sign.

The conclusion just reached will be valid even under joint debt and equity financing if the debt-equity ratio is held fixed. But as we shall see in section 5.6 the debt-equity ratio is itself likely to change, thereby introducing an even greater lack of resolution to the direction in which capital costs move as a result of inflation.

(iii) The Tobin q-ratio. Tobin (1969) proposed a theory based upon the comparison of the replacement cost of the capital stock (V^*) to its market price as revealed in the stock market ($V^{\ddagger}$). He terms the ratio V^*/V "q". When q exceeds unity the ratio of net investment to the capital stock increases and, when q is less than unity, net investment declines.

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[7] Throughout this section only equilibrium behaviour is considered. Applied research allows for the fact that actual investment will only adjust slowly to this equilibrium position.

A linear statement of this relation would be

$$\frac{NI}{K_{-1}} = \beta(q - 1) \qquad (36)$$

Both the neoclassical and q-ratio approaches can be given alternative representations that are sometimes more meaningful than those given above. In the neo-classical analysis producing (32) α is the profit share under perfectly competitive conditions i.e.

$$\frac{K^*}{K_{-1}} = \frac{\alpha PX}{K_{-1}P_I.c} = \frac{\Pi}{K_{-1}P_I.c} = \frac{R^{**}}{c} \qquad (37)$$

where Π is profits and R^{**} is the equilibrium rate of return to capital measured at replacement prices ($P_I.K_{-1}$). (37) provides an interpretation of the neoclassical theory in which the determinants of the equilibrium capital stock (K^*) are the rate of return upon capital and the user cost. Suppose equilibrium existed in the previous period - $K^*_{-1} = K_{-1}$ - allowing (37) to be combined with this assumption to yield

$$\frac{NI}{K_{-1}} = \frac{K^*-K^*_{-1}}{K_{-1}} = \frac{K^*}{K_{-1}} - 1 = \left(\frac{R^{**}}{c} - 1\right) \qquad (38)$$

(38) shows that under these conditions net investment is zero whenever $R^{**} = c$: the existing capital stock is just replaced and there is no new investment.

Although (37) expresses the capital stock decision in terms of an equilibrium rate of return R^{**}, it would be possible to conceive of this decision as being determined by an actual rate of return R^*. With a constant user cost of capital c, (38) would then become

$$\frac{NI}{K_{-1}} = \alpha_0' + \alpha_1' R^* \qquad (39)$$

or, if $\frac{X}{K_{-1}}$ is constant,

$$\frac{NI}{X} = \alpha_0 + \alpha_1 R^* \qquad (40)$$

(40) is one of the investment equations examined by Feldstein (1980) in his investigation of the impact of inflation upon U.S. investment behaviour, and it demonstrates that a fall in the rate of return to investment can be expected to reduce the *investment ratio*.

Accepting the roles of the rate of return and the user cost of capital in the determination of the optimal capital stock, it becomes necessary to measure both concepts. R* will be the after-tax gross rate of return while c is the sum of the cost of finance R and the rate of depreciation δ. A comparison of R* with c is then a comparison of the gross internal rate of return - or marginal efficiency of capital - with the cost of capital.

To derive the real cost of finance it is useful to focus upon the amount available for distribution to both shareholders and debt-holders. Assuming a balanced inflation, re-working (19)-(21) with interest payments to debt-holders now included in the level of disbursements, and recognition of taxes, gives the amount that could be distributed while preserving the real assets of the company as

$$S = GOS - DR - TC \tag{41}$$

where TC represents corporation tax paid.[8] From (28) the earnings of equity holders are $N = S - iD + \dot{p}D$ so that

$$S = N + (i - \dot{p})D \tag{42}$$

Denote the market value of the company as set in the stock market by V. Division of (42) by V establishes an expression for the real cost of finance

$$R = (1-d)e + (i-\dot{p})d \tag{43}$$

where e is the earnings yield and d is the debt/asset ratio. (43) is the

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[8] If inflation was not balanced it would be necessary to be more careful in the definition of real assets. Utilizing the consumption deflator would add a real capital gain term to (41) analagous to that in (28).

familiar weighted average expression for the cost of finance R found in most finance texts, and derived from an optimizing macro-model in Brock and Turnovsky (1981).[9] It is important for later reference to observe that *the cost of finance does not depend upon the capital gains on debt;* these capital gains accrue to shareholders at the expense of debt holders without affecting the theoretical cost of finance.

Now the effect of inflation upon investment can be analysed by considering how R^* and c vary with it. For the moment we will concentrate upon the cost of capital only; or, more specifically, on the cost of finance R. In theory the earnings yield e and the real rate of return on debt would be invariant to a fully anticipated inflation, but there may of course be variations in risk premia if there is greater variability in the inflation rate. For the earnings yield to be invariant it is necessary that equity prices adjust to any inflation-induced changes in earnings. Which direction will this cause stock prices to move in? This question has been considered by a number of authors - Feldstein (1980a), (1980b) provides a review of the U.S. literature. There are obviously a number of forces at work. As observed previously, existing tax rules act to both increase and decrease taxes. Furthermore, shareholders obtain any capital gain from debt and, as this is untaxed, it is possible that total earnings will rise with inflation. Feldstein (1980b) argues that the net effect in the U.S. has been to depress earnings, so that the equity values must fall to restore the earnings yield. Table 14 presents evidence for Australia indicating that this has not been the case here; equity prices should have risen substantially with inflation if the earnings yield was to remain constant.

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[9] More complex formulations are available depending on the definition of TC. In some cases TC includes the taxes paid by shareholders on dividends and (43) decomposes into the sum of three components involving the dividend yield, capital gains and the real cost of debt. Elliot (1980) surveys several different definitions.

TABLE 14

Earnings Yield* (%)

1969/70	1970/1	1971/2	1972/3	1973/4	1974/5	1975/6	1976/7	1977/8
7.33	8.09	9.3	8.94	22.66	28.90	14.46	13.37	8.9

* Ratio of after-tax shareholders earnings as in (24) to the value of shareholders' funds.

Source: Swan (1980) Tables 3,4.

The period 1973/4 to 1976/7 therefore saw depressed equity prices relative to earnings. Explaining this phenomenon is of some importance. It is possible that the increase in inflation in those years was associated with greater uncertainty, and the earnings yields above reflect extra risk premia; alternatively, the model of share valuation implicit in Table 14, which emphasizes earnings, is inadequate. Extra research on this question is called for.

The earnings yield is only one of the components of the cost of finance and Table 15 records the gross after-tax rate of return on capital (R*), the cost of finance (R) and the ratio of tax payable to replacement value of assets.

TABLE 15

Rate of Return to Capital, Cost of Finance and Tax Ratio (%)

	1969/70	1970/1	1971/2	1972/3	1973/4	1974/5	1975/6	1976/7	1977/8
R*	14.95	14.22	13.80	14.01	12.61	11.01	10.47	11.06	11.09
R	6.62	6.97	6.72	6.90	7.24	7.34	7.53	8.61	8.48
t	5.81	5.26	4.88	5.74	5.94	5.12	4.75	4.54	4.09

R* = Ratio of (G.O.S. less tax payable) to Replacement Value of Assets
R = Ratio of (G.O.S. less taxes less depreciation at replacement value) to Market Value of Assets
t = ratio of tax payable to Replacement value of Assets.

Source: Swan (1980) Tables 2,3.

Table 15 reveals a substantial slump in the rate of return to capital in the period 1973/4 onward and a slight rise in the cost of finance in the last years of the period. Generally, however, it would seem that the cause of any investment fall would lie in the rate of return rather than in the cost of capital; the negative real cost of debt offsetting the rise in the earnings rate observed in Table 14. What is the source of the reduction in the rate of return? The computed tax percentage of Table 14 shows that it was not primarily due to an increasing tax burden, that there was a reduction in the rate of return to capital; rather, it is the fact that pre-tax profits have declined. Whether the source of this reduction can be traced to inflation or other factors is a subject needing further research.

All of the above discussion has been conducted within the framework of neo-classical analysis. Would one obtain different conclusions through the Tobin ratio approach to investment? To answer this question observe that the equilibrium condition in the neoclassical approach is

$$R^* = c = R + \delta \tag{44}$$

or

$$R^* - \delta = R \tag{45},$$

suggesting that one might compare $R^* - \delta$ with R. The definitions of R^* and R are

$$R^* = \frac{GOS-TC}{V} \tag{46}$$

$$R = \frac{GOS-TC-DR}{V^*} \tag{47}$$

where V is the replacement value of assets and V^* is the market value. Now $DR = \delta V$ so that

$$R^* - \delta = \frac{GOS-TC}{V} - \delta = \frac{GOS-TC-\delta V}{V} = \frac{GOS-TC-DR}{V} \tag{48}$$

and therefore

$$\frac{R^*-\delta}{R} = \frac{V^*}{V} = q \qquad (49)$$

(49) illustrates that the Tobin ratio can be interpreted as the ratio of the after-tax rate of return *net* of depreciation to the cost of finance, and therefore it yields very similar conclusions to the previous analysis. Flemming *et al.* (1976) utilized the above relationship in their analysis of investment experience in the U.K. under inflationary conditions.

Capital budgeting: Although the determination of the aggregate volume net investment has been the major item of interest in the literature on inflation and investment, Nelson (1976) has looked at other aspects such as the choice between different investment projects and the timing of replacement investment under the assumption that the real after-tax rate of return remains constant. He gives the following propositions on the issues.

Proposition 1: The net present value ranking of mutually exclusive investment projects will depend in general on the rate of inflation.

Proposition 2: Net present value rankings of mutually exclusive projects which differ with respect to durability will depend on the rate of inflation. Typically, rankings will change in favour or peojects with lower durability at higher rates of inflation.

Proposition 3: Replacement policy will depend in general on the rate of inflation. The higher the rate of inflation the more likely will replacement be deferred to a future period.

All Nelson's propositions are proved for the anticipated inflation case only and they show that the rate of capital formation is retarded by inflation. This retardation is reflected in substitution away from capital towards other inputs, increase in the durability of capital and reduction in aggregate capital intensity.

Each effect described in the propositions is a consequence of the interaction of inflation and tax rules for depreciation. For the first, it is the variation in the capitalized value of future tax savings from depreciation charges; for the second, it is advantageous to select less durable projects because the depreciation cost will be restated in terms of current dollars at more frequent intervals; for the last, it is optimal to defer the project so as to achieve the higher depreciation allowances in the future.

Effect of inflation on inventory behaviour: If firms follow FIFO accounting for inventories and if the nominal increases in the value of inventories are taxable, then at the margin the cost of carrying inventories is $(1-\tau)(i-\pi)$ per dollar of inventory. It is readily seen that this cost rises with inflation if $di/d\pi > 1$, which may cause firms to economise on inventories. There are no Australian studies which have examined this effect empirically. For the U.S. Hong (1977) has examined the hypothesis that companies which carry relatively more inventories should register a greater decline in their stock market valuation during periods of inflation, but the evidence is not clear cut.

5.4 Capital/Labour Substitution and Inflation

The issue of capital/labour substitution occasioned by inflation has been the subject of some debate in Australia. From a neoclassical viewpoint, whether substitution takes place depends upon the relative prices of a unit of labour (w) to a unit of capital. A per unit price for labour can be constructed from wage rates, by making allowance for features such as productivity, payroll taxes, holiday leave etc. The price of a unit of capital - the implicit rental rate - is the product of the price of investment goods (P_I) and the user cost of capital (c), leaving the crucial ratio as

$$\phi = \frac{w}{P_I . c} \qquad (50)$$

In (50) the price of investment goods needs to be adjusted for any features such as accelerated depreciation, investment allowances etc.

How does inflation affect the ratio in (50)? Provided the cost of capital does not rise due to changed risk characteristics, a balanced inflation would leave all elements in (50) unchanged, and consequently, would have aneutral impact on the capital/labour ratio.

There have been arguments in Australia that inflation has resulted in capital/labour substitution through its effects on relative prices. The Treasury's Economic Paper NO. 4 embodies this view as a result of their comparison of a unit real user cost of labour to capital. Referring to the rental price of capital they comment (p.33, footnote).

> "One conceptual difficulty in deriving such an index is that it is not clear how much allowance firms in practice make, in costing investment projects, for capital gains and losses made on their financial and physical assets".

This is an odd statement as section 5.3 has observed that the cost of capital should be invariant to capital losses and gains, as these merely represent an increase in shareholders' incomes at the expense of debt-holders. Even if shareholders ignored these capital gains, the result should be felt solely in *equity prices* as transactions occur to restore the earnings yield. Only if inflation leads to different risk premia would it be expected that the cost of capital c would change. From Table 15 there is in fact little evidence that the cost of capital c has increased much with inflation, and it is therefore likely that most of the changes in a ratio such as ϕ in (50) result from a rise in the relative prices of w to P_I. Obviously, this discussion has focussed solely upon pure substitution effects, and has not considered the more contentious question of whehter the demand for labour declines indirectly owing to any effects of inflation upon real output.

5.5 Uncertainty and Investment

As indicated by Knight's statement recorded at the beginning of this paper, the impact of inflation upon investment decisions is frequently seen by policymakers to work through heightened uncertainty. A recent example of a contention in the same genre comes from Statement No.2 of the 1981/82 Budget (p.47) -

> "The experience of the mid-1970s amply illustrates the consequences for an economy when wage demands become excessive and inflationary expectaions are geared to accelerating price increases. The resultant uncertainty among consumers and investors leads, inevitably, to a decline in investment and economic activity and a loss of job opportunities - not only directly but also indirectly through the effects of the policy actions that have to be taken to restore some balance in the economy".

Knight's position is particularly interesting in that it spells out a transmission mechanism; it is the variability of relative prices and risk averse behaviour of businessmen which creates a direct effect of inflation upon investment decisions. Only a few attempts have been made to model such a direct relationship, and the complexity of the problem is such that only very simple models have been analysed. Bitros and Kelejian (1976) adopt Jorgenson's neo-classical model, but allow future prices and wages to be uncertain. This makes the returns to investment stochastic but, unless firms are risk averse or distributions non-symmetric, losses and gains are equi-probable and an increase in the variance of relative prices would have a neutral impact upon equilibrium investment decisions. The presence of taxes modifies this conclusion in that, whilst profits are immediately taxed, a loss is only available for offset at some future date. Bitros and Kelejian however, obtain an effect of variability upon investment by specifying that the variance of returns cannot exceed a certain level (akin to a bankruptcy constraint), but the resulting effect of a rise in the variance of relative prices is ambiguous.

Dietrich and Heckerman (1980)and Nickell (1978 have also looked at the question. Their models retain the neo-classical tradition of maximizing discounted profits, but they assume firms are restricted to a once-for-all decision on the capital stock, being only free to vary labour inputs after their initial choice. Although firms are risk neutral, the profit function, after substituting out the optimal labour choice,is no longer linear in factor prices, resulting in expected returns being dependent upon the variance of relative prices. Under this set of conditions, a greater variance in relative prices actually increases the demand for capital.

Neither of these papers is consistent with a close negative association between investment and the variance of relative prices that seems uppermost in Australian policy-makers' minds. Some sort of reconciliation seems desirable. One possibility is that the assumptions underlying the models mentioned above are incorrect. Thus risk aversion would most likely lead to the desired result. However, even among the assumptions of the models, there are two which appear dubious. Firstly, the neo-classical analysis, being supply-based, assumes that all output produced can be sold at a fixed price. Secondly, the analyses were conducted under the assumption that the nominal expected cost of capital is constant, Dietrich and Heckerman saying (p.462).

> "The assumption of a constant expected nominal cost of capital over time is not inconsistent with another assumption, that the expected rate of inflation is constant".

However, it is not clear that this assumption is realistic Friend *et al.* (1976) show that, with uncertain inflation, the expected return on the ith asset $E(r_i)$ predicted by the CAPM model would be

$$E(r_i) = r_f + \sigma_{i\pi} + \left[\frac{E(r_m)-r_f - \sigma_{m\pi}}{\sigma_m^2 - \sigma_{m\pi}/\xi}\right](\sigma_{im} - \frac{\sigma_{i\pi}}{\xi}) \qquad (51)$$

where r_f is the risk free rate of return, r_m is the rate of return on the market portfolio, $\sigma_{i\pi}$ is the covariance between the ith asset return and the rate of inflation and ξ is the ratio of risky to total value of all assets. It is apparent from (51) that the expected return required by the suppliers of financial assets would not be invariant to the variance of inflation, and that the cost of finance may therefore rise even if the expected rate of inflation (reflected in the nominal rate of return on the risk free asset if the Fisher effect operates exactly) is constant. It has been suggested that this is the proper way to evaluate investment decisions; the returns to capital are computed on the basis of expected relative prices and then evaluated with the cost of finance derived from the equity and debt sources. Unless increased uncertainty results in a rise in the risk premia implicit in these rates of return, increased variability should have no effect on capital decisions.

From this perspective therefore it is interesting to observe the results in Tables 14 and 15 which seem to reveal a rise in risk premia, although whether this reflects inflation variability or the impact of government policy induced by a high (rather than variable) inflation rate is dubious. Obviously, the evidence for the direct effects of inflation variability upon investment decisions is a lot weaker than the official policy stance would suggest.

More generally, uncertainty about policy actions can affect investment decisions - perhaps mainly through postponement (see the analysis by Cukierman (1980)) - and some of this uncertainty may be induced as a result of inflation e.g. the fear that excess capacity may emerge if tight monetary and fiscal policies are adopted in response to inflation. Disentangling these indirect effects from the more direct effects upon the cost of capital and rates of return is unlikely to be an easy task.

5.6 Balance sheet effects of inflation

The effects of inflation on corporate balance sheets can be discussed from a variety of viewpoints but three issues seem to have attracted much attention, viz. the debt-equity ratio, the maturity structure of the corporate debt and the dividend retention ratio.

Debt-Equity Ratio: Before entering into a discussion of the effects of inflation on corporate financial policy it is useful to consider a few preliminaries which help us to understand the nature of theoretical predictions about the behaviour of the debt-equity ratio in an inflationary world. The standard finance theory defines the optimal debt-equity (D-E) ratio as that which minimises the cost of capital to the firm. According to the celebrated Modigliani-Miller theorem, no optimum value of D-E ratio exists in a world with no taxes, transactions costs or default risk on loans because the cost of capital is then invariant to the choice of financial policy. In a world with personal and corporate income taxes, but no inflation or default risk, where debt and equity holders do not face identical tax rates the optimal capital structure involves corner solutions, that is, the firms are wholly bond-financed or equity financed. See King (1974), Auerbach (1979). Essentially such a result comes about because, even though firms may be indifferent between debt and equity, for some individuals the net after-tax rate of return on debt exceeds that from equity whereas for others the reverse is true. Also some individuals may face a tax rate which leaves them exactly indifferent between the two. In other words, for debt and equity to co-exist in equilibrium, equity must be held by those who have a relative tax advantage (such as that resulting from the tax treatment of capital gains) in holding equity and debt by those who have a relative tax advantage in holding debt. It is possible that the latter class consists of certain tax-exempt investors such as superannuation funds and charitable institutions.

In a model with taxes and *fully* anticipated inflation, as in Brock and Turnovsky (1981), the optimal capital structure of an individual firm also involves corner solutions, though by appealing to the notion of specialized clienteles we can still get an aggregate determinate D-E ratio.

In analysing the effect of anticipated inflation on the optimal debt-capital ratio, it seems reasonable to make its equilibrium value depend on the difference between the real rates of return on debt and equity. An increase in the cost of equity finance will lead to a higher desired debt-equity ratio, ignoring bankruptcy possibilities for the moment. The prediction that anticipated inflation will lead to an increase in the debt-equity ratio seems to depend on the return to equity rising more than the return to debt. The tax deductibility of nominal interest on debt could certainly increase the supply of debt, but the demand for debt (since it will depend upon the real return to the lenders) will vary with the type of lender. The existence and expansion of a specialised clientele for debt, whose marginal tax-rate is lower than the corporate tax rate, could lead to an increase in the debt-equity ratio. In the absence of a general equilibrium model it is difficult to make unambiguous predictions.

Perhaps it is partly for this reason that, in analysing the effect of inflation on the optimal debt-capital ratio, it has been usual to adopt a partial-equilibrium framework. For example, Auerbach (1980, p.5) obtains a formula for the real cost of capital which involves *inter alia* corporate tax rates, tax rate on dividends, capital gains tax and real after-tax returns to debt-equity holders. *Assuming that real rates of return to equity and debt holders are given,* he shows that, in the presence of tax deductibility of all interest payments including the inflation premium, inflation reduces the cost of debt finance if the

corporate tax rate exceeds the (unobserved) tax rate of debt-holders. Estimates of the latter rate for the U.S are given by Gordon and Malkiel (1980) and Feldstein and Summers (1979). A second effect of inflation on the cost of capital would arise if nominal capital gains to equity-holders were taxable. Once again, for a *given* real rate of return, this would make equity more expensive and encourage the substitution of debt for equity.

A limitation of the type of analysis discussed above is that real rates of return to equity and debt may themselves vary with the inflation rate so that conditional predictions of the type just mentioned are of limited value. A further limitation is that the above analysis takes no account of default risk or borrowing constraints - although Gordon (1980)considers this. If the income stream faced by the firm is uncertain, and if such uncertainty rises in a period of unanticipated inflation, then a highly levered firm faces a greater bankruptcy risk (which may be compounded by a tight monetary policy accompanying high inflation). Such a risk, which could be foreseen by equity-holders, would act as a brake on raising the debt-equity ratio. A final observation is that, even if the desired debt-equity ratio may rise as a consequence of the interaction between taxation, inflation and the cost of capital, the actual ratio may adjust only slowly to this level. Therefore, in analysing its behaviour a partial adjustment model (e.g. King (1977)) should be used.

The empirical behaviour of Australian D-E ratio has been studied by de Boos, Valentine and Williamson (1980) and has been commented on by CEDA (1979). The CEDA study can be dealt with briefly. It argues that "low profitability has resulted in insufficient retained earnings over the last decade and as a result the debt to equity ratio has increased. The gearing ratio of Australian companies has

increased from 0.83 to 0.96 in the five period ended 1977". See table 16 below.

TABLE 16

Debt to Equity Ratio of Australian Companies

	1972	1976	1979
All industries	0.83	0.95	0.98
Manufacturing	0.74	0.84	0.88
Wholesale trade	0.89	1.08	1.24
Retail trade	0.91	1.04	1.00
Services	1.54	1.84	1.70

Source: Reserve Bank Company Supplement

The study by de Boos *et al.* analyses, in a regression equation framework, the behaviour of all industries' debt-equity ratio as well as that of 300 major listed companies using data collected for the Campbell Committee. The debt equity ratio is shown to rise from 1960 onwards until 1976, since which time it has levelled off. Both long-term and short-term D-E ratios show a similar pattern. The regression equations are fitted for an "all industries" group as well as by size classes, and the principal explanatory variables include a time trend (to capture the effect of increased sophistication of the capital market), degree of capacity utilization, lending restrictions, and *real* after-tax profitability measured as the difference between profit rate after tax and the inflation rate. There is no allowance for possible partial adjustment. The aggregate regression results support the view that inflation has caused an increase in D-E ratios, but the regression equations by size groups yield only rather weak evidence that this has been so. It is the trend term which accounts for the bulk of the explanation. The authors argue that "firms will try to maintain the return on shareholders' funds by increasing the debt/equity ratio" in a situation where real profitability is being

undermined by increase in the rate of inflation.

It would be incorrect to suggest that this empirical work confirms the theoretical predictions outlined earlier in the section. This is because the theoretical rationale underlying de Boos *et al.* is insufficiently precise, and because certain variables such as tax rates and interest rates, which are important in theoretical discussions, do not directly appear in their regression equation (compare King (1977, ch.7.3) where the target debt-equity ratio is a function of tax incentives). There are practical difficulties in doing this; nevertheless, until some attempt is made in that direction one would not be able to separate out the effects of inflation from those of changes in tax rates.

5.7 Unincorporated Enterprise Effects

Unincorporated enterprises make many of the same decisions as corporations and it is presumably the case that the factors influencing these decisions are similar in both cases. Leaving aside the obvious differences induced by the small size of most unincorporated enterprises, the major difference lies in the restricted financing base for the unincorporated enterprise sector. With perfect capital markets and an operative Fisher effect, the rates of return on different assets should be equalized (except for relative risk differentials), and therefore the cost of finance should be the same for both classes of enterprise. In reality of course, these conditions may well be absent, but this seems to have little to do with inflation per se. Certainly the tendency in modelling has been to model aggregate investment by reference to the cost of finance established within the corporate trading sector; a development probably reflecting the above relationship. Perhaps it should be observed however that this sector may have greater recourse to debt financing than the corporate sector and, unless re-payments are made on a

basis approximating a constant real servicing burden, high nominal interest rates could have a greater effect upon investment.

Table 17 records two ratios. Firstly, the ratio of gross-fixed capital expenditure by unincorporated enterprises to that by corporate trading enterprises. Secondly, the ratio of capital expenditure by unincorporated enterprises to total private corporate investment, this latter measure attempting to make some correction for the growth of leasing.

TABLE 17

Investment Ratios : Unincorporated to Corporate Enterprises

	1968/9	1969/70	1970/71	1971/72	1972/73	1973/4	1974/5	1975/6	1976/7	1977/8
(1)	.393	.328	.257	.261	.389	.403	.389	.512	.576	.516
(2)	.353	.296	.225	.226	.318	.327	.319	.399	.440	.387

(1) Ratio of gross fixed capital expenditure (non-dwelling) of unincorporated enterprises to gross fixed capital expenditure of private corporate trading enterprises.

(2) Ratio of gross fixed capital expenditure (non-dwelling) of unincorporated enterprises to gross fixed capital expenditure of private corporate trading enterprises and private financial enterprises.

Sources: Tables 5, 11, 12, 13, *Australian National Accounts*, 1978/9.

Table 17 suggests that investment by unincorporated enterprises has been stronger than that by the corporate sector so that, whatever effect high nominal interest rates may have had upon investment by the unincorporated sector, it would appear to have been offset by other factors. It would be of interest to investigate the reasons for the differential behaviour exhibited in Table 17.

6. INFLATION AND THE CORPORATE FINANCIAL SECTOR

It is commonly believed that the effects of inflation upon the corporate financial sector may not be as pervasive as that upon the trading

sector, owing to the fact that the assets and liabilities dealt in are financial. Furthermore, as both the demand for the services of this sector and the supply of funds originate from the household/corporate trading sectors, there is a sense in which previous discussion has indicated ways in which inflation might be expected to influence the financial sector. Nevertheless, there are some effects which are worth emphasizing. Some of these are common to all institutions in this sector and are discussed in the next sub-section, while some are more specific to the nature of institutions. For this reason financial institutions are divided into two types - finance and non-finance companies, with the latter encompassing banks, building societies and credit unions.

6.1 General Effects

(i) Income Measurement. Assuming that financial enterprises have no real assets, problems of stock revaluation and depreciation would not arise. Table 18 provides the ratio of stocks plus fixed assets to total assets for various financial enterprises for selected years.

TABLE 18

Ratio of Real to Total Assets, Financial Enterprises, Selected Years...(%)

	1969	1972	1974	1976	1978	1980
Trading Banks	2.1	1.7	1.4	1.5	1.7	1.5
Savings Banks	1.3	1.3	1.1	1.3	1.8	1.6
Building Societies	1.2	1.9	2.0	2.2	2.1	2.5
Finance Companies	8.5	10.3	11.2	14.0	24.1	27.5

Source: Tables 4.2, 4.3, 4.10, 4.13, *Flow of Funds 1953/4 - 1979/80*

It is apparent from Table 18 that real assets are only important for finance companies so that a major source of bias in historical cost profits is eliminated for non-finance companies. For these companies, setting

DR to zero in (21) demonstrates that the entity based measure of income would be equivalent to operating surplus. Hence, for these companies and for that definition of income, few adjustments would need to be made to reported income to account for inflation. From an equity based view of income however, this is not so, since the lack of any capital gains upon assets ($\dot{q} = 0$) means that income as defined in (28) would be

$$DI^* = Y - \dot{p}\, E_{-1} \qquad (52),$$

that is, a correction needs to be made to reflect the capital maintenance requirement for equity-holders.

(ii) Tax Base. It is with respect to financial enterprises that the deficiencies in an entity based definition of income, as favoured by Mathews, become most obvious. With a tax rate τ, a borrowing nominal rate of interest i_B and a lending rate i_L, tax payable would be

$$T = \tau\, [i_L(D_{-1}+E_{-1}) - i_B D_{-1}] \qquad (53)$$

reflecting the tax deductibility of interest payments on debt. Any inflation leading to an equal rise in both i_L and i_B will lead to an increase in the effective tax rate because there is no tax offset to the increased revenue generated from lending the equity funds E_{-1}. Following from the earlier analysis of the Mathews recommendations, equity income

$$i_L(D_{-1}+E_{-1}) - i_B D_{-1} - \dot{p}\, E_{-1} \qquad (54)$$

would be a superior tax-base, as it provides the requisite protection to equity holders. It is clear therefore that entity definitions of income as a tax-base discriminate against financial enterprises and in favour of trading enterprises. Perhaps this point however, should be kept in perspective as, for 1979, the ratio of equity to total liabilities was only 6.6% (finance companies) .4% (savings banks) and 2.7% (trading banks). Doubtless these aggregate ratios could disguise considerable

intra-sector variation.

(iii) Demand and Supply of Assets. Even assuming a tax system that was neutral with respect to inflation, there is some possibility that inflation might affect the demand and supply of financial assets. On the demand side, discussion of the balance sheets of households and trading enterprises indicate reasons for believing that inflation and its variability will impact upon the demand for financial assets. Cagan and Lipsey (1978, p.48-9) provide a succinct summary of the various issues, most of what they say also being appropriate for Australia.

> "The development once thought to be the main danger to financial intermediaries from inflation - that households would shun fixed-dollar assets and thus reduce the inflow of funds - has not materialized. Nevertheless, intermediaries have suffered from the unprecedented changes in interest rates which have resulted both from inflation and from efforts to halt inflation. The problem has been particularly acute where legal or contractual limitations have prevented or slowed the response of intermediaries to the rise of market rates of interest.
>
> In the long run,after their interest rates have risen to compensate for anticipated inflation, intermediaries are able to pay a rate on their liabilities that maintains their competitive position in the financial structure. But, in the short run, some intermediaries have encountered difficult problems in the changing inflationary environment. Because their asset holdings are mostly long term, intermediaries responding to competitive pressures to pay higher rates on their liabilities are hampered by average rates of return on their portfolios that rise more slowly than market interest rates. The transition is not short, since it requires a turnover of a large portion of the loans and securities in their portfolios acquired earlier at lower rates. Transitional pressures underlay most of the difficulties the intermediaries underwent in recent periods of monetary restraint when short-term market rates rose sharply and the intermediaries faced massive reductions in the inflow of funds."

6.2 The Non-Finance Sector

Wilcox (1975) has listed a number of ways in which banks are affected by inflation, the major one not discussed so far being the fact that they derive part of their resources from interest-free deposits and therefore gain from any increase in *nominal* interest rates. The magnitude of any such gain will depend on the extent of substitution toward interest-bearing deposits in an inflationary environment, but there has been no evidence of

such a movement in Australia, M1 assets being 10.16% of total household financial assets in 1968 and 10.14% in 1979. Set against this gain is a loss due to the need for banks to keep a certain cash ratio against deposits, as these assets will earn a zero rate of return. This latter requirement would be a characteristic of all non-finance companies.

Some algebra highlights these effects. Let

ND = non-interest bearing deposits

TD = total deposits

CR = cash requirements

$CR/TD = \gamma$, $ND/TD = \theta$

i_L = nominal lending rate = $r_L + \dot{p}$

i_B = nominal borrowing rate = $r_B + \dot{p}$

Profits will then be (ignoring taxes)

$$\Pi = i_L(TD - CR) - i_B(TD - ND) = TD[i_L(1-\gamma) - i_B(1-\theta)] \qquad (55)$$

so that

$$\frac{\partial(\Pi/TD)}{\partial \dot{p}} = [(1-\gamma) - (1-\theta] = \theta - \gamma$$

when real rates are held constant. Trading banks, for whom $\theta > \gamma$, will therefore gain from inflation while other non-finance companies, which effectively have $\theta = 0$, will lose overall. This theoretical consideration is, however, muted by the fact that both savings banks and building societies hold extremely low cash ratios e.g. in 1978 only .27% of savings bank deposits were held in this form.

6.3 Finance Companies

The most striking feature of finance companies balance sheets in the 1970s has been the growth in the ownership of real assets. This appears to be a consequence of the rapid growth of leasing of equipment noted by a number of commentators. Because the greatest period of growth has been

since 1976 it is tempting to conclude that inflation has been an important determinant.

Theoretical analyses of the lease/buy decision can be found in Miller and Upton (1976), Lewellen *et al.* (1976), Myers *et al.* (1976), while a simple discussion is given in Franks and Hodges (1979). The latter article canvasses a number of "advantages" of leasing; one of these being that leasing is a source of finance that does not appear in balance sheets and hence does not change the gearing ratio. Generally, the conclusions of this literature are similar to Myers *et al.* (1976, p.15):

> "We have shown the importance of different tax rates for lessees vs. lessors, particularly when interest rates are high and accelerated depreciation is allowed for tax purposes".

The different effective tax rates originate from the fact that a lessee may not be able to exploit completely any investment allowance owing to low before-tax profits; as such this phenomenon seems only indirectly related to inflation. However, high nominal interest rates are associated with inflation and, as the value of the tax deferral obtained by the lessor company is greatest when interest rates are high, inflation will increase the attractiveness of leasing. The mechanism whereby this operates is that capital allowances reduce current taxable income, while the lease income increases future taxable income, so that a failure to allow replacement cost depreciation for tax purposes would reduce this gain. Franks and Hodges also observe that, for vehicle leasing in the U.K., the lessor was given a faster tax write-off than the owner, so that any inflation will encourage the growth of vehicle leasing.

7. THE EFFECTS OF INFLATION UPON THE GOVERNMENT SECTOR

Below we list the major items in the Government income and outlay account, the capital account and the balance sheet, where for the first two we use the ANA classifications:

Income	Outlay
Public enterprise income	Final consumption
Interest receipts	Interest payments
Indirect taxes	Transfers
Company income taxes	Subsidies
Personal income taxes	
Other taxes	

Capital Account	
Current surplus	Fixed capital expenditure
Grants	Purchase of assets
	Net lending

Balance Sheet

Assets	Liabilities
Notes and coins	Coin
Deposits	Private holdings of Commonwealth Government Securities
Loans to Private Sector	Local and Semi-government securities
Other Assets	Loans Securities
	Other Liabilities

In what follows special attention is devoted to the effects of inflation on the receipts and interest payments, on the outstanding public non-monetary debt, on the size of the budget deficit and the net lending/borrowing position of the public sector. Initially, it is useful to obtain some idea of the composition of tax revenue and table 19 below provides this information for 1974-80 period. The most striking developments include a significant growth in the proportion of income tax in the total between 1974 and 1978 and a subsequent decline, a steady reduction in the share of company taxes from 17 per cent of the total in 1974-75 to 12.63 per cent in 1979-80 and a reduction in the share of estate and gift duties from 0.58% in 1974-75 to 0.24% in 1979-80. This simply reflects a phased abolition of estate duties which began in 1977 and ended in July 1979. The increase in the share of customs and excise duties, especially in the last three years, reflects the growing importance of oil revenues from the crude oil levy. The revenue from the crude oil levy rose from nothing in 1974-75, to $137 m. in 1975-76 and to $790 m. in 1979-80 accounting for nearly 8 per cent of the total tax revenue.

TABLE 19

Tax Revenue

Year	Personal Income Tax %	Company Income Tax %	Customs and Excise Duties %	Sales Tax %	Estate and Gift Duties %	Total %
1974-75	55.59	17.00	18.52	8.32	0.58	100.0
1975-76	55.50	15.19	20.32	8.48	0.52	100.0
1976-77	51.05	14.58	19.40	8.52	0.45	100.0
1977-78	57.62	14.70	18.84	8.35	0.49	100.0
1978-79	55.68	13.20	23.06	7.70	0.36	100.0
1979-80	55.77	12.63	24.45	6.91	0.24	100.0

Source: Estimates of Receipts and Summary of Estimated Expenditure. (Parliamentary Papers)

7.1 Inflation and the Income Tax

Leading issues

Macroeconomic discussions of the effects of inflation on income taxes have been recently reviewed by Nowotny (1980). Leading studies of these effects include von Furstenberg (1975), OECD (1976), Allan and Savage (1974), Morgan (1977) from overseas and the Reports of the Taxation Review(Asprey) Committee (*AC*)(1974) and the Mathews Committee (*MC*) (1975) and the CEDA Study by G. Lee (1978) from Australia. The focus of attention in these studies has been on the variations in the government's "take" of the revenue directly induced by inflation. This has been studied from two angles; first, the effects of inflation on the level of taxation and second, its effects on the distribution of tax burden across different catagories of tax payers. The simplest of the discussions proceeds by assuming that there is a tax schedule defined in terms of nominal income and it remains unchanged during a period of inflation. If the rate scale is progressive in the sense that the marginal tax rates rise with the level of income, at least up to a certain level of income, and if concessional allowances of various types remains unchanged, then it is straight-forward to show that real marginal tax rates rise due to inflation and the magnitude of the rise depends on the inflation rate. This is the phenomenon of *tax drift* which was empirically studied in the Reports of both the *TRC* and the *MC*. In practice, of course, discretionary changes in the tax structure do occur and must be duly allowed for in any study aiming to calculate the effects of inflation. In what follows the effects of inflation on average and marginal tax rates, on the elasticity of tax liability at various income levels, on the real value of concessional allowances and on the position of the average income earner will be studied first. We shall then proceed to the

effects of inflation on the distribution of and changes in the tax burden defined in two alternative ways. The discussions we carry out will review available findings; in several cases, however, these are some years out-of-date and we have updated them.

Inflation and the level of taxation

It seems useful to point out that several partial effects of inflation on the level of income tax can be deduced, under certain circumstances, in a purely analytical way. Commonly, this is not done; rather the effects are illustrated through empirical calculations. The main reason for this practice would seem to be that the tax rate schedule is not continuous and differentiable but discrete and incorporating many discontinuities. This fact notwithstanding, it seems legitimate to deduce certain general effects of inflation from a continuous rate schedule suitably chosen to approximate a discrete one. The approximation must incorporate certain key features of the discrete rate scale, especially (a) the existence of the threshold level of income below which no tax is paid, (b) rising marginal tax rates which reflect progressivity and (c) the existence of a ceiling (less than unity) marginal tax rate. (In a recent unpublished study Murphy (1980) has put forward a tax liability function which captures several such characteristics of the Australian tax rate schedule. This function is quite suitable illustrating various effects of inflation but it seems that for our purposes it is even simpler not to use any particular functional form).

Let $x = Py_p - x_L$ denote the identity relating nominal taxable income (x), price level (P) and the real income (y_p). Let x_L

be the minimum income level subject to tax and let $T(x)$ denote the tax liability for nominal taxable income x. Let us also ignore tax deductions. Let $m(x) = T'(x)$ denote the marginal tax rate at income level x and let $a(x) = T(x)/x$ denote the average tax rate. In a progressive income tax system we have

$$\begin{aligned} &\text{(i)} && a(x) < m(x) < 1 \\ &\text{(ii)} && m'(x) = T''(x) > 0 \\ &\text{(iii)} && m'(x) < a'(x) . \end{aligned} \tag{56}$$

Also let $m(x) \to m^*(x)$ as $x \to \infty$, i.e. $m^*(x)$ is the highest marginal tax rate.

Now in a completely unindexed tax system the elasticity of tax liability with respect to changes in the price level is exactly the same as that with respect to real income. Therefore differentiating $T(x)$ with respect to x yields the marginal response of tax liability with respect to the change in price level. It follows immediately that the marginal and average tax rates rise with inflation. Secondly we note that by definition $\eta(x) = m(x)/a(x)$. Then

$$\frac{d\eta(x)}{dx} = [m'(x) - \eta(x).a'(x)](a(x))^{-1} \tag{57}$$

which implies that

$$\frac{d\eta(x)}{dx} < 0 \quad \text{if} \quad \frac{m'(x)}{a'(x)} < \eta(x)$$

for which a sufficient condition is that $m''(x)/a'(x)$ be less than unity. But in a progressive income tax system as we have defined it $a'(x) > m'(x)$ and hence $\eta(x)$ declines with x. Note that $a'(x) > m'(x)$ implies that beginning with a given initial income level, the proportionate increase in the average tax rate due to inflation is greater the proportionate increase in the marginal tax rate.

Next note that

$$\frac{d\,(a(x))}{dx\;a(x)} = \frac{1}{x}\,(\eta(x)-1) \qquad (58)$$

where $\eta(x)$ is the elasticity of tax liability. In our progressive tax system $\eta(x) > 1$ generally and $\eta(x) \to 1$ as $a(x) \to m(x)$. It follows immediately that the *proportionate increase in the average tax rate due to inflation is smaller the higher the initial level of nominal income.*

These simple conclusions, developed in the context of a continuous progressive rate scale, will be modified somewhat when we come to an examination of factual evidence based on a discrete rate scale.

We shall now proceed to an examination of factual evidence pertaining to the effects of inflation on the level of income taxation. This exercise is in the spirit of similar ones to be found both in the Reports of *TRC* and *MC*. However, significant changes in the tax rate scale have taken place since these Reports and our first task is to review these changes.

Changes in the rate scale since 1975

In Table 20 are reproduced the details of changes to the rate scales for years 1975-76 through 1980-81. The rate scale brackets, which in 1974-75 had been reduced in number from 29 to 14, were further reduced in number from 14 to 7 in a pre-indexation adjustment in 1975-76; further, the concessional deductions were replaced by tax rebates. This was an important change since under the former the value of the tax deduction depended upon the marginal tax bracket of the tax payer. The period from 1 July 1976 to 1 July 1978 was one of full tax indexation; in the first year the tax brackets and rebates were increased by 13 per cent and in the second by 10.9 (equal to the increase in CPI adjusted for the effect of indirect taxes). The 1977-78 Budget saw the introduction of half tax-indexation and a further reduction in the number of the brackets from 7 to 3 with the first

TABLE 20

Discretionary Changes in Income Tax Since 1975

Taxable Income	1975-76	
$	per cent	
1- 2,000	20	A general concessional rebate of $540 was allowable to all resident taxpayers, so in effect a resident taxpayer was not called on to pay tax unless the taxable income was $2,519 or more. Thus, effectively, the first two brackets of the table are:
2,001- 5,000	27	
5,001-10,000	35	
10,001-15,000	45	
15,001-20,000	55	
20,001-25,000	60	
25,001 and over	65	
		0-2,518 nil
		2,519-5,000 27
		The rest of the Table remains the same.
	1976-77	
1- 2,260	20	The general rebate for 1976-77 was $610 so, effectively, the first two brackets of the table are:
2,261- 5,650	27	
5,651-11,300	35	
11,301-16,950	45	
16,951-22,600	55	
22,601-28,250	60	
28,251 and over	65	
		0-2,846 nil
		2,847-5,650 27
		The rest of the Table remains the same.
	1977-78	
1- 3,402	nil	This scale is the mixture of two rate scales - one applying from 1 July 1977 to 31 January 1978, and the other applying for the rest of the financial year. There was a major change in tax scales announced in the 1977-78 Budget. The 7 steps were replaced by a 3 step standard rate scale and the general rebate was replaced by a zero bracket, achieving the same effect.
3,403- 3,750	27	
3,751- 6,266	29.085	
6,267-12,532	33.749	
12,533-16,000	39.579	
16,001-18,798	45.417	
18,799-25,063	51.247	
25,064-31,329	54.162	
31,330-32,000	57.077	
32,001 and over	62.915	
	1978-79	
1- 3,893	-	A surcharge of 1.5% applied in 1978-79.
3,894-16,608	32 + 1.5	
16,609-33,216	46 + 1.5	
33,217 and over	60 + 1.5	
	1979-80	
1- 3,893	nil	A surcharge of 1.07% applied in 1979-80
3,894-16,608	32 + 1.07	
16,609-33,216	46 + 1.07	
33,217 and over	60 + 1.07	
	1980-81	
1- 4,041	nil	
4,042-17,239	32	
17,240-34,478	46	
34,379 and over	60	

bracket containing the majority of tax-payers. Since this period tax indexation has never been more than half of the increase in the CPI adjusted for the effects of indirect taxes, health insurance levy and the exchange rate changes. On occasions it has been considerably less, since during 1979-80 the indexation was completely suspended. Partial indexation was again applied in 1980-81, but 1981-82 is again a year of no tax indexation.

The reduction in the number of tax brackets had certainly reduced the importance of the "bracket creep" for a period. However, the fact of two years of half indexation and one with no indexation, taken together with large wage settlements of 1980 and 1981, must imply that once again there is a high prospect of the average wage earner facing a marginal tax rate of 46 per cent as was the case in 1976. Implications of such a development for wage settlements were considered in the Mathews Report.

Effects of inflation on 'real' income rate schedule since 1974

In Table 21 below we present figures on real taxable income, measured in 1973-74 prices, average tax rate and the percentage increase in average tax rate since 1954-55. (This table is comparable with table 6.C. given in the AC Report). The average tax rates have come down from the high levels of 1974-75, the most marked reduction coming about in 1977-78. Since 1978 however they have gone up again, mainly because full indexation of tax brackets has been abandoned. But in the very highest income bracket ($100,000+) and in the lowest ($2,000 or less) the average rate now is lower than even the 1954-55 levels so it would appear that the inflationary effects on the rate scale are confined to the income range $3,000-50,000. (We shall examine later this aspect which concerns the distribution of the burden of taxes). It is clear that discretionary tax changes from 1974-78 have significantly mitigated the effects of inflation on the rate scale.

TABLE 21

Effects of Inflation on 'Real' Income Rate Schedule

1	2	3	4	2	3	4
$		1974-75			1975-76	
1,500	3.57	-3.51	-0.13	0	-100.00	-3.84
2,000	5.43	0.56	0.03	1.21	- 77.59	-4.43
3,000	9.15	10.24	0.92	9.80	18.07	1.64
4,000	12.72	18.88	2.26	14.51	35.61	4.27
6,000	19.72	29.74	5.33	21.35	40.46	7.25
8,000	26.36	38.74	9.09	25.27	33.00	7.75
12,000	35.15	38.93	13.18	32.37	27.94	9.46
16,000	40.83	35.63	15.35	38.28	27.18	11.71
20,000	45.23	32.25	16.77	42.89	25.41	13.20
30,000	51.49	23.18	16.65	50.26	20.24	14.53
50,000	57.44	15.57	15.38	56.15	12.98	12.83
100,000	62.22	7.65	10.47	60.58	4.81	6.58
		1976-77			1977-78	
1,500	0	-100.00	-3.84	0	-100.00	-3.84
2,000	1.39	- 74.26	-4.23	0	-100.00	-5.71
3,000	9.93	19.64	1.78	8.89	7.11	0.64
4,000	14.67	37.10	4.45	14.16	32.34	3.87
6,000	21.44	41.05	7.36	20.69	36.12	6.47
8,000	25.42	33.79	7.93	24.23	27.53	6.46
12,000	32.54	28.62	9.69	30.73	21.46	7.27
16,000	38.45	27.74	11.94	36.00	19.60	8.44
20,000	43.05	25.88	13.45	39.93	16.75	8.71
30,000	50.37	20.50	14.72	47.59	13.85	9.95
50,000	56.22	13.12	12.96	53.72	8.09	8.00
100,000	60.61	4.86	6.66	58.32	0.90	1.23
		1978-79 (with 1.5% levy)			1978-79 (without levy)	
1,500	0	-100.00	-3.84	0	-100.00	-3.84
2,000	0	-100.00	-5.71	0	-100.00	-5.71
3,000	9.06	9.16	0.83	8.66	4.34	0.39
4,000	15.18	41.87	5.01	14.50	35.51	4.25
6,000	21.28	40.00	7.17	20.33	33.75	6.05
8,000	24.34	28.11	6.59	23.25	22.37	5.24
12,000	30.50	20.55	6.96	29.28	15.73	5.32
16,000	34.75	15.45	6.65	33.46	11.16	4.80
20,000	38.23	11.78	6.13	36.90	7.89	4.10
30,000	45.99	10.02	7.20	44.60	6.70	4.81
50,000	52.19	5.01	4.96	50.76	2.13	2.11
100,000	56.85	-1.64	-2.26	55.38	-4.89	-5.74

.../2

Effects of Inflation on 'Real' Income Rate Schedule (Cont'd)

1	2	3	4	2	3	4
		1979-80 (with 1.07% levy)			1979-80 (without levy)	
1,500		-100.00	-3.84		-100.00	-3.84
2,000	0.19	- 96.48	-5.50	0.19	- 96.48	-5.51
3,000	11.15	34.34	3.11	10.79	30.00	2.72
4,000	16.63	55.42	6.64	16.09	50.37	6.04
6,000	22.11	45.46	8.15	21.40	40.79	7.31
8,000	24.85	30.79	7.22	24.05	26.58	6.23
12,000	31.70	25.30	8.56	30.80	21.74	7.37
16,000	35.54	18.07	7.78	34.60	14.95	6.44
20,000	39.97	16.87	8.77	39.01	14.06	7.31
30,000	47.00	12.44	8.94	46.01	10.07	7.23
50,000	52.63	5.90	5.83	51.60	3.82	3.78
100,000	56.85	-1.64	-2.25	55.80	-3.46	-4.74

Column 1 = Taxable income (constant real size 1973-74 prices)
Column 2 = Average tax rate %
Column 3 = Increase in average tax rate since 1954-55 %
Column 4 = Reduction in after-tax income as a result of change in average tax rate since 1954-55 %

The position of the average income earner

In its Report *AC* voiced the concern that "if inflation continues at anything like its present rate, it will be a matter of only two or three years before even the average wage earner finds himself paying taxes at marginal rates of 50 per cent or more". This concern was based partly on the realisation that increases in income in years such as 1973-74 reflected inflation predominantly and so to tax these increases as if they were increases in real income could lead to wage retaliation in the form of demands for wages framed to achieve certain post-tax level or earnings. Thanks mainly to the discretionary tax changes, the fears of *AC* have not been realised. In Table 22 (which can be compared with Table 6.D in the Report of the *AC*) we give the average and marginal tax rates on average earnings per employed male unit. This shows that the average rate of 23.1 per cent in 1979-80 is slightly higher than that of 21.9 per cent in 1974-75, but the marginal rate is lower, 33.07 per cent compared with 44 per cent. The table also shows that unlike 1973 and before that the increase in average earnings in the last five years wholly reflect increase in the price level with no real income growth, rather a possible reduction. Also note that the elasticity of tax liability for the average income earner is now considerably lower than it was in 1974-75, 1.43 compared with 2.0 and this also reflects a reduced tendency for the average income earner to be pushed into higher tax brackets by inflation.

Elasticity of tax liability

Table 23 gives the elasticity of tax liability with respect to taxable income in 1977-78 and 1978-79. This table may be compared

TABLE 22

Average and marginal tax rates applicable to average earnings

YEAR	AVERAGE EARNINGS	TOTAL TAX	AVERAGE TAX RATE (a)	MARGINAL TAX RATE (m)	(m/a)	INFLATION COMPONENT OF INCREASE IN AVERAGE EARNINGS
1974-75	7,709	1,692	21.9	44.0	2.00	65.14
1975-76	8,819	2,007	22.8	35.0	1.53	90.01
1976-77	9,916	2,250	22.7	35.0	1.54	111.34
1977-78	10,894	2,388	21.9	33.75	1.54	97.53
1978-79(1)	11,735	2,627	22.4	33.5	1.50	105.83
1979-80(2)	12,857	2,964	23.1	33.07	1.43	105.22

(1) 1.5% levy applies to marginal tax rate

(2) 1.07% levy applies to marginal tax rate

NOTE: This table is calculated very roughly, with rounding to whole dollars at intermediate stages of calculation, and using yearly averages, rather than working in quarterly terms and then averaging.

TABLE 23

1977-78

Proportionate Increase in Tax Liabilities
- Taxpayer with Dependent Spouse*

Taxable (net) Income Level (1974-75 prices)	Tax Paid (1974-75 prices)	Proportionate Increase in Tax Paid	Elasticity of the Tax Liability to Taxable Income
$	$	%	
4,000	62.69	185.61	18.56
4,500	210.72	72.03	7.20
5,000	379.49	44.47	4.45
5,500	548.27	33.84	3.38
6,000	717.04	28.25	2.82
6,500	885.58	24.76	2.48
7,000	1,054.35	22.41	2.24
7,500	1,223.13	20.69	2.07
8,000	1,391.90	19.40	1.94
9,000	1,735.90	20.52	2.05
10,000	2,131.76	18.57	1.86
11,000	2,527.34	18.96	1.90
12,000	2,961.17	18.41	1.84
13,000	3,415.42	18.94	1.89
14,000	3,908.50	18.36	1.84
15,000	4,420.70	17.39	1.74
16,000	4,933.26	16.62	1.66
17,000	5,445.82	16.49	1.65
18,000	5,964.85	16.35	1.63
19,000	6.506.18	15.82	1.58
20,000	7,047.90	15.37	1.54
25,000	9,971.38	15.77	1.58
30,000	13,117.23	14.39	1.44
35,000	16.262.64	13.54	1.35
40,000	19.408.49	12.97	1.30
50,000	25,700.20	12.24	1.22
75,000	41,429.02	11.39	1.14
100,000	57,157.40	11.01	1.10

*Assumes 10% increase in nominal income; no non-dependent deductions or rebates, 1977-78 rate scale.

with Table III-2 of the Mathews Report. As previously explained, we expect an inverse relationship between this elasticity and the level of income. This conclusion based on the assumption of a continuous rate scale must be slightly modified in the discrete case. In this latter case, within any tax income bracket the marginal tax rate remains constant whereas the average rate rises with income. Consequently the elasticity of tax liability varies inversely with the income level. In moving from one bracket to the next the average and the marginal tax rates both rise thereby reversing the decline in elasticity that occurred in the previous tax bracket. The third column of the Table shows that, as a result, the sharpest proportionate increases in taxes paid as a result of possibly inflation induced increments to nominal income fall on the lower income groups. (We return to this point again later in the paper). A rough comparison of our figures with those in the Report of the *MC* shows that compared with 1974-75 the elasticity of tax liability is currently lower at all income levels and so the revenue "take" from inflation now is considerably smaller than in 1974-75.

Erosion in the value of concessional allowances

The *AC* supported the view that the real value of concessional deductions had been eroded by inflation. But it drew a distinction between the erosion in the real value of amount deductible from net income and erosion in the real value of tax saving. Nominal and possibly real value of dependent deduction of a given size is greater for the tax payer in the higher marginal tax bracket. Changes in the system since 1974-75 have made the tax savings independent of the marginal tax rates since concessional deductions have been replaced

TABLE 24

Discretionary Changes in Concessional Deductions and Rebates

This table cannot be updated beyond 1974-75 because of the changes that have occurred since then. The deductions allowed against assessable income were replaced by rebates for dependants. Thus, the tax saving became independent of the marginal tax rate.

A rebate of $400 is not comparable with a deduction of $400. The rebate gives a tax saving of $400, whereas the deduction gives a tax saving of $(400 x marginal tax rate), e.g. for someone with a marginal tax rate of 32%, the tax saving is 400x.32 = $128.

The relevant information concerning dependant allowances in recent years is set out below.

1974-75 Maximum deductions allowed against assessable income were:

spouse	first child	other children
$364	$260	$208

1975-76 Deductions were substituted by concessional rebates of tax. The maximum rebates were:

spouse	first child	other children
$400	$200	$150

1976-77 This year the allowance of rebates of tax for dependent students and children was replaced by increases in family allowances (child endowment).

Maximum rebate for spouse = $500

1977-78 Maximum rebate for spouse = $555

1978-79 Maximum rebate for spouse = $597

1979-80 Maximum rebate for spouse = $597

The following figures may be useful.

	Increase in CPI since 1954-55 %	Inflation-hedged 1954-55 allowance for spouse + 2 children $
1973-74	98.1	1,030
1974-75	131.5	1,204
1975-76	161.5	1,360
1976-77	197.7	1,548
1977-78	226.1	1,696
1978-79	252.8	1,834
1979-80	288.3	2,019

For 1974-75, the appropriate figure for column 2 of Table 5 is

$$\frac{832}{1,204} \times 100 = 69.1$$

by tax rebates. Since 1976-77 the allowance of rebates of tax for dependent students and children has been by increases in family allowances. However, inflation has very significantly reduced the real value of these, see Table 24. The increases in the maximum rebate for spouse have also not kept with inflation.

The only other major concessional deduction relates to life insurance and superannuation contributions and this has remained fixed at the maximum of $1,200. The resultant reduction in the real value of the saving from this deduction has been further increased by the lowering of the maximum tax rate from 65 before 1977 to 60 per cent (excluding the levy).

Inflation and the burden of income tax

Two measures of tax burden resulting from inflation induced effective tax liability, viz. the average tax rate and the percentage reduction in disposable income resulting from a change in the average tax rate, have been used in the literature. The first has already been discussed and calculations presented in Table 21 showed that the average tax rates rise more steeply at lower income levels and hence support the notion that the burden of inflationary tax payments is greater at lower income levels. However, it was pointed out by both the *AC* and the *MC* that the percentage reduction in disposable income consequent upon an increase in the average tax rate was a more satisfactory indicator of tax burden. This measure is shown in column 4 of Table 21 for every year since 1974-75. It emerges that this measure is directly related to the level of taxable income up to a certain level, but inversely related to the level of income in the highest marginal tax bracket. Inflationary tax burden

as measured by this criterion is the greatest for taxable real incomes in the range \$16,000-30,000 (1973-74 prices).

It is easy to derive the condition which determines the "critical" level of taxable income upto which the proportionate reductions in after-tax income increase with the average tax rate. Observe that

$$\frac{d \ln (\text{Disposable income})}{da(x)} = \frac{d \ln (x-T(x))}{d(a(x))}$$

$$= \frac{1}{m(x)-a(x)} - \frac{1}{1-a(x)} \qquad (59)$$

The left-hand side is negative

$$\text{if} \quad \frac{1}{m(x)-a(x)} < \frac{1}{1-a(x)}$$

i.e. if $\eta(x) > 1 + (1-a(x))/a(x)$

We have already seen that $\eta(x) \to 1$ at very high income levels; also $a(x) \to m^*(x)$ at very high income levels. It follows that the "critical" level of income described above is determined by the intersection of $\eta(x)$ and $(1-a(x))/a(x)$ schedules. Figure 2 below gives a graphical solution to the problem.

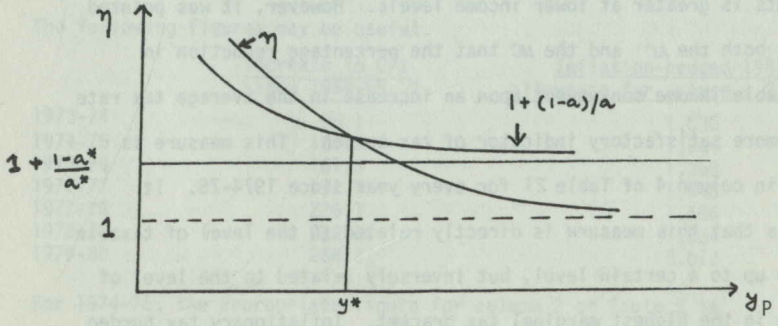

Figure 2

This result forms the basis of a frequently made suggestion that the increase in the tax burden due to inflation is the greatest for high (but not the highest) income groups. But an important qualification arises from the fact that within any taxable income band, the decline in the disposable income is larger the lower the income. If a high proportion of tax payers fall within a certain tax bracket, and if the tax rates are unchanged in the face of on going inflation, then the lower-income taxpayers are more severely disadvantaged on this criterion as well as on the criterion of average tax rate (see Mathews Report and Morgan (1977)).

Inflation and the post-tax distribution of income

We shall now consider the effect of inflation on the post-tax distribution of income. First, let $T(p,y_p)$ denote the tax liability as a function of p and y_p. Note that

$$\frac{dT}{T} = \eta_{T,P} \cdot \frac{dP}{p} + \eta_{T,y_p} \cdot \frac{dy}{y_p} \qquad (60)$$

where $\eta_{T,P}$ and η_{T,y_p} denote respectively the elasticity of tax liability with respect to the price level and real income. In a fully indexed tax system $\eta_{T,P} = 0$ whereas in a fully unindexed system $\eta_{T,P} = \eta_{T,y_p}$. The component of tax liability which is due to a change in the price level alone may be identified as *inflationary tax payment*, see Lee (1978, Ch.4). We are interested in establishing its contribution to (possible) greater equality in the post-tax distribution of income.

If the tax structure is effectively progressive (see Musgrave and Thin (1948)), then the distribution of income after tax will be more equal than that before tax. A possible way to measure the extent of

TABLE 25

1977-78 Inflationary Tax Payments*

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		77-78	74-75	77-78	77-78	
$	%	$	$	$	$'000	%
Under 4,000	7.47	17.28	2,458.80	17.28	7,189	100.00
4,000-4,999	8.47	308.90	3,184.70	308.90	145,673	100.00
5,000-5,999	8.21	601.49	3,898.02	408.33	186,577	67.89
6,000-6,999	8.46	905.72	4.613.38	419.40	197,488	46.31
7,000-7,499	4.55	1,208.79	5,250.25	461.26	116,838	38.16
7,500-7,999	5.16	1,327.59	5,499.66	477.96	137,300	36.00
8,000-8,499	5.51	1,494.98	5,851.69	501.01	153,814	33.51
8,500-8,999	5.40	1,663.05	6,204.67	524.34	157,799	31.53
9,000-9,499	5.15	1,831.80	6,559.17	528.27	151,485	28.84
9,500-9,999	4.77	2,000.20	6,913.55	528.24	140,196	26.41
10,000-10,499	4.35	2,168.27	7,266.64	528.35	128,092	24.37
10,500-10,999	3.85	2,337.02	7,621.36	528.19	113,173	22.60
11,000-11,499	3.40	2,505.76	7,975.68	528.50	100,152	21.09
11,500-11,999	3.03	2,674.85	8,331.60	528.20	88,981	19.75
12,000-12,499	2.69	2,842.92	8,684.90	528.32	79,049	18.58
12,500-12,999	2.34	3,024.75	9,040.32	540.77	70,540	17.88
13,000-13,999	3.91	3,313.29	9,557.56	583.33	126,912	17.61
14,000-14,999	2.93	3,710.26	10,269.15	641.53	104,578	17.29
15,000-15,999	2.28	4.106.05	10,978.79	699.99	88,985	17.05
16,000-16,999	1.75	4,528.33	11,685.76	785.87	76,628	17.36
17,000-17,999	1.28	4,981.13	12,392.64	902.30	64,442	18.11
18,000-18,999	0.97	5,440.30	13,110.04	972.33	52,573	17.87
19,000-19,999	0.75	5,929.74	13,813.15	1,069.61	44,591	18.04
20,000-23,999	1.61	7.062.29	15,380.75	1,327.70	118,892	18.80
24,000-31,999	1.04	9,936.72	19.274.31	1,720.76	100,035	17.32
32,000-39,999	0.33	14,666.92	25,061.01	2,269.96	41,769	15.48
40,000-49,999	0.16	20,289.00	31,400.14	3,048.89	27,653	15.03
50,000-99,999	0.155	33,182.80	45,936.43	3,099.01	26,822	9.34
100,000 and over	o.02	90,713.54	110,798.13	3,098.73	3,873	3.42
TOTAL					2,852,100	24.63

NOTES: *1974-75 is the base year

(1) Grade of taxable income
(2) Percentage of taxpayers
(3) Tax paid on average taxable income
(4) Average taxable income in 1974-75 prices
(5) Average inflationary tax payments in 1977-78 prices
(6) Total inflationary tax payments in 1977-78 prices
(7) Inflationary tax payments as percentage of total tax payments

effective progression would be to compare the Gini coefficient of concentration for pre- and post-tax income. A fall in the value of that coefficient towards zero (for after tax income) indicates effective progressivity in the tax structure. To assess the contribution of inflation towards increasing the effective progression of the tax structure, a comparison can be carried out as follows. Suppose that the distribution of income and taxes is available by deciles of taxpayers. Then one could calculate the size of inflationary tax payment made by each decile of taxpayer. The Gini coefficient can be estimated for any given year using data on disposable income both adjusted and unadjusted for inflationary tax payments. A comparison of the two will provide a measure of the effect of inflationary tax payments in causing greater 'equality'.

The above method was used by Lee using data for 1969-70 and 1974-75 and he estimated that cumulated inflation from 1954-55 onwards caused the Gini coefficient to fall by 3 per cent by 1969-70 and 9.4 per cent by 1974-75. He concluded that "in terms of individual deciles, inflationary tax payments have been responsible for *increasing* the share of total disposable income going to the lowest 90 per cent of taypayers in 1969-70 and the lowest 80 per cent in 1974-75", (see Lee (1978) p.40), and further that "given the distribution of actual income in those years, inflationary tax payments have worked to increase the degree of effective progression in the personal income tax system", (Lee, p.44). Lee concludes this discussion by presenting calculations which show that 56.5 per cent of the redistribution of incomes which took place between 1954-55 and 1974-75 was attributable to inflationary tax payments.

Whereas measurements along the lines of Lee are clearly of interest, a qualitative prediction regarding the direction of changes for the distribution of income due to inflation can be based on certain general features of the tax structure alone. Kakwani (1978 1980 (Ch.8 and Ch.11, pp.230-232)) shows that, for an isoelastic tax liability function with elasticity greater than unity, inflation decreases the post-tax income inequality for both progressive and regressive tax systems, provided pre-tax income distribution is unaffected by inflation. (This later qualification is required by Lee also). To the extent that the direction of change depends upon the elasticity of tax liability exceeding unity, we can expect Kakwani's result to carry over to any other tax system where the elasticity varies with the income level but exceeds unity at all levels. Kakwani (1978) estimates the inflation elasticity of the Gini index of post-tax income for fiscal years 1972, 1973 and 1974. The elasticity is sensitive to the assumed inflation rate; for a ten per cent per annum rate of inflation, the elasticity was found to be -.0074, -.0165 and -.0279 in the three years.

Calculations along the lines of Lee seem worthwhile because qualitative results are of ceteris paribus variety whereas in practice discretionary changes in the tax structure do occur. We have attempted to up-date some of Lee's calculations using the (latest available) tax statistics for 1977-78. He concentrated his attention on 1969-70 and 1974-75 whereas we look at 1977-78 using 1974-75 as the base year. Unlike Lee we have not grouped taxpayers by deciles because sufficient data are not available for doing this accurately. First, we calculate the size of inflationary tax payment by grade of taxable income, see Table 25.

By definition this is the part of tax payment that the taxpayer would not have made had we experienced price stability since 1974-75. The results of this calculation show that inflation induced extra tax payments in 1977-78 were of the order of $2.85 billion (1977-78 prices), or roughly 25 per cent of 1977-78 income tax revenue. By comparison, Lee (using 1954-55 as his base year) estimated that about 63.5 per cent of tax payment in 1974-75 constituted an inflationary tax payment. It seems reasonable to guess that in view of changes in the tax structure made in 1978, were inflationary tax payment calculations to be made for fiscal years 1978 or 1979, using 1974-75 as the base year, the share of such tax payments in the total would show a significant decline.

A look at the distribution of inflationary tax payments by grade of tax payer reveals the inflationary component of taxes as a proportion of the total declines with the level of income. This simply reflects the fact that the elasticity of tax liability with respect to inflation declines with the level of income.

Inflation and the distribution of income tax paid

Finally Table 26 compares the actual distribution of personal income tax paid in 1977-78 with the one that would have been obtained if CPI had remained stable at the average 1974-75 level. Using the figures in columns (4) and (6) of this Table it is possible to draw Lorenz curves for the distribution of taxes. Since the figures in column (6) are consistently smaller than the corresponding ones in column (4), the Lorenz curve under price stability would lie below the Lorenz curve for actual distribution of tax paid. Thus the degree of inequality in the distribution of tax payments declined

TABLE 26

Distribution of Personal Income Tax Paid 1977-78

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Actual		Price Stability		
$	%	%	%	%	%	% Change
Under 4,000	7.47	.06	.06			
4,000-4,999	15.94	1.26	1.32			
5,000-5,999	24.15	2.37	3.69	1.01	1.01	+134.65
6,000-6,999	32.60	3.68	7.37	2.62	3.64	+ 40.46
7,000-7,499	37.15	2.64	10.02	2.17	5.80	+ 21.66
7,500-7,999	42.31	3.29	13.31	2.80	8.60	+ 17.50
8,000-8,499	47.82	3.96	17.27	3.50	12.10	+ 13.14
8,500-8,999	53.23	4.32	21.60	3.93	16.02	+ 9.92
9,000-9,499	58.38	4.54	26.13	4.28	20.31	+ 6.07
9,500-9,999	63.15	4.58	30.72	4.48	24.78	+ 2.23
10,000-10,499	67.50	4.54	35.26	4.56	29.34	- 0.44
10,500-10,999	71.35	4.32	39.58	4.44	33.78	- 2.70
11,000-11,499	74.75	4.10	43.68	4.29	38.07	- 4.43
11,500-11,999	77.78	3.89	47.57	4.14	42.21	- 6.04
12,000-12,499	80.46	3.67	51.24	3.97	46.18	- 7.56
12,500-12,999	82.81	3.41	54.65	3.71	49.89	- 8.09
13,000-13,999	86.71	6.23	60.88	6.81	56.70	- 8.52
14,000-14,999	89.64	5.22	66.10	5.73	62.43	- 8.90
15,000-15,999	91.92	4.51	70.61	4.96	67.39	- 9.07
16,000-16,999	93.67	3.81	74.42	4.18	71.57	- 8.85
17,000-17,999	94.96	3.07	77.49	3.34	74.91	- 8.08
18,000-18,999	95.93	2.54	80.03	2.77	77.68	- 8.30
19,000-19,999	96.68	2.14	82.17	2.32	80.00	- 7.76
20,000-23,999	98.28	5.46	87.63	5.88	85.88	- 7.14
24,000-31,999	99.33	4.99	92.62	5.47	91.36	- 8.78
32,000-39,999	99.66	2.33	94.95	2.61	93.97	- 10.73
40,000-49,999	99.82	1.59	96.54	1.79	95.76	- 11.17
50,000-99,999	99.98	2.48	99.02	2.98	98.75	- 16.78
100,000 and over	100.00	0.98	100.00	1.25	100.00	- 21.60

between 1974-75 and 1977-78 as a result of inflation. The fact that the *share* in total taxes of all income grades in the top four deciles was actually lower (compare columns (3) and (5)) than it would have been under price stability should not disguise the fact that all groups would have paid less in taxes in real terms had price stability prevailed.

Inflation and lags in the payment of taxes

Though most of the preceding discussion has emphasised the increase in the real burden of taxes due to inflationary tax payments, historically the most noticeable effect of inflation on the tax system has been a dramatic erosion of real tax revenue during hyperinflations. See Bresciani-Turroni (1937), Tanzi (1977), Prest (1973), Nowotny (1980). The main causes of this consequence lie in the permissible and illegal delays in the payment of taxes, inadequately adjusted penalties for delays in payments, poor tax collection machinery and so forth. As a result significant reductions in real tax liabilities follow from delays in payments. If most or all of income tax revenue was obtained on PAYE basis, this consideration would not be significant. So the seriousness of the problem is greater in countries where PAYE system is under-developed. The Commissioner of Taxation's report does provide some information on tax outstanding, but it is not sufficiently detailed for purposes of systematic analysis. For instance, one would want to decompose the total outstanding tax liability by the year in which the corresponding tax events occurred.

7.2 Inflation Elasticity of Specific Excise Taxes.

Customs and excise duties and sales taxes are the leading indirect taxes and have accounted for 27-32 per cent of tax revenue in the last

six years. These include import, export and excise duties, local rates, entertainment taxes, betting taxes, business licences, stamp duties, motor vehicle taxes.

The major excise duties in Australia are specific taxes and take the form of fixed nominal amounts per unit of quantity. A decline in the real value of the tax is likely to occur when the nominal amount remains unchanged through a period of inflation. Whether or not the tax revenue from this source declines depends upon the inflation elasticity of a specific excise tax. To compute this quantity for four leading items, viz. beer, alcoholic beverages, cigarettes, tobacco and petroleum and coal products we have employed the formula due to Johnson (1980) which relates the inflation elasticity ($\eta_{IT,\dot{p}}$) to the size of excise tax relative to the price of taxed product ($\bar{t}/p_a$), the magnitude of the relative change in the general price level (P_o/P_1) and the price elasticity of demand of the taxed product (η_d). Specifically we have

$$\eta_{IT,\dot{p}} = -(\bar{t}/P_a) \cdot (P_o/P_1) \cdot \eta_d \qquad (61)$$

Table 27 below gives estimates of the inflation elasticity based on rather rough estimates and assumptions regarding all magnitudes involved. The data on "excise taxes" often seem to include other items also, such as sales taxes and customs duties. The calculation shows that the inflation elasticity of "excise duty" on all items seems substantially less than one and this suggests that the real value of excise duties from these sources would decline in the absence of discretionary adjustments. The sales taxes by comparison are levied on an *ad valorem* basis and therefore should have an inflation elasticity of unity provided of course that the tax base is unchanged. Discretionary adjustments are made with variable frequency. In the case of beer the rate of excise tax remained unchanged from 1973(1) to 1975(4), then again until 1978(4), and again until now. The "excise tax" on spirit appears to have been slightly more variable.

TABLE 27

Inflation Elasticity of Specific Excise Taxes (1974-75)

	Excise Tax as a Share of Product Price [a]	Assumed Price Elasticity [b]	Inflation elasticity assuming 10% inflation
Beer/Malt	.288	-.360	.094
Alcoholic Beverages	.253	-.475	.1093
Tobacco Products	.559	-.771	.3921
Petroleum and Coal products	.233	-.510	.1081

(a) Excise tax as share of product price is obtained by dividing commodity taxes by final consumption expenditure at purchasers price given in *Australian National Accounts Input-Output Tables 1974-75* (Advance Release). Note that not all commodity taxes are excise taxes. In particular spirits (included in alcoholic beverages) are subject also to a State *ad valorem* sales tax.

(b) The price elasticity estimate for beer/malt is from C. Murphy (p.19), for alcoholic beverages from Williams, for Petroleum and coal products from Donnelly (p.3, Table 1) where long-run price elasticities for petrol demand, ranging from -.30 to -.73, are reported.

7.3 Inflation and Federal Estate and Gift Duties

The effects of inflation on the federal estate duties were examined by the *AC*. Like income tax the estate duty is a progressive levy and in the absence of offsetting adjustments will impinge with greater severity on estates whose values may have increased in nominal terms only during periods of inflation. As estates get pushed into higher marginal tax brackets, the effective "real" rate of tax rises. The effect on really large estates already subject to the highest marginal tax rate is not so severe. The *TRC* pointed out that the estates which were hit the hardest by inflation were those in $150,000 - 300,000 range at 1974-75 prices and recommended a frequent adjustment of rate brackets. A phased abolition of the estate duty began in 1977 with significant exemptions being granted to smaller and middle-sized estates. The estate duty was abolished on 1 July 1979 so there is no reason to discuss the impact of inflation on it any further in this paper. Updated calculations along the lines of *AC* are given in table 28.

TABLE 28

Changes in Federal Estate and Gift Duties, 1974-77

Value of Estate at 1973-74 Prices	1974-75			1975-76			1976-77		
	If no Change in Rate Scale or Exemptions Since 1954-55	Actual	Change between 1954-55 and 1974-75 (actual)	If no Change in Rate Scale or Exemptions Since 1954-55	Actual	Change between 1954-55 and 1974-75 (actual)	If no Change in Rate Scale or Exemptions Since 1954-55	Actual	Change between 1954-55 and 1974-75 (actual)
$	%	%	%	%	%	%	%	%	%
20,000	2.14	0	-100.00	2.37	0	-100.00	3.13	0	-100.00
50,000	7.82	1.34	- 44.17	8.58	2.37	- 1.25	9.50	3.72	+ 55.00
75,000	10.74	5.39	- 0.19	11.88	6.95	+ 28.70	13.24	8.91	+ 65.00
100.000	13.66	9.51	+ 35.86	15.18	11.72	+ 67.43	17.00	14.45	+106.43
150,000	19.50	18.21	+ 89.69	21.76	21.64	+125.42	24.50	24.50	+155.21
200,000	25.34	25.34	+109.42	26.06	26.06	+115.37	26.15	26.15	+116.12
300,000	26.28	26.28	+ 53.68	26.39	26.39	+ 54.33	26.53	26.53	+ 55.15
500,000	26.86	26.86	+ 3.31	27.05	27.05	+ 4.04	27.28	27.28	+ 4.92
1,000,000	27.90	27.90	+ 4.50	27.90	27.90	+ 4.50	27.90	27.90	+ 4.50

(a) Where the whole estate passes to close relatives and does not attract any primary producer concessions. No estate duty is payable by the estate of a person dying on or after 21 November 1977 in respect of property passing to close relatives. Estate duty is abolished in relation to all property in the estates of persons who die on or after 1 July 1979.

7.4 Inflation, Government Non-monetary Debt and Interest Payments

The literature on the positive theory of public debt does not seem particularly large and that dealing with the role of inflation in the determination of debt issue is even smaller. Two recent contributions to the subject by Barro (1979,1980) argue that anticipated inflation has one-to-one effect on the growth rate of nominal debt. Barro argues that an increase in anticipated inflation would tend to be associated with a corresponding increase in nominal interest rates and hence with a rise in current real interest payments. He puts forward a theoretical model which implies that these higher real interest payments are met by issuing more debt rather than increasing taxes. He reports results in which the one-to-one link from anticipated inflation to the growth rate of nominal debt is empirically substantiated. Though Barro argues that causation runs from inflation to debt issue, the question merits a careful empirical investigation because it has also been argued that causation runs from deficits to inflation.

A superficial analysis of the data seems roughly consistent with Barro's theory. The acceleration in inflation since 1973 has also seen an acceleration in the growth of nominal debt of the Commonwealth government as well as the state and local authorities. From 1975 to 1980, the average rate of growth of non-official holdings of Australian government securities was about 15 per cent per annum whereas the average inflation rate over the same period was ? per cent per annum. The rate of increase of interest payments on outstanding debt accelerated sharply to nearly 25 per cent in 1974-75, reaching a record 46 per cent in 1976-77, but has since decelerated to about 12 per cent. Whether the debt issues were motivated by rising interest payments, as Barro's theory would suggest, is a moot point. It would appear worthwhile

to investigate this point in future work.

Inflation-induced distortions in the government saving statistics

Several writers have recently pointed out the desirability of extending inflation-adjusted accounting to the calculation of "real" government saving or borrowing requirements; see, for example, Siegel (1979) and Taylor and Threadgold (1979). More specifically, it is argued that sectoral saving figures can be significantly distorted by a failure to take account of inflation gains arising from the erosion in the real value of national debt. In their study (p.28) of U.K. saving, Taylor and Threadgold find that "general government appears to have been a net lender, in the sense that its saving was consistently in excess of the amount needed to finance investment in physical assets, in the period before 1974, and in near balance on average between 1975 and 1977, rather than a heavy borrower as ordinarily thought". Siegel's calculations for the U.S. aim to provide a re-formulated measure of the budget deficit and private saving rate after taking account of inflation. As in the case of Taylor and Threadgold the calculations are restricted to measuring the capital gains/losses on the financial liabilities of the government sector only and capital gains/losses on physical assets are ignored.

Unanticipated inflation causes a reduction in the real value of both the principal and the interest payments specified in nominal terms, the extent of which depends upon the remaining period to maturity of the security. The exponents of "real" accounting argue that the resulting capital gains should be offset against deficits to provide a measure of "real" saving. As explained in Taylor and Threadgold and Cagan and Lipsey, at least two alternative methods are available for allocating the inflation gains/losses over the life of a security, even though the *total* gains/loss yielded by both methods is the same. In what follows we shall not apply the theoretically more satisfactory, but difficult to apply, method of calculating capital gains on an accrual basis, but simply concentrate on the total capital gain

measured by $-\dot{p}(B/P)$ where (B/p) is the real value of non-official holdings of government securities. Define a reformulated measure of deficit, RBD, and adjusted measure of public sector borrowing requirement, RPSBR, defined respectively as

$$RBD = BD - \dot{p}(B/p)$$

$$RPSBR = PSBR - \dot{p}(B/p)$$

These reformulated measures properly account for the phenomenon that the increased nominal interest payments which appear as an expense item in the government budget should be offset against the reduction in capital value of the debt due to inflation. Where inflation is unanticipated the latter can be more than fully offset. Those who are concerned to take into account all gains-losses as they accrue would prefer to use the alternative formula given by Siegel (p.85). We have also made calculations along these lines but shall not report them here.

In columns (1) and (2) of table 29 we have given figures on the nominal and real value of non-official holdings of government securities. It can be seen that even though the nominal value of the debt has more than doubled since 1972-73, real debt has declined reaching a trough in 1978. The ratio of debt to GNE given in column (2) also declined until 1977 and has risen slowly since. Interest liability on government debt is shown in column (3) and it can be seen to have increased sharply as is to be expected. (For our purposes we need interest payments on non-official holdings only, not total debt, but these are not available).

Columns (2) and (3) of table 30 give the reformulated measure of the Federal sector deficit. Though the subtraction of the capital gains results in much smaller values of the deficit and PSBR, the capital

gains are not large enough to turn the deficits of recent years into surpluses or to change the public sector into a net lender. This contrasts with Taylor and Threadgold's calculations for the U.K. to which we referred earlier. (It should be noted that the numbers given in this table are sensitive to the definition of non-official holdings. One definition used in *Government Securities on Issue* treats the holdings of the Reserve Bank and certain Commonwealth trust funds as official holdings; another definition treats holdings of public authorities as part of official holdings but not those of Commonwealth trust funds, see, e.g. Deane (1970). Our definition is wider than both these and excludes the Reserve Bank, Commonwealth trust funds and public authority holdings).

The size of the deficit and PSBR is often taken to be a crude measure of the thrust of the fiscal policy (see, however, Nevile (1979)) and though the measure RBD is somewhat crude also it provides an alternative measure. Comparing PSBR and adjusted PSBR we see that the borrowing requirements of the public sector have certainly grown rapidly since 1974 and that the gain on debt is not large enough to alter the status of the public sector as a net borrower (compare Taylor and Threadgold). Comparing the deficit with the RBD, once again we see that 1974-75 through 1978-79 still average as sizeable deficit years, but 1979-80 is a year of small surplus on the adjusted measure.

From the viewpoint of welfare a redistribution of wealth towards government resulting from a reduction in the real value of debt may be regarded as an intergenerational transfer, because such a reduction also reduces the real value of future taxes that must be raised to service interest payments and meet redemptions.

TABLE 29

Debt and Interest Payments

30 June	B_1^F (1)	B_1^F/p (2)	RG (3)	B_1^F/py (4)
1967	8,176.41	15,141.51	712(3.1)	.2453
1968	8,456.84	15,130.30	771(3.1)	.2502
1969	8,948.65	15,589.97	829(3.0)	.2374
1970	8,798.98	14,640.56	903(3.0)	.2411
1071	9,269.98	14,416.77	977(2.9)	.2403
1972	10,326.72	14,944.60	1064(2.8)	.2430
1973	10,825.83	14,649.30	1140(2.7)	.2475
1974	10,579.24	12,715.44	1290(2.5)	.2389
1975	12,684.91	12,684.91	1552(2.5)	.2887
1976	14,244.85	12,343.89	1962(2.7)	.3036
1977	15,516.31	12,037.48	2350(2.8)	.2900
1978	18,408.70	13,028.10	2792(3.1)	.2963
1979	21,761.04	14,411.28	n.a.	.2850
1980	22,949.56	13,709.41	n.a.	.2812

Notes:

B_1^F : Australian government securities, non-official holdings.

p : GNE deflator 1974-75 = 1

y : GNE (real)

RG : Interest payment on government securities on issue and local authority and public corporations securities on issue. The figure in parenthesis expresses it as a percentage of GDP. (Source: Norton and Brodie (1980),p.49,53).

TABLE 30

"Adjusted" measures of budget deficit and PSBR

	Total PSBR	Capital Gain on debt	Adjusted PSBR	Budget deficit	RBD
	(1)	(2)	(3)	(4)	(5)
1968-69	1,162.9	338.34	824.56	707.32	368.34
69-70	1,018.2	565.00	453.20	562.40	- 2.60
70-71	807.8	839.38	- 31.58	31.10	-808.38
71-72	809.9	953.27	-143.37	342.98	-610.29
72-73	1,211.7	898.72	312.98	1,110.96	212.24
73-74	897.9	1,444.05	1,386.43	572.12	-871.93
74-75	3,246.0	2,322.52	923.48	3,283.0	960.48
75-76	3,381.8	1,724.16	1,657.64	3,366.55	1,642.39
76-77	3,090.7	1,238.45	1,093.31	2,479.44	1,240.99
77-78	3,796.6	1,005.77	804.5	2,732.48	1,726.71
78-79	3,617.0	746.81	2,870.19	2,372.85	1,626.04
79-80		1,130.01		1,065.11	- 64.90

Notes

All figures are in constant(1974-75) dollars. GNE deflator has been used.

(1) Total PSBR = Federal sector deficit *plus* state and local deficits.
Source: Norton and Brodie, p.39.

(2) $-(B_1^F/p)(\dot{p})$, B_1^F = non-official holdings of Government securities issued in Australia.

(3) Adjusted PSBR = (1) - (2).

(4) BD, Commonwealth budget deficit (domestic) plus State budget deficits.

(5) RBD = (4) - (2).

A related conspicuous development has been a steady reduction in the average maturity of government debt since 1974. See table 31 below. The average period to maturity has declined from about twelve years in 1974 to about seven and a half years in 1980. The share

TABLE 31

Maturity Structure of Non-official Holdings of Commonwealth Securities (Average Period to Maturity (Years))

1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
10.82	10.56	10.23	11.95	10.72	10.58	9.03	8.76	8.16	7.65

Source: Government Securities on Issue, Budget Paper No.6

of securities maturing in under five years went up from 38.3% in 1979 to 45.1% in 1980 alone and an increasing proportion of the new debt is of shorter maturity. Presumably it is the possibility of capital losses on the part of those locked in that prevents a further dramatic reduction in the average maturity period. An increasing preference for shorter term securities could be interpreted as the market's reaction to long-term interest rate uncertainty related to inflation uncertainty. Another interpretation is that it is a reaction to a change in the official policy away from stabilization of interest rates towards a form of monetary targeting. The resultant increase in variability of interest rates need not be related exclusively to inflation uncertainty.

8. INTERSECTORAL REDISTRIBUTION OF INCOME AND WEALTH

Redistributive effects of inflation have been discussed in a survey article by Foster (1976) and by Modigliani and Papademos (1978). (Foster also provides an excellent bibliography to earlier work). Two approaches are common; the first concentrates on the broad intersectoral redistributions due to unanticipated inflation using both flow of funds data and balance sheet data, whereas the second uses a macro-simulation approach. Examples of the first type are found in Bach and Stephenson (1974), Niida (1978), Piachaud (1978) and of the second type in Budd and Seiders (1971), Nordhaus (1973) and Minarik (1978). No systematic study along either of these lines is available for Australia.

Two types of questions are studied. First, whether inflation is associated with a redistribution from wage to profit earners (functional redistribution) and, second, the size of wealth redistributions from net creditors to net debtors. The main motivation behind the study of the first question appears to be a desire to confirm or refute conjectures from an earlier period when the wage-lag hypothesis was much publicised. According to this hypothesis the share of wages in the national income declined during inflationary episodes. Both the *a priori* basis and empirical evidence for the wage lag hypothesis seem weak and the analyses of Foster, Bach and Stephenson and Niida suggest that the wage-lag hypothesis needs to be given a much firmer theoretical basis before it can be taken seriously in empirical work.

The net creditor-debtor hypothesis is intended to apply to debtors and creditors whose liabilities and claims are in nominal terms. Modigliani and Papademos show that wealth redistribution from unanticipated inflation depends upon the maturity structure of the existing debt and on the timepath of unanticipated inflation over the life of the asset, being

approximately proportional to the cumulated unanticipated inflation over the remainder of the asset life.

If one follows the approach of Bach and Stephenson and examines the flow of funds and the balance sheet of the household sector, we notice (i) the household sector is in financial surplus whereas financial institutions, non-financial corporate sector and the public sector are in financial deficit, see table 32, and (ii) that the household sector is a net creditor and the other three sectors are net debtors, see table 33. There is therefore a potential for wealth redistribution from the household sector to the other three, i.e. the household sector is exposed. The data as they stand only suggest vulnerability to inflation, and further analysis is required to discover the magnitude of transfers and the identity of losers and gainers. The corporate sector gains are not all net losses to the household sector since the latter directly or indirectly owns the corporate sector, but there is certainly a transfer from the non-owning net lenders to the direct and indirect holders of equity. To the extent that equity-owners gain from this the equity prices should rise. However, the American evidence mentioned elsewhere in this paper consistently shows that equity prices have failed to keep up with inflation; see Branch (1974), Jaffee and Mandelker (1976), Nelson (1976), Bodie (1976). It is reasonable to conclude therefore that whatever redistributions have taken place have not been large enough to offset the effects of either increased real tax burden and/or the reduction in pre-tax profitability. The transfers could still be sizeable.

To form some impression of the order of magnitude involved, consider the net lending of the household sector defined as the difference between financial assets and liabilities which in 1978/79 was about $37.1 billion, see table 33. The financial assets held in the form of company shares were worth $3.5 billion. The inflation erosion on net lending adjusted for company shares would be of the order of $0.3 billion

TABLE 32

Net lending (+) or Borrowing (-) Status of Major Economic Sectors : Financial Flow Data ($mn)

	1970/71	1975/76	1979/80
Households	811	3841	5496
Financial Institutions	- 191	- 496	-1353
Public Sector	- 394	-3419	-4524
Nonfinance Corporations	-1095	- 650	-1728
Rest of the World	569	536	477

Public sector includes RBA, Commonwealth Government and State and local governments

Source: RBA Statistical Bulletin, Financial Flow of Funds Accounts Supplement. June 1981.

TABLE 33

Net Debtor or Creditor status of Major Economic Sectors ($Bn.) : Balance Sheet Data

	1965	1970	1975	1980
Households	9.85	11.41	22.63	42.38
Financial Institutions	.22	.15	- 1.24	-5.18
Public Sector	-6.93	-9.26	-15.05	-37.60
Non-finance Corporations	(-8.04)	(-10.62)	(-15.51)	-15.87
Rest of the World	4.90	8.32	9.17	16.21

Terms in parenthesis include statistical discrepancy.
Source: Pellarini, *op.cit.*

TABLE 34

Balance Sheet for Financial Assets and Liabilities of the Household Sector - 30 June 1979 ($bn).

Assets		Liabilities	
Notes and coin	3.52	Loans: Financial Institutions	38.15
Deposits	72.26	: Government	2.19
Commonwealth and LG Securities	5.72	: RBA	0.52
Company Shares	3.53	: Other	12.89
Corporate Bonds	0.98	Total	57.33
Other Assets	4.80		
TOTAL	90.81	Net Lending	37.06

Source: Pellarini, *op.cit.*

for each 1% of unanticipated inflation. For years such as 1974/75 and 1975/76, it seems more reasonable to suppose that a substantial part of inflation was unanticipated, say about 5%, in which case a figure of a loss of $1.5 bn. would be close to the mark.

A final point concerns the maturity structure of households' financial assets and liabilities. Assets with the largest maturity in the household portfolio would be deposits with the offices and superannuation funds and the principal liability of a long maturity would be the outstanding mortgages. While estimates for the first of these two items is available from various sources, e.g. Pellarini's tables suggest that in 1976 and 1980 it would have been of the order of $15.87 bn. and $24.80 bn. respectively, the estimates of the second are harder to come by. The nearest that the present authors have got are estimates of the advances from the banking system and other financial institutions discussed in section 4 of Anstie *et al.* On the basis

that the households' net advances were about 53 per cent of disposable income in 1978/79, and that most of these were outstanding mortgages, the long-term liabilities of the household sector would appear to exceed the long-term assets. However, this calculation needs to be refined considerably.

9. CONCLUSION

This paper has attempted to review a somewhat diverse theoretical literature and to provide some empirical evidence upon the effects that inflation has had upon economic behaviour and performance in Australia. Both sources of information provide ample evidence that inflation is potentially, and actually, non-neutral in its impact upon the myriad decisions made by households and corporations. Some of the sources of non-neutrality are found to reside in the failure of traditional tax systems to be appropriate in times of inflation; a failure that must ultimately demand greater scrutiny of public policy in this area, particularly if the private sector is beginning to learn "to live with" inflation.

It is impossible to summarize the results of this paper in a few paragraphs; such an attempt would also seem pointless given the role of the paper as a background document. Nevertheless, there are two striking features that do emerge from the current paper. Firstly, the theoretical literature has highlighted the importance of nominal interest rates adjusting "fully" to inflation; any such failure would be a cause of significant non-neutralities of inflation. Yet, despite its central importance, there remain no studies that attempt to discover *why* this Fisher effect is absent for long periods; only recently have studies even been made into *whether* it operates. Secondly, although the "inflation first" strategy has been the dominant policy for the past five years, there have been very few studies made in Australia into whether

inflation does have the effects ascribed to it by policy makers. As the paper demonstrates, this contrasts with the large amount of work done in the U.S. and U.K. Furthermore, even when inflation enters implicitly as a determinant of decisions as in the analyses of fixed capital formation by Coghlan et al. (1976) and residential investment by Filmer and Silberberg (1978), authors have generally not attempted to isolate the contribution of inflation from other factors. Our strategy has been to utilize the body of data provided by the authors of such studies to provide some evidence that the effects of inflation do need to be accounted for. The task of quantifying these effects must be left to more intensive, specific investigations.

LIST OF SYMBOLS

$a(\cdot)$	average tax rate on income x
b	rebate per $ of land taxes
B_1^F	Australian government securities, non-official holdings
BD	Commonwealth budget deficit (domestic) plus State budget deficits
C	real consumption
c	cost of capital
CI	before-tax company income from national accounts
CR	cash requirements
γ	cash requirements/total deposits
D	nominal value of debt
d	debt-asset ratio
DI	disbursements
DI*	level of disbursements which leaves purchasing power of equity unchanged
DR	depreciation at replacement cost
δ	(true) economic depreciation
E	Nominal value of equity
e	earnings uield
f	proportion of initial cost of asset
ϕ_t	W_{t-1}/Y_t
GOS	gross operating surplus
GDP	gross domestic product
H	subsidies to housing
HD	depreciation at historic costs
I	nominal value of investment
i	nominal interest rate
i_L	nonimal lending rate
i_B	nominal borrowing rate

List of symbols (cont.)

J	amortization period
K	capital stock at constant prices
K*	equilibrium capital stock
ℓ	loan to value ratio
L	property taxes
M_1	money stock M_1 concept
$\bar{M}$	maintenance expenditure (including insurance)
m(·)	marginal tax rate
m*(·)	maximum marginal tax rate
N	tax life of an asset
ND	non-interest bearing deposits
NI	net investment (real)
P	consumer price index
P_I	price of new investment good
Pc	nominal consumption
PY	nominal income
P*Y*	previous peak nominal income
Π	profits
π	anticipated inflation rate
Q	replacement price of a unit of K
q	V*/V
$\dot{q}$	rate of change of Q
r	real interest rate or real return
$\bar{r}$	after-tax opportunity cost of capital (housing)
r_L	real rate of return to lender
r_B	real rate of return to borrower
r_f	risk free rate of return

List of symbols (cont.)

r_m	rate of return on market portfolio
R	cost of finance
R*	actual rate of return
R**	equilibrium rate of return
R_H	implicit rental price of housing services
RBD	"reformulated" budget deficit (BD)
RG	interest payments on government debt
$\tilde{\rho}$	expected capital gain over a planning horizon less depreciation rate
S	amount that can be distributed leaving intact real assets of company
SVA	stock valuation adjustment
$\sigma_{i\pi}$	covariance between the rate of return and rate of inflation
T(·)	tax liability, personal taxes
$\bar{T}$	transactions cost at sale and purchase of house
t	ratio of tax payable to replacement value of assets
TC	corporate taxes
TD	total deposits
τ	marginal tax rate in general
τ_L	lender's marginal tax rate
τ_B	borrower's marginal tax rate
V	replacement value of corporation's assets
V*	market value of corporation's assets
W	real net worth
w	price of a unit of labour
X	output
x	nominal taxable income
$\bar{x}$	tax rebate on certain mortage interest payments
x_L	level of tax exempt income
ξ	ratio of risky to total assets

List of symbols (cont.)

Y_t	income $YL_t + \ell_t W_{t-1}$
y	GNE measure of income
Y^*	previous peak income
Y_c	GOS less interest payment on debt
y_p	real personal income
YL	disposable labour income
$\eta(x)$	elasticity of tax liability with respect to x
$\eta_{TT,P}$	elasticity of the tax liability with respect to P
Z	present value of depreciation allowances based on historical cost
Θ	ND/TD

APPENDIX

CONSTRUCTION OF TABLE 7

There is not enough information directly available from Podder and Kakwani (1976) (henceforth PK) to compute the required ratios, but most of it can be derived by manipulation of their tables. Let income deciles be indexed by i = 1, ..., 10 while net worth classes are indexed by j = 1, .., 14. The tables in PK are generally classified in one of these ways.

Define

W_i = net worth held by families in decile i

Y_i = disposable income of families in decile i

W = aggregate net worth

Y = aggregate disposable income

LA_i = liquid assets held by families in decile i

LA = aggregate liquid assets.

By definition

$$\frac{W_i}{Y_i} = \frac{W_i}{W} \cdot \frac{Y}{Y_i} \cdot \frac{W}{LA} \cdot \frac{LA}{Y}$$

$\frac{W_i}{W}$ and $\frac{Y}{Y_i}$ are available in Table 8 of PK. As Y is defined in the same way as the Australian National Accounts, a suitable measure of LA/Y is the aggregate ratio for the Australian economy given in Williams (1979) Table 10. This leaves only W/LA to be determined.

Let $\bar{W}_j$ be average net worth by wealth class and $\overline{LA}_j$ be average liquid asset holdings. Then

$$W = (\text{Tot. families}) \sum_{j=1}^{14} \phi_j \overline{W}_j$$

$$LA = (\text{Tot. families}) \sum_{j=1}^{14} \phi_j \overline{LA}_j$$

where ϕ_j= fraction of families in wealth class j. ϕ_j is available from Table 8 of PK. To obtain $\overline{LA}_j$ we have $\overline{LA}_j = \psi_j \overline{A}_j$, where $\overline{A}_j$ are average asset holdings by wealth class j and ψ_j is the faction of total assets held as liquid assets. ψ_j is available from Table 5 and $\overline{A}_j$ from Table 8 of PK. This completes the computation of net worth to income ratios by income deciles.

To obtain ratios such as liquid assets to income we proceed as follows. Firstly, it is necessary to match up income classes with wealth classes. To do this, average wealth by income class, $\overline{W}_i$, is found by multiplying average disposable income $\overline{Y}_i$ by the ratio W_i/Y_i computed above. $\overline{Y}_i$ is available from Table 7 of PK's submission to the Asprey Committee.

This matching process yields the following equivalences:

Income Decile	1	2	3	4	5	6	7	8	9	10
Wealth Class	1	3	5	7	9	11	12	13	14	14

Table 5 of PK then yields the ratio LA_i/A_i, Table 8 provides A_i/Y_i so that $LA_i/Y_i = (LA_i/A_i)\ (A_i/Y_i)$ can be formed.

REFERENCES

Aaron, Henry J. ed. *Inflation and the income tax.* Washington, D.C. Brookings Institution, 1976.

Adams, C. and Porter, M. "The Stability of the Demand for Money", *Conference in Applied Economic Research: Papers and Proceedings,* Reserve Bank of Australia, 1976, pp. 213-43.

Alchian, A.A. and Kessel, R. "Redistribution of Wealth through Inflation", *Science,* September 1959, pp. 535-539.

Allan, J.R. and Savage, David. "Inflation and the Personal Income Tax", *Nat. Inst. Econ. Rev.,* Nov. 1974, 70, pp.61-74.

Anstie, R.K., Gray, M.R. and Pagan, A.R. "Inflation and the Consumption Ratio", Discussion Paper No. 27, *Centre for Economic Policy Research,* The Australian National University, May 1981.

Asprey, (Chairman). *Taxation Review Committee,* Full Report, 31 January 1975, Canberra AGPS, 1975.

Australia, Taxation Review Committee. Full Report: 31 January 1975. Canberra: Australian Government Publishing Service, 1975.

Australia. Treasury. Treasury Taxation Paper. *Personal Income Tax, Personal Allowances,* Canberra, AGPS, November 1974.

Auerbach, A.J. "Inflation and the Tax Treatment of Firm Behaviour", *Harvard Institute of Economic Research,* Discussion Paper No. 785, August 1980.

Auerbach, A.J. "Wealth Maximization and the Cost of Capital", *Quarterly Journal of Economics,* Vol. 93, 1979, pp.433-446.

Bach, G.L. and Stephenson, J.B. "Inflation and the Redistribution of Wealth", *Review of Economics and Statistics,* February 1974, pp.1-10.

Bailey, Martin J. "The Welfare Cost of Inflationary Finance", *Journal of Political Economy,* Vol. 64, April 1956, pp.93-110.

Bailey, C. "Estimates of Current and Constant-Cost Depreciation and Net Capital Stock", *Australian Bureau of Statistics,* 1981, Mimeo.

Barro, R.J. "Federal Deficit Policy and the Effects of Public Debt Shares", *Journal of Money Credit and Banking,* Nov. 1980, pp.747-762.

Barro, R.J. "On the Determination of Public Debt", *Journal of Political Economy,* October 1979, pp.940-971.

Bitros, G.C. and Kelejian, H.H. "A Stochastic Control Approach to Factor Demand", *International Economic Review,* Vol. 17, No. 3, October 1976, pp.701-717.

Blinder, A.S. and Esaki, H.Y. "Macroeconomic Activity and Income Distribution in the Postwar United States", *The Review of Economics and Statistics,* Vol. 60, November 1978, pp.604-609.

Bodie, Z. "Common Stocks as a Hedge against Inflation", *Journal of Finance*, Vol. 31, May 1976, pp.459-483.

Bonyhardy, B.P. and Caton, C.N. "The Saving Ratio - a Progress Report", Australian Treasury, *Mimeo*, 1976.

Bookstaber, R. "The Effect of Inflation Uncertainty on Crowding Out", *Journal of Macroeconomics*, Vol. 2, 1980, pp. 85-95.

Boonekamp, C. "Inflation, Hedging and the Demand for Money", *American Economic Review*, Vol. 68, 1978, pp. 821-833.

de Boos, B., Valentine T. and Williamson, P. "Financing of Industry: Recent Trends and Possible Policy Issues", Discussion Paper No. 7, *Centre for Economic Policy Research*, The Australian National University, June 1980.

Bosworth, B. "The Stock Market and the Economy", *Brookings Papers in Economic Activity*, Vol. 2, 1975, pp. 257-300.

Branch, B. "Common Stock Performance and Inflation: An International Comparison", *Journal of Business*, Vol. 47, January 1974, pp. 48-52.

Bresciani-Turroni, *The Economics of Inflation*, London, 1937.

Brock, W.A. and Turnovsky, S.J. "The Analysis of Macroeconomic Policies in Perfect Foresight Equilibrium", *International Economic Review*, Vol. 22, 1981, pp. 179-210.

Budd, E.C. and Seiders, D.F. "Impact of Inflation on the Distribution of Income and Wealth", *American Economic Review*, Vol. 61, May 1971, pp. 128-138.

Cagan, P. and Lipsey, R.E. *The Financial Effects of Inflation*, Cambridge, Ballinger, 1978.

Cassing, J. and Cassing, S. "An Analysis of the Owner-Renter Decision in the Australian Housing Market", Paper presented to the *10th Conference of Economists*, Canberra, August 1981.

C.E.D.A. (Committee for Economic Development of Australia), *The Council Role of Profitability*, (a C.E.D.A. Research Study), Sydney, September 1979.

Clements, K.W. and Izan, H.Y. "On the Measurement of Inflation", *Reserve Bank of Australia*, Discussion Paper March 1981.

Clements, K.W. and Johnson, L.W. "Alcohol Consumption in Australia: A System-wide Analysis", Paper presented to the *10th Conference of Economists*, Canberra, August 1981.

Clements,,K.W. and Nguyen, P. "Inflation and Relative Prices: The Australian Experience", *Reserve Bank of Australia* Discussion Paper 8007, 1980.

Covick, O. "The Australian Labour Market December 1980", *Australian Bulletin of Labour*, Vol. 6(1), December 1980, pp. 3-17.

Cukierman, A. "The Effects of Uncertainity on Investment Under Risk Neutrality With Endogenous Information", *Journal of Political Economy*, Vol. 58, June 1980, pp. 462-475.

Davey, G.M. "A Consumption Function with Money Illusion: The Australian Experience", *Economic Analysis and Policy*, Vol. 6, 1975, pp. 23-41.

Diamond, P.A. "Inflation and the Comprehensive Tax Base", *Journal of Public Economics*, Vol. 4 (3), Aug. 1975, pp. 227-244.

Dietrich, J. Kimball and Heckerman, Donald G. "Uncertain Inflation and the Demand for Capital", *Economic Inquiry*, July 1980.

Donnelly, B. "The Demand for Petrol in Australia", Paper presented to the *10th Conference of Economists*, Canberra, August 1981.

Downs, A. "Too much Capital for Housing?", *Brookings Bulletin*, Vol. 17, 1980, pp. 1-5.

Elliott, J.W. "The Cost of Capital and U.S. Capital Investment: A Test of Alternative Concepts", *Journal of Finance*, Vol. 35, 1980, pp. 981-999.

Evans, E.A. and Higgins, C.I. "Consumption Behaviour in Accelerating Inflation", Australian Treasury, *Mimeo*, 1972.

Fama, E.F. "Inflation Uncertainty and Expected Returns on Treasury Bills", Working paper 75-39, Brussels, *European Institute for Advanced Studies in Management*, September 1975.

Feige, E.L. "How Big is the Irregular Economy", *Challenge*, Vol. 22, 1979, pp. 5-13.

Feldstein, M.S. "The Welfare Cost of Permanent Inflation and Optimal Short-Run Economic Policy", *Journal of Political Economy*, Vol. 87, 1979, pp. 749-768.

Feldstein, Martin. "Inflation, Tax Rules and Investment: Some Econometric Evidence", National Bureau of Economic Research Inc., Working Paper Series, No. 577, November 1980, pp. 1-73.

Feldstein, M. "Inflation and the Stock Market", *American Economic Review*, Vol. 70, 1980a, pp. 839-47.

Feldstein, M.S. "Inflation, Tax Rules and the Stock Market", *Journal of Monetary Economics*, Vol. 6, 1980b, pp. 309-331.

Feldstein, M. "Inflation, Portfolio Choice, and the Prices of Land and Corporate Stock", *American Journal of Agricultural Economics*, Proceedings, Vol. 62, 1980c, pp. 910-916.

Feldstein, M.S., Green, Jerry and Sheshinski, Eytan. "Inflation and Taxes in a Growing Economy with Debt and Equity Finance", *Journal Polit. Econ.*, April 1978, Part 2, 86(2), pp.S53-S70.

Feldstein, M.S. and Summers, L.H. "Inflation and the Taxation of Capital Income in the Corporate Sector", *National Tax Journal*, Vol. 32, 1979, pp. 445-470.

Filmer, R. and Silberberg, R. "A Model of the Private Housing Sector in Australia" in *Papers Prepared for the National Housing Economics Conference*, Brisbane, AGPS, 1978, pp.73-87.

Fischer, Stanley. "Capital Accumulation on the Transition Path in a Monetary Optimizing Model", *Econometrica*, Vol. 47 (6), November 1979, pp. 1433-1439.

Fischer, Stanley. "Towards an Understanding of the Costs of Inflation II", *Mimeo*, January 1981.

Fischer, S. and Modigliani, F. "Towards an Understanding of the Real Effects and Costs of Inflation", *Weltwirtschaflsliches Archiv*, Vol. 114, 1978, pp. 810-832.

Fisher, I. *Stabilizing the Dollar in Purchasing Power*, New York, E.P. Dutton & Co., 1918.

Fisher, I. *The Purchasing Power of Money*, New York, 1920.

Fisher, I. *The Theory of Interest*, New York: Macmillan, 1930.

Flemming, J.S., Price L.D.D. and Byers, S.A. "The Cost of Capital, Finance and Investment", *Bank of England Quarterly Bulletin*, Vol. 16, 1976, pp. 193-205.

Flemming, J.S. *Inflation*, Oxford University Press, 1976.

Flemming, J.S., Price, L.D.D. and Ingram, D.H.A. "Trends in Company Profitability", *Bank of England Quarterly Bulletin*, 1976.

Foster, J. "Redistributive Effects of Inflation - Questions and Answers" *Scottish Journal of Political Economy*, 1976, pp.73-98.

Franks, J.R. and Hodges, S.D. "The Role of Leasing in Capital Investment", *National Westminster Bank Quarterly Review*, August 1979, pp. 20-31.

Freebairn, J.W. "Assessing some Effects of Inflation on the Agricultural Sector", Presidential Address, 25th Annual Conference of Australian Agricultural Economics Society, Christchurch, N.Z. February 1981.

Freebairn, J.W. "Determinants of Consumption", in *Conference in Applied Economic Research: Papers and Proceedings*, W.E. Norton and D.W. Stammer (Eds.), Sydney: Reserve Bank of Australia, 1976.

Freebairn, J.W. "Inflation and the Stability of the Household Consumption - Savings Function", *Economic Record*, Vol. 53, 1977, pp. 198-218.

Friedman, M. "The Optimum Supply of Money", in *The Optimum Supply of Money and other Essays* edited by M. Friedman, Chicago: Aldine, 1969.

Friedman, M. "Time Perspective in Demand for Money", *Scandinavian Journal of Economics*, Vol. 79, 1977, pp. 397-416.

Friend, I., Landskroner Y. and Losq, E. "The Demand for Risky Assets under Uncertain Inflation", *Journal of Finance*, Vol. 31, 1976, pp. 1287-1298.

von Furstenberg, G.M. "Individual Income Taxation and Inflation", *National Tax Journal*, Vol. 28, March 1975, pp.117-127.

Gandolfi, Arthur. "Taxation and the 'Fisher Effect'." *Journal of Finance*, Vol. 16(5), December 1976, pp. 1375-86.

Goldfeld, S.M. "The Case of the Missing Money", *Brookings Papers in Economic Activity*, 1976, pp. 683-739.

Gordon, R.S. "Inflation, Taxation and Corporate Behaviour", Paper presented at the *World Econometric Congress*, Aix-en-Provence, August 1980.

Gordon, R.H. and Malkiel, B.G. "Taxation and Corporate Finance" *Princeton University Financial Research Centre Memorandum* No. 31, January 1980.

Gordon, Robert J. "The Welfare Cost of Higher Unemployment", *In Brookings Papers Econ. Activity*, No. 1, 1973, pp. 133-205.

Guttmann, P.M. "The Subterranean Economy", *Financial Analysts' Journal*, Vol. 34, 1977, pp. 26-27.

Hagger, A.J. "Inflation", in F. H. Gruen (Ed.), *Surveys of Australian Economics*, Vol. 1, 1978, pp. 132-185.

Haig, B.D. "Inflation and Profits - the SVA and Depreciation Adjustments in the National Accounts", *Centre for Economic Policy Research* Discussion Paper No. 29, 1981.

Haig, B.D. "Profits and Investment in Manufacturing: A Contrary View", *Australian Bulletin of Labour*, Vol. 6, No. 2, March 1980.

Haig, B.D. "The Treatment of Stock Appreciation in the Measurement of the National Income", *Review of Income and Wealth*, Vol. 19, 1973, pp. 429-36.

Hall, A.R. *Australian Company Finance: Sources and Uses of Funds of Public Companies, 1946-1955*. Canberra: ANU, 1956.

Hall, A.R. "Some National Income Accounting Anomalies", *Centre for Economic Policy Research* Discussion Paper No. 30, 1981.

Hall, Robert E. "The Phillips Curve and Macroeconomic Policy", in the *Phillips Curve and Labour Markets*, edited by Karl Brunner and Alan Meltzer. Carnegie-Rochester Conferences on Public Policy (Supplementary series to the *Journal of Monetary Economics)*, Vol. 1, Amsterdam: North-Holland, 1976.

Hawkins, R.G. "Business Fixed Investment in the 1970s", *Reserve Bank Conference in Applied Economics*, 1979, pp. 194-231.

Hendershott, P.M. "Real User Costs and the Demand for Single-Family Housing", *Brookings Papers on Economic Activity*, 1980, pp. 401-444.

Hendry, D.F. and von Ungern-Sternberg, T. "Liquidity and Inflation Effects on Consumers' Expenditure", in A.S. Deaton (Ed.), *Essays in the Theory and Measurement of Consumers' Behaviour*, Cambridge, Cambridge University Press, 1980.

Higgins, C.I., Johnston, H.N. and Coghlan, P.L. "Business Investment: The Recent Experience", *Reserve Bank Conference in Applied Economic Research*, 1976.

Knight, H.M. 'Beyond the Shortrun Prospect'. Address to the *Economic Society of Australia and New Zealand* (New South Wales Branch), Sydney, 1976.

Koopmans, T.C. 'The Dynamics of Inflation', *Review of Economics and Statistics*, February 1942, pp. 53-65.

Lawson, G.M. and Stark, A.W. 'Equity Values and Inflation: Dividends and Debt Financing', *Lloyds Bank Review*, 1981, pp. 40-54.

Lee, G. H. *Inflation, Personal Income Taxation and the Distribution of Income*, CEDA Study No. 55, July 1978.

Levi, Maurice D. and Makin, John H. 'Fisher, Phillips, Friedman and the Measured Impact of Inflation on Interest', *Journal of Finance*, Vol. 34, March 1979, pp. 35-52.

Levi, Maurice D. and Makin, John H. 'Inflation Uncertainty and the Phillips Curve: Some Empirical Evidence', *The American Economic Review*, Vol. 70, No. 5, December 1980, pp. 1022-1027.

Levi, M.D. and Makin, John H. 'Anticipated Inflation and Interest Rates: Further Interpretations of Findings on the Fisher Equation', *American Economic Review*, December 1978, pp. 801-812.

Lewellen, W.G., Long, M.S. and McConnell, J.J. 'Asset Leasing in Competitive Capital Markets', *The Journal of Finance*, Vol. 31, No. 3, June 1976, pp. 787-798.

Logue, D.E. and Willett, T.D. 'A Note on the Relation between the Rate and Variability of Inflation', *Economica*, Vol. 43, 1976, pp. 151-158.

Lucas, R.S. 'Some International Evidence on Output, Inflation Trade-off', *American Economic Review*, Vol. 63, 1973, pp. 326-334.

Macfee, K. 'A Glimpse of the Hidden Economy in the National Accounts', *Economic Trends*, (C.S.D.), Feb. 1980, pp. 81-86.

Mathews, R. 'Company Taxation and Inflation', *Australian Economic Review*, No. 32, 1975(4), pp.29-34.

Mathews, R. (Chairman). *Committee of Inquiry into Inflation and Taxation*. Canberra: AGPS, 1975.

Mathews, R. and Grant, J. McB. *Inflation and Company Finance*, Sydney: Law Book Co., 1958.

Melichar, E. 'Capital Gains versus Current Income in the Farming Sector', *American Journal of Agricultural Economics*, (Proceedings), 61 (1979), 1085-1092.

Miller, M.H. and Upton, C.W. 'Leasing, Buying and the Cost of Capital Services', *Journal of Finance*, Vol. 31, No. 3, June 1976, pp. 761-786.

Minarik, J.J. 'The Size Distribution of Income During Inflation', *Review of Income and Wealth*, Vol. 26, 1980, pp. 377-392.

Minarik, J. "Who Wins, Who loses from Inflation?", *Challenge*, January/February 1979, 21, pp. 26-31.

Minford, A.P.L. and Hilliard, G. "The Costs of Variable Inflation", Proceedings of 1976 Annual Conference of the Association of University Teachers of Economics, 1977, 109-139.

Modigliani, F. "The Life Cycle Hypothesis Twenty Years Later", in M. Parkin and A.R. Nobay (Eds.), *Contemporary Issues in Economics*, Manchester: Manchester University Press, 1977.

Modigliani, F. and Brumberg, R. "Utility Analysis and the Consumption Function: an Interpretation of Cross-section Data" in K.K. Kurihara (Ed.), *Post Keynesian Economics*, London: Allen & Unwin, 1955.

Modigliani, F. and Papademos, L. "Optimal Demand Policies against Stagflation", *Weltwirtschaftsliches Archiv*, 114 (1978), pp. 736-782.

Morgan, D.A. "Overtaxation by Inflation", *International Economic Association*, Hobart Paper 72,1977.

Muellbauer, J. "Prices and Inequality: The United Kingdom Experience" *Economic Journal*, Vol. 84, 1974, pp. 32-55.

Mullineaux, D. "Inflation Expectations and Monetary Growth", *American Economic Review*, March 1980, pp. 149-161.

Murphy, C. "Personal Income Tax Collections", *Paper prepared for M.Ec. Case Studies in Applied Econometrics*, ANU, 1980.

Murphy, C.W. "The Market for Alcoholic Beverages: Pricing, Demand and Taxation", Paper presented to the *10th Conference of Economists*, Canberra, August 1981.

Musgrave, R.A. and Thin, T. "Income Tax Progession 1929-48", *Journal of Political Economy*, 56 (Dec. 1948), pp. 498-514.

Myers, S.C. Dill, D.A. and Bautista, A.J. "Valuation of Financial Lease Contacts", *Journal of Finance*, Vol. 31, No. 3, June 1976, pp. 799-820.

Nelson, C.R. "Inflation and Capital Budgeting", *Journal of Finance*, Vol. 31, 1976, pp. 923-932.

Nevile, J.W. "Inflation, Company Profits and Investment", *The Australian Economic Review*, 4th Quarter, 1975, pp. 35-36.

Nevile, J.W. "Definitions and Measurements of the Australian Deficit", in *The Significance of the Budget Deficit*, by J.R. Hewson et.al., Centre for Applied Economic Research, Paper No. 7, June, 1979.

Nevile, J.W. "Economic Activity and Fiscal Policy in Australia: A Survey and Critique", *Economic Record*, Vol. 566, 1980, pp. 301-315.

Nickel, S.J. *The Investment Decisions of Firms*, (Cambridge, 1978)

Niida, H. "The Redistributional Effects of the Inflationary Process in Japan, 1955-75", *Review of Income and Wealth*, Vol. 24, 1978, pp. 195-219.

Nordhaus, W.D. "The Effects of Inflation on the Distribution of Economic Welfare", *Journal of Money, Credit and Banking*, 1973, pp. 465-504.

Norman, P.M. and Purvis, D.D. "The Behaviour of Monetary Aggregates", *Economic Record*, Vol. 53, 1977, 364-89.

Norton, W.E. and Brodie, M.W. *Australian Economic Statistics 1949-50 to 1978-79: I Tables*, Reserve Bank of Australia Occasional Paper No. 8A, 1980.

Nowotny, E. "Inflation and Taxation", *Journal of Economic Literature*, Vol. 18, 1980, pp. 1025-1049.

OECD Committee on Fiscal Affairs, *The Adjustment of Personal Income Tax Systems for Inflation: A Report*, Paris: OECD, 1976.

Okun, A. "The Mirage of Steady Inflation", *Brookings Papers on Economic Activity*, Vol. 2, 1971, pp. 485-498.

Okun, Arthur M. "The Great Stagflation Swamp", *Challenge*, Nov/Dec 1977, 20 (5), pp. 6-13.

Okun, A.M. "Inflation: Its Mechanics and Welfare Costs", *Brookings Papers in Economic Activity*, 2: 1975, pp.366/

Pagan, A.R. and Volker, P.A. "The Short Run Demand for Transactions Balances in Australia", *Economica* (Forthcoming) 1981.

Pagan, A.R., Hall, A.D. and Trivedi, P.K. "Assessing the Variability of Inflation", Working Papers in *Economics and Econometrics*, Australian National University, September 1981.

Parkin, M. "Inflation and the Redistribution of Wealth", Chapter 6. in B. Carsberg, E.V. Morgan and M. Parkin (ed.) *Indexation and Inflation*, Financial Times, 1975.

Pellarini, F. *Funds Markets* (Comert Pty. Ltd. 1978)

Phelps, E.S."Anticipated Inflation and Economic Welfare", *Journal of Political Economy 73*, 1-17, January 1965.

Phelps, E.S. *Inflation Policy and Unemployment Theory*, W.W. Norton and Co., New York, 1972.

Phelps, E.S. "Inflation in the Theory of Public Finance", *The Swedish Journal of Economics*, Vol. 75, 1973, 67-82.

Phelps, E.S. "Inflation Planning Reconsidered", *Economica*, Vol. 45, May 1978, pp. 109-124.

Piachaud, D. "Inflation and Income Distribution" in F. Hirsch and J.H. Goldthorpe, *The Political Economy of Inflation*, London: Martin Robertson 1978, pp. 88-116.

Podder, N. and Kakwani, N.K. "Distribution of Wealth in Australia", *Review of Income and Wealth*, Vol. 22, 1976, pp. 75-92.

Poole, William "Nominal and Real Rates of Interest in Australia", (forthcoming) 1981.

Prest, Allan "Inflation and the Public Finances", *Three Banks Rev.*, March 1973, 96, pp. 3-29.

Reece, B.F. "Potential Redistribution of Household Wealth by Inflation", *Economic Analysis and Policy*, 7, (1) (March, 1977), pp. 51-57.

Reserve Bank Conference in *Applied Economics*, December 1979.

Rosen, H.S. and Rosen, K.T. "Federal Taxes and Home-ownership: Evidence from Time Series", *Journal of Political Economy*, Vol. 88, 1980, pp. 59-75.

Saunders, A. and Tress, R.B. "Inflation and Stock Market Returns: Some Australian Evidence", *Economic Record*, Vol. 57, 1981, pp. 58-66.

Sheshinski, E. and Weiss, Y. "Inflation and Costs of Price Adjustment", *Review of Economic Studies*, 44 (2), 137 (June, 1977), pp. 287-304.

Shiba, T. "The Personal Savings Function of Urban Worker Households in Japan", *Review of Economics and Statistics*, Vol. 61, 1979, pp. 206-213.

Shoven, John B. and Bulow, Jeremy I. "Inflation Accounting and Non-financial Corporate Profits", *Brookings Pap. Econ. Act.*, 1975, (3) pp. 557-98 and 1976, (1), pp. 15-57.

Sidrauski, Miguel "Rational Choice and Patterns of Growth in a Monetary Economy", *American Economic Review, Papers and Proceedings*, 57 (1967), pp. 534-544.

Siegel, J.J. "Inflation-Induced Distortion in Government and Private Saving Statistics", the *Review of Economic and Statistics*, 61 (1), (Feb. 1979), pp. 83-90.

Solow, Robert M. "The Intellignet Citizen's Guide to Inflation", *Public Interest*, No. 38 (Winter 1975), pp. 30-66.

Swan, P. "The Mathews Report on Business Taxation", *Economic Record*, Vol. 54, 1978, pp. 1-16.

Swan, P. "An Optimum Business Tax Structure for Australia", Submission to the Committee of Inquiry into the Australian Financial System, 1980.

Tanzi, V. "Inflation, Lags in Collection, and the Real Value of Tax Revenue," *Int. Monet. Fund Staff Paper*, March, 1977, 24 (1), pp. 154-67.

Tanzi, V. *Inflation and the Income Tax*, New York: Cambridge, 1980.

Tanzi, V. "Inflationary Expectations, Economic Activity, Taxes and Interest Rates", *American Economic Review*, March 1980a, pp. 12-21.

Tanzi, V. "The Underground Economy in the United States: Estimates and Implications", in *Banca Natzionale del Lavoro Review*, 1980b, pp. 427-453.

Taylor, C.T. and Threadgold, A.R. "Real National Saving and its Sectoral Composition", *Bank of England Discussion Paper No. 6* October 1979.

Tobin, J. "A General Equilibrium Approach to Monetary Theory", *Journal of Money, Credit and Banking*, Vol. 1, 1969, pp. 15-29.

Tobin, J. "Money and Economic Growth", *Econometrica*, 33,(1965), 671-684.

Tobin, J. "A General Equilibrium Approach to Monetary Theory", *Journal or Money, Credit and Banking*, 1, 1969, pp. 15-29.

Treasury Economic Paper No. 4, *Job Markets: Economic and Statistical Aspects of the Australian Market for Labour*, Canberra, AGPS, 1979.

Treasury Taxation Papers, No.3 *Personal Income Tax: The Income Base*, October 1974; No.4 *Personal Income Tax The Rate Scale*, October 1974; No.14 *Indexation of Personal Income Tax System*, July 1975; No.15 *Income Tax Treatment of Stocks and Depreciation Under Inflationary Conditions*, July 1975.

Turnovsky, S.J. *Macroeconomic Analysis and Stabilization Policy*, Cambridge University Press, 1977.

Volker, Paul "Expectations of Inflation and Nominal Interest Rates in Australia 1968 (1) - 1979 (2)", (forthcoming).

Wilcox, M.G. "Inflation and Its Effects on Banks and Finance Houses", *Midland Bank Review*, August 1975, pp. 10-16.

Williams, R.A. "Estimation of Household Demand Reponses Using Cross-Section Data: A System's Interpretation of Podder's Results". *Preliminary Working Paper* No. SP-02, Industries Assistance Commission, Melbourne, January 1977.

Williams, R.A. "Household Saving and Consumption in the 1970s", in W.E. Norton and I.W. Little (Eds.), *Conference in Applied Economic Research*, Sydney: Reserve Bank of Australia, 1979.