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# Sensitivity of household savings to taxation (IRD)

The purpose of this note is to explore what the economic literature on savings can tell us about the drivers of household savings as a basis for simulating the effects of various policy changes of the level of household and national savings.

It is well known that the direction of change of private savings with respect to changes in the after-tax interest rate cannot be determined theoretically. Savings could either rise or fall following a reduction in the tax rate on savings because of offsetting "substitution" and "income" effects. An increase in the after-tax interest rate increases the incentive to save which will tend to cause people to substitute away from current consumption towards savings. At the same time, it makes those who save able to afford more consumption in all periods. This income effect will tend to encourage them to increase current consumption which will reduce savings. The net effects of a decrease in taxes on private saving will depend on these offsetting income and substitution effects and on the time profile of an individual's earnings.

At the same time, a decrease in taxes on savings will generally decrease tax collections. Net international indebtedness depends upon changes in national savings, not private savings alone. Whether net international indebtedness rises or falls depends upon the size of any increase in private savings relative to the revenue cost to the government.

It should be noted that if the key concern is New Zealand's vulnerability to a potential loss in confidence by foreign investors, international experience suggests that higher government net debt increases vulnerability for a given level of international indebtedness. In that case an increase in private savings that was just equal to the revenue cost to the government, (no change in net international indebtedness), would increase vulnerability.

The government could also consider a package of changes which reduce taxes on income from savings, but increases taxes on other bases, such as consumption or labour income. In that case national savings would be expected to rise. If the package were an increase in the GST, offset by an across the board income tax decrease as in the 2010 Budget, there would also be efficiency gains. However such a shift raises questions concerning the fairness of the distribution of the tax burden among different individuals.

The paper also does not directly analyse special incentives to boost savings, such as tax preferred retirement accounts. These types of incentives are discussed in the paper on EET/TEE tax systems

We consider that a review of the literature and the analysis contained in this paper provides reasonably robust evidence that cutting taxes on capital income by themselves is unlikely to do much, if anything, to boost national savings. We analyse this using a standard life cycle model. To the extent that people are not all life cycle savers, we think these results are likely to overstate the responsiveness of savings to changes in after-tax interest rates.

The note begins by outlining factors that can affect the level of savings and its responsiveness to changes in tax rates on capital income. A model of life cycle savings is used to simulate the impact on private and national savings of various possible policy changes. Finally these results are compared to those of some recent studies, notably, for the Mirrlees Review of retirement savings.

## Drivers for household savings

There are numerous reasons people save. Incomes are uneven over life relative to consumption needs and people borrow and save in order to smooth out their consumption streams. Borrowing to buy a house and saving for retirement are classic examples of these motives. Economic theory predicts that after-tax interest rates can affect these decisions. The life-cycle model is used to study the relationship between such savings and interest rates. Other savings may be for specific purposes. Saving for education costs or establishing a precautionary rainy day fund are others. Some motivations for saving may reduce interest sensitivity. For example, if households have a target level of savings, an increase in after-tax interest rates allows this to be attained with less savings.

In a standard life-cycle model reducing the tax rate on savings income will induce individuals to shift relatively more of their consumption to later periods, increasing their average level of assets over their live. Taxes on income from existing savings will be reduced; to be somewhat offset by higher levels of GST and taxes on income earned from the higher level of assets. The impact on national savings is the net result of all of these impacts. In principle, national savings could either increase or decrease after a reduction in the tax rate on savings income. If savings are low but respond positively and sensitively to interest rates, a cut in capital income taxes would be likely to boost private savings more than the loss in government savings. Conversely, if savings are high and relatively insensitive to interest rates, the loss in government savings is likely to be greater than any gain in private savings. Given the considerable uncertainty about the values of relevant parameters it is not possible to make precise estimates.

Specific drivers for savings; and their likely responsiveness to tax induced changes in the after-tax interest rate are outlined in the following sections.

### *Life-cycle smoothing*

The life-cycle model provides an internally consistent framework in which to make this investigation. The life-cycle model assumes that individuals allocate their consumption over their life subject to a lifetime budget constraint of income. It makes predictions on consumption smoothing decisions such as savings for retirement.

The taxation of capital income enters into this allocation through its effect on the after-tax interest rate that individuals can earn on their savings. The discount factor, (1 + the after-tax rate of return), determines the relative "price" of shifting consumption from one period to another.

The model allows simulations of the effect of potential policy changes on the pattern and level of consumption of an individual over their lifetime. These results can be transformed into estimates of relative changes that might be observed to stocks of private savings and the cumulative fiscal position of the government[1].

### *Uncertainty and precautionary savings*

Uncertainty can play an important role in determining the level of savings of an individual. Income, expenses and the length of life are all uncertain. Individuals set aside precautionary savings to

[1] Following Attanasio and Wakefield, these results for individuals can be transformed into a national index by summing across the years, essentially treating each as a cohort of the population. Taxation amounts are the cumulative taxes paid up until that year, brought forward (in our calculations) at the *before* tax real rate of interest, in order to estimate the impact of different tax structures on the stock of government savings/debt.

cover unanticipated events, over and above those needed for smoothing consumption patterns under the life-cycle model. Uncertainty greatly increases the complexity of modelling and has not been explicitly incorporated into the simulations reported below.

Bernheim[2] concludes that precautionary savings tend to be relatively insensitive to the after-tax rate of return. This would suggest that they are likely to reduce the sensitivity of actual savings levels relative to those reported below. However, this appears to be controversial. Attanasio and Wakefield report greater interest sensitivity where individuals face income risk. They point out, however, that changes resulting from allowing for income risk are likely to be small relative to those produced by changing assumptions on the elasticity of intertemporal substitution.

***Bequests***

Theoretically the impact of bequests that an individual provides on the sensitivity of savings to interest rates is ambiguous. Some bequests are "accidental" and reflect the fact that people die earlier than planned. As such bequests are unplanned; they do not affect the level of planned savings or its sensitivity to interest rates.

If bequests are established as targeted amounts, this will tend to reduce interest sensitivity. In the extreme case, where a fixed bequest is desired, increasing the rate of return would actually decrease the savings required to meet the target.

On the other hand, bequests may result from "altruism, in that the parent incorporates the child's future stream of consumption into their life-cycle calculations. In the extreme, this would transform an individual into one who was effectively infinitely-lived. This would increase interest sensitivity.

The impact of bequests received on the level of discretionary savings would depend upon whether they were anticipated. If anticipated, they are likely to reduce savings of the recipient. But in either case, they would reduce the cost effectiveness of tax incentives for savings as they would add an interest insensitive block of savings, raising revenue costs relative to response.

The model does not include bequests other than the value of a house at the end of life.

***Borrowing***

Individuals whose income increases over time may have an initial period of time when their optimal savings are negative. That is, they borrow against future income to finance current consumption. Assuming that interest on funds borrowed for consumption is not tax deductible, savings to reduce the level of an individual's debt effectively earns the pre-tax rate of return. The fact that they face the pre-tax interest rate for a period of time decreases the sensitivity of their savings to changes in the tax rate. This effect is incorporated in the modelling.

Liquidity constraints may not allow individuals to borrow. In that case, the individuals who would ideally like to borrow are also likely to be less sensitive to changes in capital income tax rates. This effect is ignored in the modelling, but is simulated in the Appendix.

[2] Bernheim. B.D., 2002, 'Taxation and Saving', in Auerbach, A,J, and M.S. Feldman (eds.), *Handbook of Public Economics*, vol. 3. North Holland; and Orazio P. Attanasio and Matthew Wakefield, 2010, 'The Effects on Consumption and Savings of Taxing Asset Returns", Dimensions of Tax Design, The Mirlees Review, Oxford University Press.

### *Housing and durables*

The existence of a house, as part of a person's portfolio, has important effects on the analysis of the impact of tax changes on the level of national savings.

First, while a mortgage exists and is being paid off, interest sensitivity is reduced as with other borrowings. Savings made in the form of mortgage principal payments effectively earn the before-tax interest rate. On the other hand, that portion of the person's portfolio that is in housing is not subject to tax, and so the revenue cost for a given level of savings is reduced. Thus the impact of the house on the effectiveness of tax reductions for capital income on increasing national savings is ambiguous.

While an understanding of how housing fits into the life-cycle model is obviously important, the surveys note that work is not well advanced in this area. We have not attempted to model the housing choice endogenously. In our model, we assume that households acquire a fixed value of housing at a fixed point in time.

## Policy simulations

The following simulations report on the percentage changes in the stock of household savings that would be predicted by the life cycle model as well as the net impact on national savings once revenue costs to the government have been taken into account. It looks at a long-run equilibrium level of savings under the assumption that the tax rates have been in place throughout the lives of the individuals. No attempt is made in these simulations to imbed the individuals into an economy with feed-backs and interactions. It is a comparative static comparison of the impact of different policies rather than a forecast of annual flows over a transition period.

In ignoring transition to the steady state, we are following Attanasio and Wakefield. Transition to the steady state is likely to be an important consideration. Our focus on the steady state eliminates a number of effects, such as the time it takes individuals to adjust their behaviour to the new environment (perhaps consumption lags and accidental savings occur) and the impact of windfall tax reductions on existing stocks of savings (most of the early tax savings are on older individuals who have substantial stocks of savings, who are unlikely to increase savings propensity).

The Appendix models the transitional impact on a life-cycle saver of a reduction of capital tax rates part way through their life. They are assumed to adjust savings and consumption immediately. The windfall benefit on existing savings means that the reduction is less cost effective over the transition than reported for the long run.

A number of policies are simulated:

1. A reduction of the top tax rate on capital from 33 to 20%.

2. An increase in the GST rate from 15 to 20% with compensation for NZSuper.

3. A 20% GST (compensated) and an offsetting general income tax rate decrease from 33 to 29.2% that would be approximately revenue neutral across the economy, but would reduce taxes for the modelled individual.

The model assumes a higher income individual who pays the top tax rate on their labour and capital income. They work for 40 years before they retire and receive NZSuper for a further 20 years.

They purchase a house after 10 years and pay the principal off as they save (in the base case 15 years). They own the house until they die and it forms their bequest. The implications of changing these assumptions are explored in the Appendix.

***20% tax rate on savings income***

Table 1 shows the percentage increase in private savings and changes in levels of private savings and national savings for every $100 of governmental revenue cost.

**Table 1: Impact on Stock of Savings**
(% of private savings and per $100 of revenue cost)

| Tax Rates | | | | Private | | Gov't | National |
|---|---|---|---|---|---|---|---|
| | **GST** | **Lab** | **Cap** | % | $ | $ | $ |
| **1.** | 15% | 33% | 20% | 6% | +$85 | $100 | –$15 |

Decreasing the tax rate on capital from 33 to 20% leads to an increase in private savings of some 5%, which is about 85% of the foregone revenue cost of the government. This is less than the revenue cost to the government so that the long run stock of national savings falls.

***Increasing the GST***

The Working Group also enquired what the impact of increasing the GST to 20% would be, with and without an offsetting decrease in income tax rates.

Table 2 shows the impact of these policies on private and national savings. The figures are expressed as a percentage of private savings, as the model cannot estimate the stock of net national savings after government expenditures.

**Table 2: Impact on Stock of Savings**
(% of private savings)

| GST and Income Tax Rates | | Private | National |
|---|---|---|---|
| **2.** | GST to 20%, no offset | –1% | +40% |
| **3.** | GST to 20%, 3.8% income tax rate cut | +5% | +5% |

Increasing the GST in itself does not lead to an increase in private savings. An increase in the rate of GST does not affect the price of substituting consumption between periods. Its impact on savings would be the same as an across the board decrease in income, which under common assumptions (of homothetic preferences) would lead to a proportionate decrease of consumption in every period that just offset the increased tax payable under the GST. There is the same stock of private savings as before the increase of the GST[3]. Accordingly almost all of the GST increase results in an increase in national savings.

[3] In the model there is a small impact on private savings due to the interaction of the GST and NZSuper, under the assumption that NZSuper is raised to compensate for the effect of the GST on its purchasing power.

Increasing the GST and funding a revenue-neutral across-the-board-decrease in tax rates for labour and capital (3.8 percentage point reduction), leads to an increase in private savings of about 5%[4]. The income tax rate reduction of 3.8 percentage points is revenue neutral across the economy relative to the increase in the GST rate to 20%. However, the modelled taxpayer is a saver and has relatively high income. Thus, while the policy is aimed at being broadly revenue neutral for the population as a whole, the individuals modelled would likely experience a net reduction in tax.

***Comparison of result to other studies***

Although the extent to which tax preferences influence levels of saving remains a matter of considerable debate, a few reasonably clear themes do emerge from the literature. The conventional theoretical view holds that tax incentives have ambiguous and probably limited effects on levels of both household and national savings. Incentives are, however, likely to influence the composition of household savings. The empirical evidence appears generally to support these conclusions.

Lowering the rate of tax on capital income has both substitution and income effects. Net returns are increased, which would tend to encourage saving. The amount that needs to be saved to fund a given level of future consumption is reduced, which tends to reduce saving. The overall effect on household savings is therefore ambiguous. At the same time, there is a fiscal cost to the government. Unless there is an increase in private saving that exceeds this cost, the result will be a decline in national saving.

The literature is, to some degree, inconclusive about the how these factors combine in practice. Some studies have argued that a positive relationship does exist between tax incentives and levels of saving. However, their conclusions are disputed (Feenberg & Skinner, 1989; and Gravelle, 1991). Overall, there is a reasonable consensus that evidence for such a relationship is not strong. A 1994 OECD report, *Taxation & Household Savings*, found no clear evidence that factors affecting the rate of return, including tax, generally affected levels of saving (Robson, 1995). A review of experiences in the United States and the United Kingdom suggests that, at most, only a small fraction of the amounts invested in tax-preferred savings vehicles represents new saving that and that "the best interpretation of the evidence is that such policies are expensive ways of encouraging savings" (Attanasio, Banks & Wakefield, 2004).

This finding is not inconsistent with the observation that high rates of tax on the returns to saving are inefficient. Capital income taxes are inefficient because they create a distortion between present consumption and future consumption (not because they affect choices between consumption and saving as such). They may impose a substantial welfare cost even in the absence of significant impacts on net savings (Feldstein, 1978).

There is good evidence that tax can affect the composition of household savings. Differences in effective tax rates across assets or investment vehicles are likely to influence decisions about how to save. People facing higher-marginal rates are likely to hold a higher proportion of tax preferred investments. Those facing lower marginal rate are more likely to be motivated by other considerations, including the liquidity of their savings. A number of studies have tended to support this view (Robson, 1995).

[4] The increase in stock of savings is for the individuals modelled (assumed to be life-cycle savers) and in the long-run. It is not directly comparable to estimates of changes to short-term savings flows.

The discussion in this note has been based upon two recent surveys[5] of the recent literature on taxation and savings using life-cycle models. Simulations have been performed using a life-cycle model based upon those surveys that has been calibrated to New Zealand.

A key parameter in determining the responsiveness of savings to changes in after-tax interest rates is the "intertemporal elasticity of substitution". Bernheim argues that this lies somewhere between 0 and 1 and Attanasio and Wakefield argued that this lies somewhere between 0.4 and 1.0. We choose 0.6 as our base case. The Appendix contains sensitivity analysis to those assumptions.

Attanasio and Wakefield choose a figure of 1.0 for their base case which seems biased towards assuming the most optimistic responsiveness of savings. They find an increase of retirement wealth of almost 20% in their base case for a cut in the tax rate on interest from 40% to 25% but find that slightly less than 10% of this increase in wealth is not offset by lost tax revenue. However, they assume that costs of the government debt compound up at an after-tax interest rate rather than a pre-tax interest rate. We correct for this in our methodology which will make any effects of capital tax cuts on national savings less positive or more negative than Attanasio and Wakefield's findings.

There are key features of New Zealand's tax system which will lower any responsiveness of savings to changes in capital taxes relative to what has been modelled elsewhere. One issue is the fact that most savers will acquire an owner-occupied house over their lifetimes. During the period they are paying off their mortgage, each dollar saved earns the pre-tax interest rate. This is in contrast to the United States and, until recently, the United Kingdom, where mortgage interest is deductible from taxable income. Thus studies based on US and UK data would show greater interest rate sensitivity than New Zealand. We allow for the impact of mortgage debt on the interest rate in our modelling under the relatively conservative baseline assumption that a mortgage on a house is paid off over about 15 years. There are other features of the New Zealand tax system that we do not take into account which would also reduce the effects on savings of changes in tax rates on capital income. An important issue is that few New Zealanders in retirement will face a higher tax rate than 17.5%. In our simple modelling, we consider an individual who is taxed at the top rate of 33% in all periods of his or her life.

## Conclusion

Potentially large changes to tax rates applied to capital income (considered as Option 1) are unlikely to have a very large impact on the level of private savings given our assumed elasticity of intertemporal substitution which is in the middle of the feasible range cited by Bernheim and Attanasio and Wakefield. When the impact on national savings is considered, the effects on private savings can be more than offset and New Zealand's net national indebtedness could increase. (As noted, Attanasio and Wakefield's baseline assumption leads to a higher increase in private saving but they still find that less than 10 percent of this constitutes an increase in national saving and their methodology appears to understate the costs of accumulating public debt by using an after-tax rather than a before-tax real interest rate).

Increasing the rate of GST by itself would increase national savings markedly, but there would be little impact on stocks of private savings. But increasing GST without compensation is likely to be an unattractive policy for the government.

[5] Bernheim. B.D., 2002, 'Taxation and Saving', in Auerbach, A,J, and M.S. Feldstein (eds.), *Handbook of Public Economics*, vol. 3. North Holland; and Orazio P. Attanasio and Matthew Wakefield, 2010, 'The Effects on Consumption and Savings of Taxing Asset Returns", Dimensions of Tax Design, The Mirlees Review, Oxford University Press.

Revenue neutral changes that incorporated a reduction in the tax rate applied to income from savings would lead to increases in private savings and parallel increases in national savings.

The above numbers of course must be used with caution. The model is highly stylised with individuals in the steady state initially facing a 33 percent tax rate on all savings. The model does not incorporate a number of key determinants of the level of savings and would not be relevant for lower income individuals (who do not save much) and the very wealthy. However, the above discussion indicates that extensions of the model to make it more ‘realistic” are likely to reduce the sensitivity of savings to tax rates and could increase the relative size of government revenue losses.

# Appendix: Sensitivity of Results to Assumptions

This Appendix explores the sensitivity of the model results to variations in the assumptions used in the base model. These assumptions are of two kinds. The first are the parameters which describe the individual's preferences over time. The second are the exogenous economic characteristics, such as income, NZSuper, price of house etc. In the simulations reported in Table 2 we show the impact on private and national savings of a reduction of the tax rate on capital to 20% for various assumptions.

**Impact of varying assumptions**

The life cycle savings model as formulated in Bernheim and Attanasio and Wakefield assume than an individual's utility from consumption is

$$\sum_{t=0}^{T} \frac{u(c_t)}{(1+\beta)^t} \quad \text{where} \quad u(c) = \frac{c^{1-\gamma}}{1-\gamma}$$

Consumption depends upon two key parameters. The first is the rate of individual's pure rate of time preference, β which determines whether they tend to consume early or late in life, and the second is the elasticity of substitution, 1/γ, which governs the extent to which they wish to substitute consumption in one time period given relative prices in the two periods as determined by the after-tax interest rate. Of these two, the most relevant for our purposes is the elasticity of substitution. Sensitivity to tax rate changes is critically dependent upon its value. Bernheim and Attanasio report econometric estimates of this parameter. Unfortunately there is no consensus on its value. Bernheim suggests a value of anywhere between 0 and 1. Attanasio suggests a variation of 0.4 to 1[6]. In the base case we use an elasticity of substitution, 0.6, that is the mid-point of these numbers. In the sensitivity analysis below, Table 2 compares the base case to value of 0.5 and 0.7.

Table 2 also shows the effects of variations in key economic characteristics on the impact of reducing the tax rate on capital taxes to 20%. The characteristics include:

| | **Base Case** |
|---|---|
| Initial income | $100 |
| Real income growth rate | 2.0% |
| Real interest rate | 4.0% |
| Inflation (β) | 2.0% |
| Time preference | 2.0% |
| House Price | $450 |
| Marginal tax rate labour | 33.0% |
| Marginal tax rate capital | 20.0% |
| GST rate | 15.0% |
| NZ super | $30 |
| Rate of growth NZ super | 1% |
| Nominal pre-tax interest rate | 6.1% |
| After tax interest rate | 2.03% |
| Bequest given | House |
| Bequest received | $0 |

[6] As noted earlier, Attansio and Wakefield use this extreme value as a base of their simulations.

Table 3 reports three other cases:

- No house and a bequest of $450;
- No house and no bequest; and,
- No borrowing.

**Table 3: Effect of Assumptions on Results**
**(as a percentage of private savings)**

| | Private Savings | | Gov't | National |
|---|---|---|---|---|
| | % | $ | $ | $ |
| **Base case (20% capital rate)** | +6% | +$85 | −100 | −$15 |
| **1. EOS = 0.5** | +4% | +$56 | −100 | −$44 |
| **2. EOS = 0.7** | +9% | +$154 | −100 | +$54 |
| **3. No House, bequest 450** | +10% | +$57 | −100 | −$43 |
| **4. No house, no bequest** | +20% | +$115 | −100 | +$15 |
| **5. No borrowing** | +6% | +$63 | −100 | −$37 |

1. If the elasticity of substitution is reduced from .6 to .5, as expected, savings become less sensitive to changes in the after-tax rate of interest, and therefore there is a smaller percentage increase in private savings and a greater relative fall in national savings due to the revenue loss to the government.

2. On the other hand, with a greater elasticity of .7, the increase in private savings is greater than the fall in government revenue, so that there is an increase in national savings.

3. The situation where there is no house, but the level of bequest remains the same is interesting. On one hand, the sensitivity to the after-tax rate of return increases since all income from savings is exposed to taxation. No savings are made in tax exempt housing. On the other hand, all of the income from savings is now taxed and so the revenue cost to the government is increased. The net effect is that private savings now increase by 10 rather than 5%, but national savings falls by $43 per $100 of revenue cost rather than $15. So substituting cash savings for housing reduces the cost effectiveness of reducing the tax rate applied to capital income.

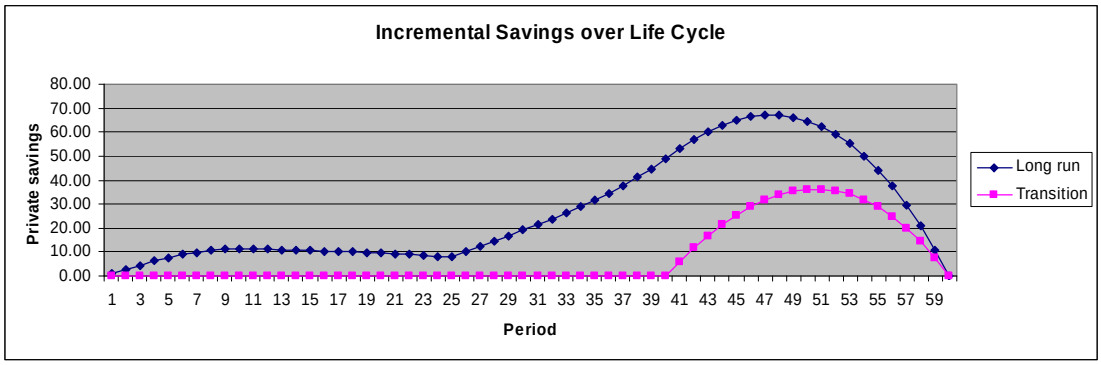
4. For a taxpayer without a house or a bequest, all savings are life cycle savings and all capital income is subject to taxation. In that case, the sensitivity of private savings is much higher, and there is an increase in national savings.

5. Finally, when borrowing, other than to buy a house, is not allowed, there can be a small reduction in the sensitivity of private savings to reductions in the taxation of capital income. The current model is likely to understate this effect as it does not incorporate a precautionary motive for savings. Borrowing constraints are likely to increase the desire for such savings, further reducing the sensitivity of the model to the after-tax rate of interest.

## Transition

A full model of transition using the life cycle model would stretch the model beyond its useful capacity. Modelling the impact in real time of changes to taxation would need to incorporate numerous assumptions about lags, feed-backs and adjustments. Nevertheless, it is useful to ask if the results over a transitional period are likely to show more or less sensitivity to changes in taxation than in the long run.

Absent other factors that are not captured by the life cycle model, applying a life cycle analysis to an unanticipated tax reduction in the middle of someone's life is likely to be less cost effective over the transition that predicted in the long run. Consider an individual who enjoys a tax reduction on capital income at the age of retirement. The cost to the government relative to the base case is simply the change in tax rate applied to the base case level of savings income. Therefore the cost is the same over that time period for either the transitional or the long run case. But the tax reduction induces a smaller savings response since it applies over a shorter time period. Shortening the time period reduces the savings response. (In the limit consider a person who receives a tax reduction in the last period of their life. All of the reduction would be consumed immediately.) The chart below compare the incremental savings that occur in the long run, where the lower tax rate is in place for the entire life of the individual to a situation where there is an unanticipated tax cut when they reach 65.




In each case, the chart shows the incremental savings over the base case for a reduction in the tax rate on capital income. In the long run, there is increased savings in each period. The large increase in the rate of savings occurs after the house mortgage has been paid off and marginal savings receive the benefit of the rate reduction. In the transition case, there is no effect on savings until the tax reduction comes into effect, when the taxpayer reaches 65. The shortened time period means that there is less time to increase savings levels before such assets are consumed.