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Moving to a direct tax on consumption: Some transitional issues

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MOVING TO A DIRECT TAX ON CONSUMPTION:
SOME TRANSITIONAL ISSUES

by

SHOUNAK S. SARKAR

A THESIS SUBMITTED
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ABSTRACT

Moving to a Direct Tax on Consumption:
Some Transitional Issues

by

Shounak S. Sarkar

The thesis shows two possible ways in which intergenerational redistributions associated with a reform from a comprehensive income tax to a direct consumption tax are affected when the standard models studying this phenomenon are extended.

The usual models studying the welfare impact of a direct consumption tax reform on transitional generations use numerically simulated overlapping generation general equilibrium models with strict life-cycle savers and a single production sector. The models examine the welfare impact of moving from a comprehensive income tax to either an expenditure tax or a wage tax; business taxes are ignored and assumed to "pass through" to individuals. One important result of these studies is that the expenditure tax reform results in large steady state welfare gains at the cost of imposing substantial welfare losses on the initial elderly generations. In marked contrast, a wage tax reform creates welfare gains to the elderly generations but results in lower steady state welfare gains (or even losses). This thesis tests the robustness of these conclusions under two important conditions ignored by these models.
First, the thesis incorporates an explicit business sector in these models and studies the impact of implementing the two above described consumption taxes with an additional reform of replacing the business income tax with a business cash flow tax. Intergenerational redistributions are altered and difference in steady state welfare gains are much smaller under such consumption tax reforms.

Second, the thesis shows how practically feasible transition rules can lower intergenerational redistributions without affecting the final steady state values. A variety of transition rules, both in business and individual sectors, are studied in this context.
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CHAPTER ONE

INTRODUCTION


There are three possible reasons for the lack of implementation of a consumption based tax. First, the reluctance to replace an income tax by such a tax strongly suggests that a compelling case has not yet been made by consumption tax proponents in terms of the traditional criteria of efficiency, equity and simplicity. This is certainly a plausible explanation. For example, a consumption tax proves to be superior to income tax on efficiency grounds in simple models of individual behavior (Feldstein 1978). However, the superiority becomes ambiguous if certain complicated features are added to the model
(Auerbach 1979, Atkinson and Sandmo 1980, King 1980). Similarly, the case for a consumption tax on grounds of equity becomes less obvious when different preference structures are considered and more complicated tax systems are analyzed (Zodrow 1990).¹

Second, there may simply be a "novelty effect" as no country wishes to be the guinea pig in an experiment as drastic as replacing the income tax, especially since there are likely to be many unanticipated problems associated with the actual implementation of a consumption tax.

Third, it is possible that the implementation of a consumption tax reform is perceived to be associated with "secondary" problems which are severe enough not to warrant such a reform. For example, during the debate prior to passage of the Tax Reform Act of 1986 (hereafter, TRA86) it was argued by the U. S. Department of the Treasury (1984) that adoption of a consumption tax was not a realistic reform option because (1) since all other countries have income-based tax systems, coordination problems would be difficult and unmanageable, (2) if gifts and bequests were not subject to tax to both donor and recipient, as seemed likely from a political standpoint, a consumption tax reform would be inequitable, and (3) transitional problems associated with such a drastic reform would be too severe.² Transitional issues in moving to a direct tax on consumption (rather than an indirect tax such as a national sales tax or a VAT) are the focus of this thesis.

Such transitional problems arise in the context of all tax reforms because any change in an existing tax structure will induce welfare gains and losses, and these reform-induced redistributions are generally viewed as inequitable from a social standpoint. More

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¹ For a detailed discussion on this, see Zodrow (1992)
specifically, such gains and losses can be viewed as essentially arbitrary and capricious — and thus as inequitable — as long as (1) the existing tax code has been in place for a reasonably long period of time, so that many assets have changed hands since the last reform and current "windfall losses" do not simply reverse previous "windfall gains", and (2) the reform is largely unexpected so that the effects of the tax reform are not already reflected in asset prices. Under these circumstances, individuals who made different types of investments based on a reliance on the existing tax structure will be affected very differently by the enactment of reform. The basic premise of the "optimal tax reform" literature is that such reform-induced redistributions are inherently inequitable, and thus represent a social cost of reform that should be weighed against any gains in efficiency or in social welfare attributable to enactment of reform. This reasoning implies that it is socially desirable to implement reform in such a way as to reduce the magnitude of such redistributions.

This view is not held universally, as several observers have argued that such reform-induced redistributions are not particularly problematical. For example, Graetz (1979) notes that despite the fact that any change in public policy causes redistributions of individual wealth, it is not common practice to compensate those who suffer losses (or attempt to tax those who gain); accordingly, it is unclear why the government should be especially concerned with tax-reform induced redistributions. In addition, Kaplow (1992)

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3 The second condition implies that the redistributions occur at the time of enactment of the reform. If the reform is anticipated, the only change in the analysis is that the redistributions would occur at the time the expectations of reform are formed rather than at the time of enactment; thus, similar transitional issues would arise in both cases.

4 See Feldstein (1976) and Zodrow (1985b) for elaborations of this argument, and Goode (1987) for a discussion of conditions under which it is relevant.

5 However, compensation does occur in some cases; see Cordes and Weisbrod (1979, 1985).
argues that establishing transition rules as the norm eliminates incentives for individuals and businesses to diversify away the risk of tax reform; if they did so, the cost of such redistributions would largely disappear. Although these arguments certainly have some validity, one can debate their relevance for major tax reforms. In particular, one can argue that the government should be concerned regarding the effects of major reforms if they are sufficiently large, even if not all effects of government actions are compensated. Similarly, individuals either may not be able to — or in practice do not — diversify away the risks of major reforms. In any case, political considerations and past experience suggest that concern about tax-reform induced redistributions is a reality, and may hinder or even rule out reforms that increase overall social welfare but cause losses to certain individuals; this is especially likely to be true if, as is often the case, the gains from reform are widely distributed but the losses are highly concentrated among politically powerful interest groups. Accordingly, we shall assume government aversion to reform-induced redistributions for the rest of this analysis.

The next issue is whether such transitional problems would in fact be particularly severe for the implementation of a direct consumption tax. It would appear that the severity of such difficulties has been overstated. Several arguments can be offered in support of this position.

First, the current tax system is a hybrid between a comprehensive income tax and a pure consumption tax; as a result, the transitional problems caused by moving from the current system to a pure consumption tax system would be less difficult than if the current

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6 See Aaron, Galper and Peckman (1988) for various papers dealing with the current "hybrid income-consumption tax".
system were a true income tax. For individuals, the primary transitional effects of implementing a direct consumption tax would be caused by changes in the tax treatment of saving. However, several types of saving vehicles currently receive tax treatment that is inappropriate under a true income tax but is more nearly consistent with a consumption tax, under which savings would be taxed either on a "cash flow" basis with deductions for saving and full taxation of all withdrawals, or on a "tax prepayment basis" with exemption of all capital income. For example, although employers can deduct employee contributions to pension plans, employees are not required to include these contributions as taxable income and income accruing in pension plans is not taxable. Similarly, some contributions to IRAs and contributions to Keogh, SEP, 401 (k) and 403 (b) plans are treated on a cash flow basis, while the income from owner-occupied housing, consumer durables and state and local bonds is excluded from tax. Saving in such forms constitutes a major portion of individual wealth. For example, out of total household financial assets of $13.8 trillion in 1989, 20.7 percent was held in pension funds, roughly 5.0 percent was held in IRAs or Keogh plans, and another 2.5 percent was invested in tax exempt obligations; in addition, 47 percent of the total net stock of fixed reproducible tangible wealth was held in owner-occupied homes and consumer durables.

7 However, it must be noted that this assertion is somewhat less relevant than it was prior to 1986, since TRA86 generally moved the tax system closer to the income tax paradigm. This is discussed further below.

8 Both approaches are generally referred to as "consumption" taxes and, under certain circumstances, are equivalent in present value terms; see Zodrow and McLure (1991).

9 In addition to the non-taxation of imputed income from home ownership, current law allows deductions for home mortgage interest and property taxes, generous roll-over provisions for investments in owner-occupied housing and a special exemption for capital gains on home sales by taxpayers over 55 years of age.

For businesses, pre-1986 tax provisions such as investment tax credits, accelerated depreciation deductions and the absence of inflation indexing of interest deductions created zero or even negative marginal effective tax rates (hereafter, METRs) on certain types of business investment.\textsuperscript{11} For example, Fullerton (1986) calculates negative METRs for all types of equipment, and METRs between 24-44 percent for structures and between 42-45 percent for inventories and land.\textsuperscript{12} Passage of TRA86 generally increased METRs; for example, Fullerton calculates a range of post-1986 METRs on all assets between 29-49 percent. Nevertheless, the current tax treatment of business does not constitute comprehensive income taxation; in particular, the income from investment in intangible capital, which accounts for 11 percent of the nation's capital stock, is untaxed at the business level.\textsuperscript{13} In addition, it is interesting to note that the more uniform tax treatment of business assets under TRA86 implies that a move to uniform taxation under a consumption tax would result in fairly small changes in relative prices (except for housing relative to business assets), and thus would impose relatively small windfall losses on the holders of such assets.

Finally, by way of comparison, it is not clear that the redistributions associated with moving to a direct consumption tax would be significantly greater than some of those caused by enactment of TRA86. For example, TRA86 (which was passed in October of 1986) repealed the investment tax credit effective January 1, 1986, and reduced preferential

\textsuperscript{11} The business-level METR on equity financed investment under a comprehensive income tax equals the statutory rate; by comparison, under a consumption-based business tax, this METR is zero.

\textsuperscript{12} Fullerton's calculations include state taxes and individual level taxes, and assume a four percent inflation rate and a fixed financing mix. Fullerton also assumes the validity of the "new view" of dividend taxation; for a discussion of the traditional and new views of dividend taxation, see Zodrow (1991).

\textsuperscript{13} See Fullerton and Lyon (1988).
tax treatment of capital gains without any transition rules for old assets, other than the option of realizing gains at the relatively low rate in effect until the end of 1986. Similarly, there were few transitional provisions mitigating the effects of other provisions that affected existing investments, such as the limitation on the deductibility of investment interest and the expansion of the alternative minimum tax. Finally, investments in non-residential real estate received fairly little special transitional treatment despite the introduction of limitations on passive losses and increases in capital gains taxes.

These factors suggest that the transitional problems associated with the implementation of a direct tax on consumption may not be as difficult as is sometimes argued. Nevertheless, as will be detailed later, such a reform would involve many issues that are indeed quite problematical, and it seems clear that some resolution of such issues would be an essential part of any feasible consumption tax plan. Accordingly, this thesis investigates some transitional issues that arise in moving to a direct consumption tax.

The thesis concentrates on the two forms of consumption taxation that are most prominent in the recent literature. The first is a tax on individual cash flow (hereafter, ICF) coupled with a business tax on real and financial cash flows; it is termed the "ICF/RF" tax. Unlike the income tax, which does not allow any deduction for saving and taxes the annual return to such saving, the ICF tax (also known as a personal expenditure tax) allows a deduction for saving placed in so-called qualified accounts and withdrawals from such accounts, including earnings thereon, are included in the tax base. Loans are also treated on a cash flow basis, as the proceeds are included in the tax base, but repayment of principal and interest is deductible. This individual level tax is accompanied by a business level tax that allows immediate expensing of all purchases of depreciable assets and taxes all receipts. Business loans are also treated on a cash flow basis.
The second type of consumption tax combines the individual tax prepayment (hereafter, ITP) approach with a business tax assessed on only real cash flows; this approach is termed the "ITP/R" tax. Also known as a wage tax or a yield-exemption tax, the ITP tax simply ignores loans as well as interest income and expense. This individual level tax is coupled with a cash flow tax at the business level which allows immediate expensing of all real investment but also ignores loans and loan repayment.\textsuperscript{14} \textsuperscript{15} The wage tax is equivalent to the expenditure tax in present value terms in strict life-cycle models with constant tax rates in which the rate of return equals the discount rate.\textsuperscript{16} Throughout the thesis, references to "consumption taxation" will imply the discussion includes both ICF/RF and ITP/R (or, both ICF and ITP, as the case may be), while any specific type of consumption tax will be referred to by its name.

There are a number of transitional problems associated with a consumption tax reform and two different analytical frameworks that have been used to analyze these issues. The first considers various asset based transition programs to reduce or eliminate reform-induced welfare gains and losses. These analyses usually focus on isolated effects of

\textsuperscript{14} The ICF/RF approach is analyzed in U.S. Department of the Treasury (1977), Institute for Fiscal Studies (1978) and Aaron and Galper (1985). The ITP/R approach is discussed by the U.S. Department of the Treasury (1977), Institute for Fiscal Studies (1978), Hali and Rabushka (1983, 1985), Bradford (1986) and McLure, Muti, Thuronyi and Zodrow (1990). Consideration is not given to the U.S. Department of the Treasury (1977) proposal that would allow individuals to choose between ICF and ITP treatment on the grounds that such treatment would be complex and would create opportunities for abuse that could not readily be prevented; these avoidance and evasion opportunities are detailed by Graetz (1979). For the same reasons, the proposal by Gauthier (1988) involving the introduction of an ITP/R tax that would gradually be replaced with an ICF/RF tax is ignored. Further, the S-base, proposed by the Institute of Fiscal Studies as an alternative form of a business level consumption tax base, is ignored as it has never been considered seriously in any consumption tax proposals.

\textsuperscript{15} The terminology is similar to that introduced by the Institute for Fiscal Studies (1978).

\textsuperscript{16} See Zodrow and McLure (1991)
reform on various types of assets but fails to incorporate the net effects of many changes that would occur under a consumption tax reform.

The second framework uses an utility-based analysis to study the net impact of various consumption tax reforms on individual welfare. These studies use numerically simulated general equilibrium models of an economy populated by life-cycle savers in an overlapping generations framework to examine the reform-induced changes in the welfare levels of taxpayers over the transition period. The primary works in this context are those of Summers (1981) and Auerbach and Kotlikoff (1987), (hereafter AK). Although the specific results of these analyses differ considerably due to differences in model structure and in the parameter values used in simulating the models, two general results are strikingly clear. First, Summers and AK both stress that an ICF tax reform is unambiguously superior to an ITP tax reform as the ICF tax reform results in a much larger steady state welfare gain.17 Second, AK show that moving to either of the two consumption taxes results in significant but diametrically opposite transitional redistributions across generations, and that these redistributions affect the final steady state welfare gains (or losses).

This thesis analyzes the robustness of these conclusions. It contends that Summers and AK place too much emphasis on this distinction between the two types of consumption taxes. Specifically, they ignore the possibility that a tax reform at the business level may partially or fully offset the welfare effects of a tax reform at the individual level. Further, they do not consider the possibility of implementing feasible transition rules in reducing redistributions. The thesis is organized as follows. Chapter 2 outlines the major

17 These models assume that all business taxes are simply "passed through" to individuals.
transitional problems associated with a move to a consumption tax, and discusses possible transition mechanisms that would have the effect of reducing or eliminating reform-induced windfall gains and losses. The chapter also provides an overview of the two different analytical frameworks that have been used to analyze these issues.

Chapter 3 extends the basic general equilibrium model of Summers and AK to incorporate a more detailed business sector with explicit taxation of firms, under the income tax in the initial equilibrium and under a cash flow tax in a consumption tax equilibrium. The chapter shows how the introduction of a cash flow tax at the business level influences both steady state values and reform-induced welfare changes across generations in a number of ways. The chapter also shows how "reasonable" transition rules on the business tax base can alter the pattern of these transitional welfare changes.

Chapter 4 examines the effects of alternative transitional rules on the tax treatment of saving and alternative government budget constraints within the context of the basic models of Summers and AK. In particular, the chapter shows appropriate transition rules result in optimizing consumers that have the same consumption pattern under both ICF and ITP taxes and also result in much smaller redistributions across generations for either consumption tax reforms.

Chapter 5 draws a brief conclusion with suggestions for future research.
CHAPTER TWO

TRANSITIONAL PROBLEMS AND POSSIBLE SOLUTIONS:

A LITERATURE REVIEW

There are numerous transitional issues associated with a consumption tax reform and some of them are quite problematical. Unfortunately, comprehensive research on transitional issues of consumption taxation is scarce. Several existing proposals recommend specific treatments; however, no comprehensive set of alternative transitional scenarios or in-depth exploration of their implication under a variety of tax reform objectives have been studied. This chapter provides an overview of the research done in this context.

The chapter is divided into four sections. The following section outlines the major transitional problems associated with a move to a consumption tax, and discusses possible transition mechanisms that would have the effect of reducing or eliminating reform-induced windfall gains and losses. The second and third sections discuss two different analytical frameworks that have been used to analyze these issues; the former considers various asset-based transition programs, while the latter examines utility-based analyses of the net impact of various consumption tax reforms (with and without transition rules) on individual welfare. The final section offers some conclusions which lead into the later chapters.

I. THE MAJOR TRANSITIONAL PROBLEMS

This section considers — in isolation — the major transitional problems that would be caused by implementation of either the ICF/RF or the ITP/R consumption tax reforms. The analysis begins by considering those problems that are common to the two approaches;
since both taxes propose cash flow treatment of real transactions at the business level, all of
the business transition problems, apart from those related to the treatment of existing loan
obligations, are included in this group. The remainder of the analysis considers, in turn,
the problems specific to the ICF/RF and the ITP/R reforms.

Issues Common to Both Types of Taxes

Changes in Asset Prices

Tax reforms inevitably affect after-tax returns in different industries in different
ways. As a result, businesses in different industries and thus ultimately their individual
stockholders or owners, experience changes in the prices of their assets; in addition, tax
reforms affect the prices of non-business assets, such as owner-occupied housing and
municipal bonds. In the case of the two consumption tax reforms, both proposals would
greatly reduce or eliminate tax differentials across industries, as well as the tax differential
favoring investment in housing over non-residential investment. This in turn would change
the relative prices of such assets; for example, declines in after-tax returns and asset prices
would be experienced by immobile factors employed in business sectors that would lose
relatively favorable tax treatment. Such "price change problems" are a commonly cited
example of arbitrary reform-induced redistributions.¹ Their magnitude would be greater
for immobile assets, especially those highly specific to certain industries, assets with
relatively inelastic supplies and long-term fixed claims of any kind. To the extent deemed
desirable, these price change problems could be mitigated with the standard sorts of delay,
phase-in, grandfathering or compensation provisions.² However, as noted in the

¹ This terminology follows the U.S. Department of the Treasury (1977).
introductory chapter, the benefits of reducing reform-induced redistribution through the use of such provisions should always be weighed against the costs of postponing the equity, efficiency and simplicity advantages of the consumption tax.

However, it should be noted that the overall impact of reductions in or the elimination of business tax differentials on individual stockholders and owners of companies holding business assets may be relatively small, since such asset price changes would tend to cancel each other. Accordingly, it would be very useful to analyze data on asset holdings to determine if individual portfolios were generally sufficiently diversified to minimize the negative effects of asset price changes, in which case special transitional provisions might be unnecessary.³

Depreciation Deductions on Existing Assets

The question of the treatment of depreciation deductions is an excellent example of a second general type of reform-induced transitional issue that has been called the "carryover problem" — the determination of the treatment of transactions that were either (1) taxed under the pre-reform regime but would be taxed again under the reformed system, or (2) tax deferred under the pre-reform regime but would normally be untaxed under the reformed system.⁴

Simply disallowing depreciation deductions on existing investments would have a negative effect on their values, especially investments made just prior to the enactment of reform. Thus, eliminating depreciation deductions would effectively impose a one-time

³ As suggested above, the asset price change problems associated with implementation of a consumption tax were reduced by the provisions of TRA86.

⁴ This terminology also follows U.S. Department of the Treasury (1977).
lump sum tax on existing capital. This loss would be mitigated to the extent that (1) existing capital owners would have better opportunities to take advantage of the benefits of the new consumption tax system, and (2) wealth-owners generally would benefit from higher after-tax returns to saving due to consumption tax treatment (which in turn would be offset by any reduction in the gross return to saving due to greater saving and investment).

The lump sum nature of such a windfall tax on old capital would allow lower tax rates on new economic activity; the resulting increase in the efficiency gain obtained under the new consumption tax system would thus be associated with a higher welfare level in the steady state. Indeed, with a sufficiently large lump sum tax, it is possible that all future generations would benefit from the implementation of the consumption tax at the expense of the capital owners at the time of enactment. However, the assessment of such a one-time wealth tax on owners of existing capital would be viewed as highly inequitable and, if widely perceived, might provoke fierce political opposition. Moreover, such policies affect investor expectations regarding future tax policy, and are therefore not as nondistortionary as they might appear.\(^5\) The alternative policy, which is more consistent with historical precedents, would be to allow firms to continue to take depreciation deductions on existing assets; the primary problem with this approach is its revenue cost. We shall return to these issues in the discussion below.

*Taxing the Income Attributable to Previous Investments*

Since accurately identifying the income attributable to pre-reform investments would be very difficult — and there is no particular reason to exclude such income from the cash flow tax in any case — all returns attributable to pre-reform investments would

\(^5\) See Bradford and Stuart (1986).
presumably be fully included in the business cash flow tax base. Note that moving to expensing of business investment under either of the two consumption tax plans would lower equilibrium gross returns to existing investment (since the cost of capital would be reduced). This in turn would lower the value of existing capital and result in a one-time windfall loss for the owners of existing assets.\(^6\)

*Revenue Loss Caused by Expensing*

Finally, note that an additional transitional issue is the revenue loss due to switching from the deductions for depreciation allowed under current law to expensing under a consumption-based business tax. This problem also arises under the individual portion of the ICF/RF tax. It may be desirable to spread out this revenue loss over several years. One means of accomplishing this would be to replace actual expensing over a transition period with "present value expensing" — deductions that would be spread out over several years but would be equivalent in present value terms to expensing in the year of purchase. For example, during the first few years following the enactment of the consumption tax, deductions equal in present value to expensing could be allowed. At the end of the transition period, expensing would be allowed. Alternatively, present value expensing could be phased-out at the cost of some additional complexity; for example, deductions for equipment could initially be spread out over three years, then two, and finally expensing could be allowed. An analogous "spreading out" of deductions for savings might be required under the individual portion of the ICF/RF tax to limit revenue losses in the first few years following enactment of reform.

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\(^6\) See Auerbach and Kodikoff (1983) for a discussion of this phenomenon.
As is true of all special transition rules, allowing present value expensing would add complexity during the transition period. Taxpayers would have to take deductions for purchases of depreciable assets and land over several years instead of only one, and accounting for sales of assets that had not been fully deducted would be complicated. However, in addition to spreading out the revenue loss that would otherwise occur with a switch to expensing, the adoption of present value expensing during the transition period would have two other beneficial effects. First, the number of firms that would have sufficient deductions to eliminate their tax liability entirely during this period would be reduced; such a reduction in the number of firms that can "zero out" is likely to be desirable on perception grounds. Second, a variety of tax evasion and avoidance schemes are particularly effective in reducing tax liability when expensing rather than deductions for depreciation is allowed. Present value expensing reduces the attractiveness of such schemes somewhat, since deductions are spread out over several years.

Issues Specific to the ICF/RF Tax

The Treatment of Existing Savings

Another example of an important carryover problem is the treatment of existing savings under a switch to an ICF/RF tax. Suppose that income saved under the old system were subject to full income taxation. In that case, adoption of a rule that deemed all existing financial assets to be subject to tax upon withdrawal would result in double taxation of such assets. Since such treatment is extremely harsh, it seems likely that a

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7 Note that this problem is particularly severe during the transition period; in later years, the income from previously expensed investments will offset the deductions for the expensing of new investment.

8 For a discussion of such schemes, see McLure, Muttl, Thuronyi and Zodrow (1990).
transition rule would exempt from tax withdrawals of assets existing at the time of reform (other than those in consumption-tax-type accounts). However, such an approach would add a great deal of complexity to the tax system, including rules designed to insure that income accruing to such assets after the enactment of reform was subject to tax and a "stacking rule" that would determine which savings are designated as withdrawn from "old" assets and are thus tax free. Alternatively, if data on assets were available or could be reasonably imputed from data on capital income, one could designate a certain fraction of such assets as eligible for tax-free withdrawal; these tax-free withdrawals could be spread out over several years.

The Treatment of Capital Gains

A related issue involves the treatment of the basis of existing capital assets, which under current law would be excluded from the tax base upon realization but would be included in the ICF/RF tax base. The most straightforward approach would be to allow deduction — for some finite time period — of basis for assets purchased prior to the enactment date of reform. Upon expiration of this grace period, all withdrawals would be taxed in full. If the grace period were sufficiently long, the basis of assets purchased before the enactment date would in most cases be a relatively small fraction of the total sales price for sales occurring after the expiration of the grace period. Note that such treatment would require a deduction for basis during the grace period. Special rules would probably be desirable to ensure tax-free recovery of basis for family businesses, closely-held enterprises, and perhaps for other types of assets. In addition, taxpayers could be allowed

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9 Note, however, that the "harshness" of full inclusion of existing assets diminishes over time, to the extent that investors unexpectedly benefit from income tax exemption under the ICF/RF regime. Thus, the need for special transition rules declines over time; see U.S., Department of the Treasury (1977) for a discussion of this point.
to recover basis tax free by paying capital gains tax during the transition period on a constructive realization basis (for those assets whose values could be readily determined without an actual sale). The proceeds of the "sale" would then be treated as a new investment under the ICF/RF tax.

*The Treatment of Existing Loan Obligations*

The ICF/RF base allows deductions for both interest and the repayment of principal. Allowing deductions for repayment of principal on old debt would create huge windfall gains to the owners of debt. No current proposals call for such drastic measures. The most likely treatment is that interest income and expense related to loans existing at the time of the enactment of the reform would continue to receive pre-reform treatment — deduction of interest expense and inclusion of interest income — for the remaining term of the loan. In this case, all interest payments, and the repayment of principal associated with new loans would be deductible, with offsetting inclusions in income by the recipients. The period of time over which such treatment was allowed might be limited.

*The Treatment of Dividends*

Under current law, dividends paid are not deductible at the business level; since this is consistent with both the R and RF based consumption taxes, no transitional issues with regard to dividends would arise at the firm level. The same is true at the individual level under the ICF/RF tax, since dividends would be included in the tax base as they are under current law.
Issues Specific to the ITP/R Tax

The Treatment of Existing Savings

A different version of the carryover problem occurs for the treatment of existing savings under an ITP/R tax, as existing assets would suddenly become exempt from tax. It seems unlikely that — apart from capital gains and retained earnings (which are discussed below) — the government would attempt to tax such assets. However, it should be noted that the U.S. Department of the Treasury (1977) suggested that it might be desirable to impose special high tax rates on individuals who are young and relatively wealthy at the time of the enactment of an ITP/R reform.

The Treatment of Capital Gains

In the absence of transition provisions, capital gains accrued under the income tax would never be taxed under the ITP/R tax. Since such treatment would be extremely generous, it seems likely that the government would instead attempt to tax such gains. Ideally, gains accrued prior to enactment would be taxed, while subsequent gains would be tax exempt; this approach would require valuation of assets at the time of enactment, and would be exceedingly difficult to implement for many assets. An alternative approach would be to include capital gains on assets purchased before the enactment of reform in the tax base, and to phase-out this provision over some period of time.10

10 See U.S. Department of the Treasury (1977) for a description of such a scheme.
The Treatment of Existing Loan Obligations

If the rules of the ITP/R base were applied to existing loans, interest payments would no longer be deductible and interest income would not be taxed; this would clearly have the greatest negative impact on highly leveraged firms and individuals. Alternative approaches would be to (1) grandfather existing loans, including interest income, until the loans are closed out,\textsuperscript{11} or (2) allow individuals and firms a fixed total amount of interest deductions, perhaps spread out over several years to avoid immediate revenue losses based on their level of interest payments in the previous year (or an average of several previous years). One might even attempt to have offsetting inclusion of interest income on the part of the recipients of deductible interest. For example, Hall and Rabushka (1985) would allow deductions of 90 percent of interest expense on "old" loans as long as the associated interest income were fully included in the tax base of the recipient. Such provisions would, however, be extremely difficult to monitor. (Hall and Rabushka (1985) would also limit the availability of expensing of new investment to firms that elect to continue taking depreciation deductions on existing capital.) Any of the above approaches would increase complexity, although (2) would avoid a large number of definitional issues regarding issues such as which loans qualified for transitional treatment, how should additional amounts borrowed on the terms of an existing loan be treated, etc.

\textsuperscript{11} If interest rates fell as a result of reform — which would be expected since interest income would no longer be subject to tax — many existing loans, especially those with long terms, would likely be refinanced or renegotiated. As a result, the length of the transition period for existing loans might not need to be too long.
The Treatment of Dividends

Since dividends paid from funds earned prior to the enactment of reform would escape tax at the individual level under the tax prepaid approach, special provisions would be needed to avoid windfall gains. For example, Bradford (1986) recommends an add-on tax on net corporate distributions. Alternatively, firms could be assessed a special tax — which could be assessed over several years — based on the amount of retained earnings at the time of enactment. Yet another alternative would be to devise a set of rules that determined which distributions came from earnings retained prior to enactment of reform, and require inclusion of such earnings in the individual tax base.

II. Transition Rules: Asset-Based Approaches

Most analyses of the transitional problems of implementing a direct consumption tax follow the approach used above; that is they examine the effects that the new tax would have on various types of assets held by businesses and/or individuals. A complete discussion of all such transition plans that have been proposed over the last fifteen years or so will be repetitious and confusing and the following subsection provides a more systematic exposition by grouping these proposals into four broad categories: (1) the “cold turkey” approach, (2) the use of grandfather rules, (3) phase-in approaches, and (4) a unique proposal made by Aaron and Galper (1985).

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12 The calculation of the level of retained earnings could be based on firms’ earnings and profits accounts.

13 For a discussion of similar rules in the context of business-individual tax integration, see Auerbach (1989). One example of a one-time tax designed to eliminate a reform-induced windfall gain is the “windfall recapture tax” proposed by the Treasury prior to passage of TRA86; see Aaron (1985) and Zodrow (1988) for discussions of this innovative proposal.
The Cold Turkey Approach

Perhaps the simplest way to handle transitional problems is to ignore them — that is, to avoid special transitional provisions entirely. As noted in the introductory chapter, Graetz (1979) and Kaplow (1992) provide a theoretical argument that supports such an approach. In addition, such a "cold turkey" approach was recommended by Hall and Rabushka (1983) for the ITP/R tax, who emphasized its inherent simplicity. They argued that the benefits of a (hopefully) permanent implementation of a sound and comprehensive tax reform far outweigh any damage caused by the transition; in addition they suggested that the net impact of the transition to an ITP/R tax would be reasonably small for most individuals, so that special transitional provisions would not be needed. However, this argument must be analyzed carefully to determine, first, whether reform-induced windfall gains and losses are in fact offsetting in the aggregate and, second, whether gains and losses are concentrated among certain individuals even if the net effect is small. For example, under a “cold turkey” implementation of the ITP/R reform, firms with relatively large, recently purchased capital stocks would be disproportionately affected by the loss of depreciation allowances, and highly leveraged firms and individuals would suffer disproportionately from the loss of interest deductions, while holders of existing assets would benefit disproportionately from the elimination of capital income taxation. Similarly, with a “cold turkey” implementation of an ICF/RF reform, the holders of existing assets would suffer disproportionately by the double taxation of existing assets and the loss of depreciation allowances, and holders of existing debt would receive large windfall gains if the repayment of principal were suddenly deductible. Further, taxpayers would have an incentive to understate existing assets at the time of enactment of an ICF/RF reform — for example, by converting them to cash reserves or to balances held abroad. Such compliance problems would create temporary revenue losses and complex compliance rules.
The cold turkey solution would also be difficult to implement from a political standpoint, as it would have negative impacts on a wide variety of firms and individuals and it would be difficult for policy makers to withstand the pressure for special transition rules from these agents. The revenue impact of this solution would also have to be examined. The introduction of expensing and a deduction for saving under the ICF/RF tax would reduce revenues, but this might be offset by other provisions, such as the elimination of depreciation deductions, the elimination of interest deductions under the ITP/R approach, and the taxation of existing assets under the ICF/RF approach. For example, Gordon and Slemrod (1988) estimate that a switch from the current tax treatment of businesses to a cash flow tax would result in a long-run revenue increase, even after accounting for the revenue loss due to transition rules for existing assets.

The Use of Grandfather Rules

The measures described in the previous section generally involved devising grandfather rules that would largely exempt existing assets from the effects of the new tax laws. These include allowing continued deductions for depreciation for existing assets, exempting pre-reform wealth accumulated out of after-tax dollars under the ICF/RF tax, and allowing interest deductions (and taxing the associated interest income) on existing loans.\textsuperscript{14}

The biggest advantages of grandfather rules are that they can, if structured appropriately, reduce reform-induced losses in a lump-sum fashion — that is, without causing any associated efficiency losses.\textsuperscript{15} In this case, grandfather rules are a low-cost

\textsuperscript{14} See, for example, U.S. Department of the Treasury (1977) and Hall and Rabushka (1985).

\textsuperscript{15} See Zodrow (1992) for an analysis of grandfather rules.
means of increasing the political acceptability of reform by reducing opposition that is based solely on negative transitional effects. In addition, a great deal of experience with grandfather rules of various types suggests that they are politically acceptable, and indeed even expected, in many cases.

The biggest problem with grandfather rules is that they increase complexity; in addition, if grandfather rules are not applied symmetrically to all transactions, revenue losses are likely to result. Moreover, grandfather rules can reduce efficiency gains (or other increases in social welfare) to the extent that they delay desirable changes induced by the reform.

The Phase-In Approach

Another common means of mitigating reform-induced transitional problems is to phase-in the reform over a certain period of time. The U.S. Department of the Treasury (1977) suggested that, for a period of ten years, individual taxpayers would compute their tax under both the old and new tax rules and pay the higher of the two taxes. Corporations would continue to be treated under the corporate income tax over this ten-year period. At the end of the ten-year interval, all remaining capital gains on assets purchased before the date of enactment of the reform would be "flushed out" of the system by taxing them at the current capital gains rate. Similarly, the Meade Committee proposed a ten-year transition to an ICF/RF tax that involved the substitution of an additional one-tenth of the ICF/RF base in the income tax base each year.16 Bradford (1986) proposed a five-step phase-in where the ITP/R tax becomes an increasingly important add-on to the existing

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16 As an alternative to a phased-in approach, the Meade Committee proposed an immediate conversion to an ICF/RF tax, with a one-time tax credit based on age and the amount of assets existing at the time of reform.
income tax. The plan called for acceleration of depreciation deductions until full first-year write-off is achieved coupled with phase-out of interest deductions on old debt and a phase-out of other investment incentives.

Phasing-in reform delays changes in tax liability and thus reduces the magnitude of reform-induced windfall gains and losses, relative to those associated with the "cold turkey" approach to implementing a consumption tax. This approach also has the advantage of avoiding significant revenue disruptions during the transition.

However, phasing-in also suffers from many problems. The first and most important is that phase-in proposals are very complex, and thus imply that much of the simplicity advantages of a consumption tax would be foregone for a significant period of time. In particular, proposals calling for the calculation of tax liability under two alternative tax systems would be quite complex for most taxpayers and would be likely to introduce a variety of tax avoidance strategies. Similarly, implementing "flush-outs" of existing capital gains or providing age-based tax relief would be hard to understand and implement and might open avenues for tax avoidance.

Second, Auerbach and Kotlikoff (1983) argue that phasing-in of more rapid depreciation deductions is undesirable because it is likely to have serious negative effects on investment during the phase-in period; this occurs because firms anticipate capital losses on investments made during the transition period (since the returns to such investments will decline until the end of the phase-in period) and thus avoid such investments to the extent possible. In a similar vein, Howitt and Sinn (1989) show that moving from an income tax to an ITP/R consumption tax with higher rates can reduce welfare if the reform is phased-in too slowly; this occurs because firms are reluctant to invest in the early years of the phase-
in because their expensing deductions are taken at low rates while the associated income is taxed at subsequently higher rates.

Finally, maintaining part or all of the present tax code over an extended phase-in period may increase uncertainty by suggesting to taxpayers that reversal of the reform is more likely than it would be if the reform were implemented immediately. In addition, an extended phase-in period provides opponents of the reform with a long time to attempt to reverse the reform.

The Aaron and Galper Transition Plan

The most comprehensive transition plan for a movement to an ICF/RF has been designed by Aaron and Galper (1985). This approach differs fundamentally from those described thus far, which generally involve rules designed to avoid windfall gains and losses by maintaining income tax treatment of existing assets. In marked contrast, Aaron and Galper argue that such an approach creates incentives for churning assets (so that assets can qualify for more generous treatment under the new consumption tax) and that providing some assets with consumption tax treatment and others with income tax treatment results in severe administrative problems. Accordingly, Aaron and Galper proposed an ingenious plan that would effectively implement consumption tax rules for existing assets (as well as new ones) at the time of enactment of the reform (and thus avoid the two problems noted above).

This is achieved by providing the following treatment for "old" assets — those existing at the time of enactment of reform. Upon the actual sale of such assets, taxpayers would receive a deduction equal in present value terms to the tax basis of the asset in the year of enactment of reform. Thus, old assets sold in the year of enactment would receive a deduction for remaining basis, while old assets sold in later years would receive a
deduction equal to the basis remaining in the year of enactment, indexed by a factor equal to one plus a market-related nominal interest rate for each year since the enactment of reform. In addition, they propose immediate disallowance of all deductions for interest expense on all old loans. Finally, the proceeds of all sales of "old" non-financial assets would be fully included in the business tax base.

The effect of the Aaron and Galper transitional rules would be to provide "old" assets and "old" loans with consumption tax treatment in the year of the enactment of the reform. Cash flow treatment would be applied to old assets; that is, assets sold in the year of enactment would receive expensing of remaining basis in that year, with assets sold in later years receiving the same treatment in present value terms. The proceeds of all asset sales would be included in the tax base. At the same time, tax prepayment treatment would be applied to old loans; that is, repayments of interest and principal would not be deductible, and also would not be included in the tax base of the lender. As noted above, these treatments are roughly equivalent, and both are consistent with taxation on the basis of consumption.

The Aaron and Galper plan would be most appropriate if individual behavior were consistent with the strict-life cycle model (with no bequests), such as that constructed by Summers (1981) or by Auerbach and Kotlikoff (1987), in the case in which the initial equilibrium is characterized by comprehensive income taxation. Under such circumstances, all saving comes from either wage income or capital income that was fully taxed under the comprehensive income tax; thus, one could argue that consumption

17 Aaron and Galper do not specify whether the associated interest income would be excluded from tax, but such treatment would be required if existing loans were to be treated on a consumption tax basis.
financed by the sale of accumulated assets should be exempt from tax, as would be the case under the Aaron-Galper transition rules.

However, the Aaron-Galper plan can be criticized on several grounds. The first is that policymakers may be very averse to granting consumption tax treatment to existing wealth. Advocates of a consumption tax already have great difficulty convincing income tax proponents that the long run distributional effects of a tax based on consumption are equitable; their case would be made much more difficult if such a reform were accompanied by tax exemption of the income earned by existing assets. It seems likely that many proponents of consumption taxation would be willing to live with the complexity of rules designed to limit the benefits of churning and to identify income and deductions attributable to pre-reform assets in order to avoid conferring such a windfall gain on the holders of existing assets.

Second, like the cold turkey solution, the magnitude and direction of the effects of the Aaron-Galper rules would depend on the relative magnitudes of remaining basis and outstanding debt. Owners of existing assets would gain (be indifferent, lose) to the extent that remaining basis was greater than (equal to, less than) outstanding debt. That is, the proposed treatment would be quite generous to investors whose assets were primarily equity financed, since they would receive immediately the benefits of expensing the remaining basis of all existing assets, but would lose little from the elimination of interest deductibility. On the other hand, the proposed treatment would be quite harsh to investors whose assets were debt financed, and/or had little or no remaining basis. To such investors, expensing would be of little benefit, but the loss of interest deductibility would be quite costly.
Third, transition rules should take into account the fact that all existing assets are not subject to comprehensive income taxation; in the case of such assets, granting immediate consumption tax treatment confers an undesirable windfall gain. Fourth, indexing the deduction for basis from the time of enactment using a nominal interest rate under the Aaron-Galper transition rules would add complexity, and the choice of the interest rate would undoubtedly be controversial. Finally, any additional rules designed to reduce the revenue loss associated with effective immediate deductions of basis for all existing assets would add complexity.¹⁸

III. TRANSITION ISSUES: A UTILITY-BASED APPROACH

One problem with the above discussions of reform-induced redistributions is that they focus on isolated effects of reform on various types of assets. The Aaron-Galper approach is an exception to this rule as it provides a consistent and comprehensive approach to dealing with transitional issues; nevertheless, it is still an asset-based approach that does not consider explicitly the net effects of the many changes that would result under a consumption tax reform. Such analyses may leave the impression that the transitional problems associated with implementing a consumption tax reform — or indeed any major change in the tax structure — are insurmountable.

However, as noted before, such approaches ignore the fact that, from an individual perspective, many reform-induced redistributions have offsetting effects; that is, an individual who suffers windfall losses because of one set of provisions is likely to enjoy windfall gains as a result of other reform provisions. In addition, the reform will presumably also result in some efficiency gains, which will be distributed across the

¹⁸ See Aaron and Galper (1985, pp. 102-3) for a discussion of such rules.
individuals in the economy. In principle, it is the net effect of these redistributions and efficiency gains that should be of concern in thinking about the transitional problems caused by the implementation of tax reform. That is, the reform-induced changes that are of primary concern are the net changes in individual welfare attributable to the reform. The calculation of such changes is of course complicated since one should in principle use a general equilibrium model to identify all the gains and the losses experienced by each class of taxpayers and then calculate the net effects of reform on each group. Nevertheless, such an approach is essential in helping to avoid the use of unnecessary special transitional provisions; that is, such provisions should be utilized only in those cases in which net redistributions were sufficiently large to be deemed undesirable from a social standpoint.

The standard way to measure such net redistributions is to examine the reform-induced changes in the welfare levels of taxpayers over the transition period. In the case of a consumption tax reform, these changes would depend critically on total asset holdings, the types of assets held, and the age of the taxpayer; accordingly, a utility-based analysis of reform-induced welfare changes should include these factors. The following subsection summarizes the work done in this context. The summary focuses on overlapping generations models which concentrate on intertemporal distortion associated with income taxation within the context of single-good economies and ignores the effect of alternative tax systems on intersectoral allocation of resources. Special attention is given to discussions on transition issues.

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19 In principle, one would like to identify net gains or losses for each individual. The aggregation required for any realistic modeling of reform implies that, for example, a net gain for a particular group of taxpayers is very likely to be associated with losses for some individuals within that group. This should be kept in mind when analyzing any particular modeling of the pattern of reform-induced redistributions.

20 For a comprehensive summary on intersectoral distortions, see Zodrow (1990).
Literature Review

The starting point of such analysis is the paper by Summers (1981). Summers constructs a general equilibrium model of a closed economy composed of strict life-cycle savers in an overlapping generations framework. The representative individual maximizes over a 50-year adult life a constant elasticity of substitution (CES) utility function of the form

\[ U = \frac{1}{1 - 1/\sigma} \sum_{s=0}^{49} \frac{c_s^{1-1/\sigma}}{(1 + \rho)^s}, \]

where \( c_s \) denotes consumption at time \( s \), \( \sigma \) is the intertemporal elasticity of substitution and \( \rho \) is the pure rate of time preference. The individual has an exogenous earnings stream \( (w) \) in the first forty years of his life and maximizes lifetime utility subject to a lifetime budget constraint (which in the absence of taxes is) given by

\[ \sum_{s=0}^{49} \frac{c_s}{(1 + i_t)^s} = \sum_{s=0}^{39} \frac{w_s}{(1 + i_t)^s}. \]

The individuals are myopic and expect wages, interest rate and tax rates to be constant over time. Wages and interest rates are determined endogenously from a Cobb-Douglas production function. Leisure is exogenous so that distortion in labor-leisure choices is ignored. The economy has a natural growth rate while technological growth rate is expressed in labor-augmenting form.

Numerically simulating such a model under certain parameter values Summers finds savings to be very interest elastic — a departure from previous theories which maintained that interest elasticity of saving is quite small. Under such conditions, elimination of tax on capital income (i.e., a consumption tax reform) has significant economic effects.
Specifically, a consumption tax reform induces saving and higher capital stock. And in an economy far below the golden rule level of capital intensity there are substantial gains in steady state consumption and welfare.

Summers argues that the critical factor missing from a two-period analysis of savings-consumption decisions in which labor income is earned only in the first period is the "human wealth" effect arising from the change in the present value of future earnings that occurs when the interest rate changes. Specifically, elimination of capital income tax causes an increase in the nominal after tax interest rate individuals use to discount future cash flows, which in turn implies a reduction in the value of the individual's human wealth — the present value of all future earnings. This perception of a decreased wealth prompts greater saving and future consumption.

The impact of this human wealth effect overshadows the income and substitution effects to generate large saving elasticities. For example, the simulations reported by Summers suggest interest elasticities of aggregate savings range from 1 to 3; by comparison, the point estimate suggested in the frequently cited study by Boskin (1978) is 0.4.

As mentioned before, the large saving responses in Summers model implies that replacing an income tax system with a consumption tax system creates large steady-state welfare gains. For example, in one of the central cases Summers examines a consumption tax reform from an initial equilibrium with a capital income tax rate of 50 percent, a wage

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21 The income and substitution effects are offsetting and results in small savings elasticity in the usual two period models with income earned only in the first period.

22 Summers also notes such empirical studies ignored the human wealth effect in addition to suffering from various econometric problems.
tax rate of 20 percent, a pre-tax return to capital of 10.5 percent, a rate of time preference of 3 percent and an effective growth rate of 3.5 percent. Under such parameter values, a switch to an equal revenue yield ICF tax results in a huge steady state welfare gain ranging from 11.3-11.8 percent of lifetime income. In contrast, a switch to an equal revenue yield ITP tax results in steady state welfare gains ranging from 1.4-7 percent.

Apart from showing the steady state welfare gains of a consumption tax reform the Summers model has another important implication; the results of the simulations show that an ICF tax reform results in much larger steady state welfare gains than does the ITP tax reform. This result obtains for two reasons. The first is that the assets held by the elderly at the time of the enactment of reform are taxed when they are consumed under the ICF approach, even though they were accumulated out of after-tax income under the existing income tax regime. As a result of this double taxation during the transition to an ICF tax, elderly generations experience a significant windfall loss. The additional revenue thus raised implies that the steady state consumption tax rate can be relatively low, which in turn implies that the steady state welfare gain is relatively high. In marked contrast, under the ITP approach, there is no taxation of the return to existing assets; this confers a transitional windfall gain to the elderly owners of existing assets — who expected continuation of the income tax regime — and the reduced revenue results in a relatively high steady state tax rate coupled with a relatively low steady state welfare gain (or even a loss in some cases).

The second reason for the difference in steady state welfare gains is due to what has been called a "postponement effect" that occurs only under the ICF approach. Specifically, under an ICF tax, younger generations must save more (relative to an ITP tax) in order to pay tax on future consumption financed from withdrawals of savings and the returns to such savings; by comparison, neither of these items is subject to tax under the ITP approach. As a result, aggregate savings and the size of the capital stock are larger, gross
wages are higher, tax rates are lower and welfare levels are higher in the steady state under the ICF tax — provided that one follows Summers and AK in making the critical assumption that the government must balance its budget each period, rather than using debt policy to smooth revenue flows across periods. In addition, the annual budget constraint implies that during the transition from an income tax to an ICF tax, rates must be relatively high to offset the reduction in the tax base due to the new deductions for saving under the ICF tax; these higher rates also reduce the welfare of those who are elderly at the time of the tax change. The cumulative effect of these factors is a significant reduction in the welfare of the elderly at the time of enactment of the ICF tax, coupled with relatively larger steady state welfare gains under this approach than under the ITP alternative.

Summers results have been criticized in several different ways. Evans (1983) shows that Summers' results are not robust to changes in parameter values. For example, within the context of the Summers model a change in the rate of time preference from 0.03 to 0 changes the savings elasticity from 3.55 to 1.11. Again, with the same base case parameter values as Summers, the model is also very sensitive to changes in the intertemporal elasticity of substitution; savings elasticity ranges from 3.55 (for $\sigma=1$) to 1.90 ($\sigma=0.25$). Evans concludes that such simulation studies are too sensitive to parameter values to determine savings elasticities definitively, and thus should not be used to justify any policy reform.

Similarly, Starrett (1988) argues that the utility function used by Summers is inappropriate for two reasons. The first is that a fixed percentage decline in consumption has the same proportionate effect on welfare regardless of the initial consumption level. He suggests the use of a Stone-Geary utility function in which a minimum level of consumption deemed as necessities must be purchased before saving becomes an option. Such a function implies less interest sensitivity of saving as the minimum consumption
level is approached from above. For example, in the Summers model (with $\sigma=1$) an interest rate of 4 percent yields an savings elasticity of 3.7; however, if 50 percent of the general standard of living is deemed as necessities the savings elasticity drops dramatically to 0.68. This is not surprising as new savings elasticity is the average of zero elasticity for necessities and an elasticity similar to Summers model for the remaining consumption. In response, Summers (1988) argues that at current consumption levels in the U.S., a Stone-Geary utility function in which as much as half of consumption is considered as necessities is unreasonable.

Second, Starret argues that the CES utility function with intertemporal separability — that changes in consumption in any one period have no effect on the marginal utility derived from consumption in all other periods — is inappropriate. He cites purchases of "big-ticket" items like housing and children's education as examples where consumers have much less discretion in the timing and size of purchases. Starret argues that including them explicitly in the model should also reduce the interest sensitivity of saving. However, his simulations show that big-ticket expenditures typically lower the elasticity only slightly. In fact, Summers (1988) contends that expenditures on consumer durables like big-ticket purchases behave similarly to investment and increases in the interest rate tend to reduce such purchases and should increase the interest elasticity of saving.

This path-breaking work by Summers has been extended in a number of ways. The most extensive study done on this model are by AK (1983) which builds on a earlier work by Auerbach, Kotlikoff and Skinner (1983). In particular, AK makes four critical changes in the assumptions of the Summers model, each of which tends to lower the above discussed advantages of consumption taxation.
First, AK considers a 55 period adult life-cycle and a utility function in which leisure is an endogenous component. Consumption taxation distorts labor-leisure choice and makes it less efficient compared to the findings in Summers model. However, as Ballard (1990) notes, if the perceived loss in human wealth experienced by consumers after the enactment of a consumption tax reform causes them to work more, saving might actually increase.

Second, following Welch (1979), AK assume a hump-shaped wage profile which peak around age 50. Compared to Summers' assumption of an exponentially growing wage till retirement, the AK assumption results in smaller human wealth effect. This, in turn, implies smaller saving elasticities and smaller welfare welfare gains.

Third, AK use more conservative parameter estimates than does Summers, which also results in lower saving elasticities and lower welfare gains. For example, in their benchmark case for initial income tax equilibrium, they consider a tax rate of 15 percent on both wage and capital income. Further, they use an intertemporal elasticity of substitution of 0.25, a time preference rate of 0.015 and an effective growth rate of 1 percent. When compared to the parameter values chosen by Summers, these values result in lower saving elasticities.

Fourth, AK assume that individuals have perfect foresight regarding the effects of changes in tax policies on factor prices and tax rates. This has two implications. First, perfect foresight implies a lower human wealth effect as individuals are aware that the general equilibrium effect of greater capital intensity will be to lower future returns to capital. Second, this assumption dampens the big swings in saving and tax rates in the initial years of reform that usually occurs under myopic modelling.
Mainly as a result of these four differences, the welfare gains obtained by implementing a consumption tax are significantly smaller in the AK simulations. For example, in one of their central simulations, a switch to an ICF tax increases steady state welfare by only 2.32 percent of the present value of "full" lifetime resources (defined so as to include the value of leisure) while a switch to an ITP tax decreases steady state welfare by 0.9 percent of the present value of "full" lifetime resources. The welfare gains (losses) on transitional generations are also smaller; no generation loses more than 1 percent of the present value of remaining lifetime resources under either consumption tax reform and no generation gains more than 0.02 percent of of the present value of remaining lifetime resources under the ITP tax reform.

AK also emphasize the importance of intergenerational redistributions caused by a consumption tax and the need to separate efficiency gains from steady state welfare gains. In order to separate pure efficiency gains from increases in economic efficiency through transfers in resources from earlier generations, AK introduces a separate redistributive government agency in the model that uses lump sum taxes and transfers to keep existing generations at the status quo level of utility. The agency is constrained only by a present value budget constraint. Under such lump sum redistributions, the steady state welfare gain under the ICF tax is only 0.29 percent — eight times smaller than the steady state welfare gain under the ICF tax without any lump sum redistributions. Similarly, the introduction of the lump sum redistributive authority reduces steady state welfare by 0.25 percent under the ITP tax compared to the welfare loss of 0.9 percent under the ITP tax reform without such redistributions.²³

²³ AK consider the effects of several other factors like pre-announced policy changes, short term tax cuts, social security and fiscal deficits in their model. I ignore these aspects for the purpose of this thesis.
Gravelle (1991) separates redistribution from efficiency in these types of models using a different compensation approach which enables her to study these effects without tracing the transition. This compensation scheme restores old consumption levels to the generations alive at the time of enactment of reform by lump sum payments; the payments are distributed across generations in a fashion such that the payments sum to zero in any time period. With no government borrowing, the last condition is necessary to account for all income without tracing the transition. Using this scheme, Gravelle claims that nearly all of the steady state gains of a consumption tax reform can be attributed to redistribution. For example, a base case wage tax rate of 15 percent and a capital income tax rate of 30 percent in Summers model with $\sigma=0.25$ results in a 5.03 equivalent variation gain under the ICF tax reform but a 4.09 equivalent variation loss under the ITP tax reform. The compensated steady state welfare gain, however, is only 0.61 percent under both consumption tax reforms indicating that over 85 percent of gains are purely redistributional.

Seidman (1983) examines the importance of inheritances and bequests in determining aggregate saving and tax policy, a factor both Summers and AK ignore. Seidman shows that introducing bequests in the utility function of the donor undermines the neutrality of the ICF tax. If bequests are taxed under the ICF tax, as they should be according to the 'lifetime endowment' view of equity, the welfare gain is smaller compared to the Summers model as taxing one use of saving distorts intertemporal allocation decisions and depresses saving. In fact, if the postponement effect is not big enough, an ICF tax reform which exempts bequests (as considered desirable by the 'dynastic' view of equity) achieves a higher steady state welfare gain. The same postponement effect causes an ITP tax reform which exempts inheritances to achieve a welfare gain larger than an ITP reform which taxes inheritances. However, these effects are not large in Seidman's simulations.
Alternative modelling of bequests generate different results. Starrett (1988) argues that bequests should be modelled similarly to "big-ticket purchases" as individuals have very little control over this form of consumption. Modelling bequests in such fashion will significantly lower the interest elasticity of saving. Alternatively, bequests can be modeled on an altruistic basis with bequests affecting the utilities of the donor and the heirs. Under such modelling, reform-induced intergenerational redistributions are offset by changes in bequest behavior resulting in smaller saving elasticities in the short run. For example, the windfall loss to the elderly generations due to the implementation of the ICF tax would result in smaller bequests by these generations. However, the long run saving will increase as the interest rate returns to its steady state level (which is independent of the level of taxation of capital income).

More important from the perspective of this thesis, however, is Seidman's (1984) work showing the importance of transition rules in altering the intergenerational redistributions caused by a consumption tax reform. Seidman considers a policy of age-phasing for an ICF tax reform whereby the population is divided at a chosen age. Persons older than this age age remain under the income tax for the remainder of their lives; persons younger or equal to this age are subject to the expenditure tax. Each year, the dividing age is increased by one till the whole population falls under the ICF regime.

Such a policy of age-phasing protects the generations older than the defined age from being double taxed on their existing assets and from facing a high tax rate that usually occurs in the initial years of reform in the Summers model. The net result is a much smaller transitional redistribution. For example, in his 55 period Summers' type model with bequest motive, Seidman shows that a maximum welfare loss of 14 percent to any generation in one of his simulation is halved if age phasing is applied with an initial dividing age of 25.
Seidman's transitional policy of age phasing seems impractical to implement and doomed from a political perspective. The key problem would be the difficulty to stop tax avoidance. Consider, for example, a married couple with the man older than the optimal age and the woman younger than the optimal age. The family can purchase a loan under the income tax with no tax obligation and deduct repayment of interest and principal under the cash flow system. Furthermore, it is impossible to choose an optimal dividing age and it is equally difficult to explain and monitor such a tax policy. However, the paper highlights the importance of transition rules under any tax reform in altering redistributions across generations. The remaining chapters in this thesis focus on practically feasible rules which serve the same purpose of altering intergenerational redistributions.

The most comprehensive paper studying the effects of alternative transition rules is by McGee (1991). McGee generates the Summers model (with perfect foresight) and studies the implementation of the ICF tax with two major alterations. First, he considers the transition to the ICF tax which differs in the tax treatment of old and new assets. Old wealth not shifted into qualified accounts continue to be taxed as under the income tax with income from such wealth taxable. In contrast, any assets deposited into these qualified accounts would receive cash flow treatment with immediate deductions on deposited funds and taxation on withdrawals from such accounts. Under these rules, individuals would shelter the basis of their existing assets in non-qualified accounts to prevent windfall losses from double taxation of these assets. However, young and future generations would desire to deposit all their wealth in the qualified accounts. To prevent the resulting large drop in
immediate tax base the model restricts deposits in qualified accounts to one-third of an individual's wage income.24

McGee compares the transition from an income tax to the ICF tax under these rules with the transition from the same income tax equilibrium to the ICF tax with no defined rules. In his central simulation, a transition to a simple ICF tax increases steady state welfare by approximately 7 percent of lifetime consumption at the cost of lowering welfare of all those aged 22-50 at the time of implementation of the reform; some generations lose as much as 21 percent of their remaining lifetime consumption. In marked contrast, a transition to the ICF tax with the above-mentioned rules obtains the same increase in steady state welfare but with no generation losing more than 5 percent of their remaining lifetime consumption; the older generations escape the double tax and are only affected by the initial increase in tax rate on their asset income.

Second, McGee studies the effects of removing the balanced budget constraint from these model with a more practical policy of constant tax rates. Removing the fluctuation in tax rates in these models eliminate the postponement effect and partially reduces intergenerational redistributions significantly. For example, the lower initial tax rates lower the welfare loss for the elderly even under a simple ICF tax reform. The combination of a constant tax rate with the above transition rules results in near zero intergenerational redistributions. However, the steady state gain is also smaller, especially in models with high saving elasticities in which practically all of the steady gain occurs due to intergenerational transfers. In his central simulation, the steady state gain is no more than 0.2 percent of lifetime welfare.

24 The model differs from the Aaron and Galper proposal which allows income from old assets to be tax exempt.
Roadway (1990) refers to Gauthier (1988) who demonstrates the possibility of a Pareto-improving consumption tax reform by first implementing an ITP tax and then gradually replacing it with an ICF tax. This implies phasing in of the intergenerational redistributive component of the policy change with a slower pace of implementation corresponding to redistribution over a larger percentage of population.

This policy is rather complicated and would result in sacrificing much of the simplicity advantages of consumption taxation for many years. In addition to the problems of phasing in and simultaneous existence of two alternative tax systems (discussed above) the proportion of assets held treated under a particular tax alternative will vary with age during the transition. It essentially compounds the problems of the U.S. Treasury (1977) proposal of a simultaneous implementation of the two consumption-based tax alternatives with the problems discussed in Seidman's proposal of age phasing. Accordingly, this thesis shall consider alternative transition rules.

IV. Conclusion

Two important conclusions obtain from the above summary. First, the large differences in steady state welfare gains from ICF and ITP tax reforms obtained in Summers' model may be overstated. Smaller gains in welfare and smaller differences in steady state values between ICF and ITP tax reforms can be obtained using alternative assumptions, conservative parameter values and different functional forms of the utility function.

Second, a major factor affecting the steady state welfare gains (or losses) of a consumption tax reform is the intergenerational redistributions associated with the transition to such a reform.
The following chapters analyze two important issues ignored by the previous studies but certainly relevant to the above context. First, the thesis highlights the importance of distinguishing consumption taxation at the individual and business levels: incorporating business taxes explicitly in the model affects significantly the transition and steady state values under a consumption tax reform. Second, the thesis shows how properly designed transition rules can lower intergenerational redistributions without affecting final steady state values. The thesis also examines the conditions under which ICF and ITP tax reforms are equivalent.
CHAPTER THREE

THE ROLE OF THE CASH FLOW BUSINESS TAX

I. INTRODUCTION

Although the specific results of the simulation models of Summers and AK differ considerably due to differences in structure and in the parameter values used in simulating the models, one general result is strikingly clear — both Summers and AK stress that the ICF tax results in much larger steady state welfare gains than does the ITP tax. For example, as mentioned in the previous chapter, switching from an income tax to an ICF tax in a typical version of the AK model results in a welfare gain equal to 2.3 percent of the present value of lifetime resources (including leisure). In contrast, switching to the ITP form of the consumption tax reduces welfare by 0.9 percent. Analogous results in the Summers model are even more pronounced. For example, in one set of simulations the implementation of an ICF tax reform increases lifetime income by amounts that range from 11.2-11.7 percent, while the enactment of an ITP tax increases lifetime income by amounts that range from 1.4-7.0 percent. Summers and AK argue that these results indicate that the ICF form of a direct consumption tax is an reform option that is far superior to the ITP alternative.

The primary purpose of this chapter is to examine whether the ICF tax is in fact superior to the ITP alternative. In particular, as argued by Zodrow (1990), there are two important reasons why the Summers and AK results are likely to overstate seriously the relative superiority of the ICF approach. First, both models focus exclusively on individual level taxation, as they simply assume that business taxes are “passed through” to
individuals in the form of a higher tax rate on capital income.\footnote{1}{2} However, a full elaboration of the details of business level taxation — including the treatment of depreciation allowances, interest expense and dividends paid — is critical to evaluating the transitional effects of reform which, as indicated by the discussion in the previous chapter, play an important role in determining steady state welfare levels. In particular, all of the recent consumption tax proposals that recommend ITP treatment at the individual level also include a cash flow "consumption-based" tax (i.e., one that allows expensing of all purchases of depreciable assets) at the business level. However, as will be detailed below, replacing income taxation of business with a cash flow tax would result in some of the same transitional effects as does implementing an ICF tax in the Summers and AK models. As a result, the implementation of an ITP tax at the individual level, coupled with a cash flow tax at the business level, results in windfall gains and losses on the elderly and steady state welfare effects that are intermediate to the two extreme cases — all cash flow or all wage tax — analyzed by Summers and AK. By comparison, accounting for the transitional effects of implementing cash flow taxation at both the individual and the business levels tends to result in windfall gains and losses on the elderly and steady state welfare effects that are roughly similar to those obtained with the implementation of an ICF tax in the Summers and AK models.

Second, Summers and AK ignore the possibility that transition rules would be utilized to reduce the windfall gains and losses experienced by different generations.

\footnote{1}{See AK (Chapter 9, p. 127-144).

\footnote{2}{Although AK include a simple model of business taxation in a chapter that examines the differential effects of saving and investment incentives under an income tax, this extension is not used in their analysis of alternative forms of consumption taxation. In any case, their model of business taxation is sufficiently stylized that it largely precludes an examination of the transitional issues that are the focus of this paper.}
However, it seems unlikely that a reform as major as a shift to consumption taxation, which generates large windfall gains and losses, would not be accompanied by at least some transition rules designed to reduce these intergenerational redistributions. Accordingly, this chapter also examines the effects of implementing some practically feasible transition rules.³

The chapter also addresses another important issue often raised by opponents of consumption tax reforms. Specifically, many income tax proponents have argued that even if a direct tax on consumption were preferable to an income tax in terms of steady state comparisons, the transition to a consumption tax from an existing income tax would be so difficult that such a reform is infeasible. For example, as mentioned before, transitional problems was one of the primary reasons for the rejection of the consumption tax option by the Treasury (1984). The results in this paper suggest that this argument may also be overstated — at least in terms of the intergenerational redistributions caused by implementation of the combination of an ITP tax at the individual level and a cash flow business tax — as the magnitudes of such redistributions are relatively small in the model analyzed below.

The chapter is organized as follows. Section II presents the details of the basic model. Section III describes the simulation procedures used to examine the transition from an income tax to each of the two consumption tax alternatives and the steady state values under the three tax alternatives; it also discusses the parameter values used in the simulations. Section IV presents the results of simulated moves to the two consumption tax reform options; it examines both steady state and transitional effects, focusing on

³ In particular, the model does not rely on lump sum taxes and subsidies to reduce intergenerational redistributions.
reform-induced intergenerational redistributions. Section V tests the sensitivity of the model to changes in some important parameter values. Section VI examines the effects of transitional rules on these intergenerational redistributions, and a brief concluding section considers the implications of the results. Appendices 3A-3D provides technical details of the derivations used in the chapter; appendix 3E discusses the difference between the "traditional" and "new" views of dividend taxation, an issue relevant to this chapter.

II. THE MODEL

The intertemporal general equilibrium model utilized in this paper is most similar to that constructed by Keuschnigg (1990), which is an extension of Summers and AK. The model describes a closed economy that consists of three sectors — firms, households, and the government. Firm behavior is based on the "q" theory of investment, while household behavior is explained by the strict life-cycle model (bequests and inheritances are ignored). The government uses either income or consumption taxes to finance a fixed per capita level of public services, and is subject to an annual budget constraint. The model is similar in structure to the infinite-horizon asset price models of Summers (1987) and Goulder and Summers (1989), except that individuals are assumed to be finitely-lived, and individuals and firms are assumed to be myopic in their expectations about future prices and tax rates.

Both the life cycle theory of consumption and the "q" theory of investment require agents to form expectations about the future prices and tax rates. Almost all the research in this field has adopted either of two approaches. The first approach assumes that the current behavior of economic agents depends only on current or past prices and includes both myopic and adaptive expectations. General equilibrium models adopting this approach include Summers (1981), Fullerton, Shoven and Whalley (1983) and Seidman (1983). The alternative assumption — utilized by AK(1987), Keuschnigg (1990) and Goulder and
Summers (1989) — is that agents have rational expectations and perfectly foresee future prices and tax rates.

Neither perfect foresight nor myopia provides an accurate assumption about the behavior of an economic agent. AK criticizes myopic expectations as assuming that all households are irrational in a particular manner; they consider such an assumption as undesirable. Further, they state that transition paths of myopic life cycle economics are likely to differ significantly from perfect foresight paths. Unfortunately, they do not offer any empirical evidence to support their assertions. Ballard (1987) numerically simulates a consumption tax reform on a general equilibrium model under both static and rational expectations and obtains near similar results with perfect foresight generating welfare gains five to ten percent below those of myopia within ten years of implementation of a cash flow tax and converging to the same steady state values. Differences in foresight affect the speed of adjustment to a change in tax policy but the basic qualitative patterns of behavior are similar under both forms of expectations. Further, rational expectations seems an extremely sophisticated behavior on part of individuals whose utility functions are still as primitive as to be additively separable. As Ballard states: "This combination of assumptions yields models in which people have tremendous understanding of the external world and its prices, but little understanding of themselves."

This model incorporates myopic expectations for three reasons. First, myopic expectations allows the economy's dynamic path to be solved recursively, one year at a time. In contrast, perfect foresight necessitates simultaneous solution for all transition

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4 The difference in values depends on the discount rate and the intertemporal elasticity of savings.

periods and is cumbersome from a computational standpoint. Myopia makes computation much simpler.

Second, as mentioned above, the basic qualitative patterns of behavior are the same under both forms of expectations and, accordingly, the basic results obtained in the following analysis would also obtain in a perfect foresight model.

Third, the model described below incorporates an adjustment cost function which dampens the large investment swings in the initial years of transition. The presence of this dampening effect narrows the difference between transitional paths obtained under myopic and perfect foresights.

The model is constructed in a discrete time frame and the following convention is adopted: Consumption, investment, prices and taxes are measured at end of period, but individual asset accumulation and capital stock are measured at the beginning of each period, reflecting wages, consumption and investment in previous period. Present values are taken at the end of each period. Thus, for example, the value of assets measured at the beginning of period two must be adjusted by interest for one period. This convention follows, among others, Seidman (1984) and Keuschnigg (1990). The remainder of this Chapter describes the model in detail; the notation used is summarized in Table 3.1.

A. Individual Behavior

Individual behavior is modeled using an overlapping generations framework that consists of fifty cohorts (denoted by ages that range from $a=0$ to $a=T=49$), each of which has an economic life span of fifty years. Individual tastes are identical so that differences in behavior across generations are due solely to differences in lifetime budget constraints, and a single individual is representative of each generation.
### TABLE 3.1 SUMMARY OF MODEL NOTATION

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$F$</td>
<td>Production function</td>
</tr>
<tr>
<td>$P_t(a)$</td>
<td>Population of age $a$ at time $t$</td>
</tr>
<tr>
<td>$K_t$</td>
<td>Capital stock at time $t$</td>
</tr>
<tr>
<td>$L_t$</td>
<td>Effective labor at time $t$</td>
</tr>
<tr>
<td>$L_t$</td>
<td>Labor force at time $t$</td>
</tr>
<tr>
<td>$DIV_t$</td>
<td>Dividend at time $t$</td>
</tr>
<tr>
<td>$I_t$</td>
<td>Investment at time $t$</td>
</tr>
<tr>
<td>$T_{E_t}$</td>
<td>Corporate tax at time $t$</td>
</tr>
<tr>
<td>$EARN_t$</td>
<td>Corporate earnings at time $t$</td>
</tr>
<tr>
<td>$V_t$</td>
<td>Value of equity at time $t$</td>
</tr>
<tr>
<td>$B_t$</td>
<td>Value of bonds at time $t$</td>
</tr>
<tr>
<td>$BN_t$</td>
<td>New bond issues at time $t$</td>
</tr>
<tr>
<td>$VN_t$</td>
<td>New share issues at time $t$</td>
</tr>
<tr>
<td>$w_t$</td>
<td>Wage at time $t$</td>
</tr>
<tr>
<td>$w^e_t$</td>
<td>Effective wage at time $t$</td>
</tr>
<tr>
<td>$i_t$</td>
<td>interest at time $t$</td>
</tr>
<tr>
<td>$r_t$</td>
<td>return on equity at time $t$</td>
</tr>
<tr>
<td>$K^C_t$</td>
<td>Capital for ACRS</td>
</tr>
<tr>
<td>$ITC_t$</td>
<td>Investment Tax Credit at time $t$</td>
</tr>
<tr>
<td>$Q_t$</td>
<td>Average price of equity at time $t$</td>
</tr>
<tr>
<td>$C_{t(a)}$</td>
<td>Individual consumption of person of age $a$ at time $t$</td>
</tr>
<tr>
<td>$C_t$</td>
<td>Aggregate consumption at time $t$</td>
</tr>
<tr>
<td>$A_{t(a)}$</td>
<td>Individual financial wealth of person of age $a$ at time $t$</td>
</tr>
<tr>
<td>$A_t$</td>
<td>Aggregate asset wealth at time $t$</td>
</tr>
<tr>
<td>$GEXP_t$</td>
<td>Government expenditure at time $t$</td>
</tr>
<tr>
<td>$n$</td>
<td>Population growth rate</td>
</tr>
<tr>
<td>$g$</td>
<td>Technological growth rate</td>
</tr>
<tr>
<td>$k$</td>
<td>Capital per effective labor</td>
</tr>
<tr>
<td>$\zeta$</td>
<td>Dividend payout fraction</td>
</tr>
<tr>
<td>$b$</td>
<td>Debt capital ratio</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>Capital share in the production function</td>
</tr>
<tr>
<td>$\beta$</td>
<td>Adjustment cost parameter</td>
</tr>
<tr>
<td>$\delta$</td>
<td>Depreciation rate</td>
</tr>
<tr>
<td>$\mu$</td>
<td>Adjustment cost parameter</td>
</tr>
<tr>
<td>$\delta_t$</td>
<td>Accelerated depreciation rate for tax purposes</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Intertemporal elasticity of substitution</td>
</tr>
<tr>
<td>$\rho$</td>
<td>Rate of time preference</td>
</tr>
<tr>
<td>$\tau_b$</td>
<td>Corporate tax rate</td>
</tr>
<tr>
<td>$\tau_w$</td>
<td>Wage tax rate</td>
</tr>
<tr>
<td>$\tau_c$</td>
<td>Consumption tax rate</td>
</tr>
<tr>
<td>$\tau_d$</td>
<td>Dividend tax rate</td>
</tr>
<tr>
<td>$\tau_g$</td>
<td>Capital gains tax rate</td>
</tr>
<tr>
<td>$\tau_i$</td>
<td>Tax rate on interest income</td>
</tr>
</tbody>
</table>
Individual behavior follows the strict life cycle model, as bequests and inheritances are ignored. Preferences for current and future consumption are represented by a constant elasticity of substitution (CES) utility function

$$U = \frac{1}{1-1/\sigma} \sum_{s=0}^{49} \frac{C_s}{(1+\rho)^s}^{1-1/\sigma},$$

where $C_s$ denotes consumption at time $s$, $\sigma$ is the intertemporal elasticity of substitution and $\rho$ is the pure rate of time preference — the rate at which the individual discounts future consumption. The intertemporal elasticity of substitution, $\sigma$, denotes the percentage change in the ratio of consumption in any two years with respect to a percentage change in the ratio of prices in the two years, and equals $[\delta \ln(C_{t+1}/C_t)]/[\delta \ln(U_{t+1}/U_t)]$. The term $\rho$, the "pure" rate of time preference, reflects the extent to which the individual discounts future consumption and larger values of $\rho$ imply relatively large levels of consumption early in life. Although fixed values of $\rho$ and $\sigma$ restrict individual preferences, this model is sufficiently rich to allow considerable variation in individual behavior.\(^6\)

In the absence of taxes and transfers, the individual lifetime budget constraint is

$$\sum_{s=0}^{49} \frac{C_s}{(1+i_t)^s} = \sum_{s=0}^{39} \frac{w_s}{(1+i_t)^s},$$

where $T'=39$ is the age at which the individual retires, $w_s$ is the wage rate in period $s$ and $i_t$ is the interest rate in period $t$.\(^7\) The wage rate, which is the same for all workers in any time period, increases over time at the rate of technological growth $g$, so that $w_s=(1+g)^s$.

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\(^6\) See AK (1987), who also note that limited empirical evidence regarding the values of the parameters in the utility function precludes more elaborate formulations of individual tastes.

\(^7\) The constant interest rate is implied by the assumption of myopic expectations.
\[ t w_t \text{, where } w_t \text{ is the wage rate in period } t. \] An individual of age \( a \) at time \( t \) can accumulate assets \( A_t(a) \) from the time of "economic birth" (when \( A_t(0) = 0 \)) as well as fund consumption (including that during the retirement period) from age \( a=40 \) to death at age \( a=49 \) by drawing down these assets, with \( A_t(50) = 0. \)

At any time \( t \), an individual of age \( a \) plans \( C_{s-a}(a) \) for \( s = a + t, \ldots, T + t \), to maximize rest-of-life utility

\[ \frac{1}{(1-1/\sigma)} \sum_{s=a+t}^{t+49} \frac{C_{s-a}(a)(1-1/\sigma)}{(1+\rho)^{s-a-t}}, \quad (3.3) \]

subject to the "rest-of-life" budget constraint

\[ \sum_{s=a+t}^{t+49} \frac{C_{s-a}(a)(1+\tau_{ct})}{[1+i(1-\tau_{it})]^{s-a-t}} = A_t(a)[1+i(1-\tau_{itt})] + \sum_{s=a+t}^{t+39} \frac{w_{s-a}(1-\tau_{wt})}{[1+i(1-\tau_{it})]^{s-a-t}}, \quad (3.4) \]

where \( \tau_{ct} \) is the tax rate under the ICF tax, \( \tau_{wt} \) is the tax rate under the ITP tax (and the tax on wage income under the income tax), and \( \tau_{it} \) is the tax rate under the income tax, so that \( i(1-\tau_{itt}) \) is the after tax rate of return on the asset under the income tax regime.

The assumption of myopic expectations implies that the individual maximizes rest-of-lifetime utility in any time period \( t \) expecting that wages, interest rates and tax rates will remain indefinitely at their values in that period. Although these expectations are accurate

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\(^8\) As discussed later, the model assumes that arbitrage occurs at the individual level so that individuals get the same after tax rate of return from different types of assets. It is, therefore, reasonable to define the aggregate asset accumulation of each individual as \( A_t(a) \).
in the steady state, these variable change during the transition from one steady state to another in response to a change in the tax system. Thus, during this transition, the consumer must recalculate the optimal consumption plan in each period.

The Lagrangian for the consumer optimization problem is thus

$$\ell = \frac{1}{(1-1/\sigma)} \sum_{s=a+t}^{49+t} C_{s-a}(1-1/\sigma) \frac{C_{s-a}(1+\tau_{ct})}{(1+i(1-\tau_{it}))^{s-a-t}} - \lambda_t \sum_{s=a+t}^{49+t} \frac{C_{s-a}(1+\tau_{ct})}{(1+i(1-\tau_{it}))^{s-a-t}} \cdot A_t(a)[1+i(1-\tau_{it})]$$

$$- \sum_{s=a+t}^{t+39} \frac{w_{s-a}(1-\tau_{wt})}{(1+i(1-\tau_{it}))^{s-a-t}}$$

where $\lambda_t$ is the shadow price of the lifetime budget constraint in period $t$ and equals the marginal utility of income. Solving for the optimal time path of $C_{s-a}$ yields

$$C_{s-a}(a) = [\lambda_t(1+\tau_{ct})]^{-\phi} \phi^{s-a-t}, \quad s=a+t, \ldots, T+t,$$

(3.5)

where $\phi = [(1+i(1-\tau_{it}))(1+\rho)]^{\sigma}$.

Substituting the optimal $C_{s-a}(a)$ into the budget constraint (3.4) yields

$$[\lambda_t(1+\tau_{ct})]^{-\phi} =$$

$$\left\{ A_t(a)[1+i(1-\tau_{it})] + [w_t(1-\tau_{wt})] M_a^T [(1+g)/(1+i(1-\tau_{it}))] \right\}$$

$$M_a^T[z]$$

where $z = \phi/[1+i(1-\tau_{it})]$, and for any argument $x$ of the function $M,$
\[ M^T_a(x) = \sum_{s=a}^{T^*} x^s = (x^{T^*} + x^0) / (x - 1), \quad x \neq 1. \]

The time path of consumption can thus be simplified to

\[ C_{s-a}(a) = [C_t(a)] \psi^{s-a-t}, \quad s = a + t, \ldots, T + t, \quad (3.6) \]

where \( C_t(a) = \{ A_t(a) + \{ w_t(1-\tau_w) \} M^T_a[(1+g)/(1+i(1-\tau_d))] \} / \{ (1+\tau_c) M^T[a] \}. \) The value of \( \psi - 1 \) denotes the rate at which consumption increases with age and \( C_t(a) \) denotes the value of the expected lifetime wealth of the individual at time \( t \) — comprising of the existing asset wealth plus the expected human wealth to be earned as wages from the present until retirement.

**B. Firm Behavior**

The behavior of the firm is based on Tobin's "q" theory of investment, as extended to include adjustment costs by Abel (1982) and Hayashi (1982). The economy has a single production sector characterized by a Cobb-Douglas production function

\[ F(K_t, L_t) = K_t^{\alpha} L_t^{1-\alpha}, \quad 0 < \alpha < 1, \quad (3.7) \]

where \( K_t \) and \( L_t \) denote inputs of capital and effective labor used for production in period \( t \) and \( \alpha \) is the capital share parameter in the production function.

In the interest of simplicity (and following Summers), labor supply \( (L) \) is assumed to be exogenous and the size of the population of any age, \( P(a) \), is assumed to grow at a constant rate \( n. \) Technological growth takes place in purely labor augmenting form at a constant rate \( g. \) Thus, in period \( t, \)
\[ L_t = \sum_{s=0}^{39} P_t(s), \quad (3.8) \]

\[ P_t(a) = (1+n)P_{t-1}(a), \quad (3.9) \]

while

\[ L_t = L_t(1+g)^t. \quad (3.10) \]

Gross investment in period \( t \), \( I_t \), equals

\[ I_t = K_{t+1} - (1-\delta)K_t, \quad (3.11) \]

where \( \delta \) is the rate at which capital depreciates. The investment and production goods are assumed to be identical.

In order to model more realistically the adjustment of the capital stock to a change in the tax structure as significant as a move from income to consumption taxation, adjustment costs are included in the model; these costs reflect the resources that must be devoted to installing the new capital rather than producing output. Following Goulder and Summers (1989), the adjustment cost function is assumed to be linearly homogeneous in total investment \( I_t \) and the capital stock \( K_t \), and to take the form

\[ \Phi_t(I_t/K_t) = (\beta/2)(I_t/K_t - \mu)^2 / (I_t/K_t) \quad (3.12) \]

where \( \beta \) and \( \mu \) are the adjustment cost parameters; higher values of \( \beta \) and lower values of \( \mu \) imply higher adjustment costs. The adjustment cost function plays an important role in modeling the transition from one tax regime to another; this is especially true in models
characterized by myopic expectations since adjustment costs dampen what would otherwise be very large investment swings in the initial years after tax reform.

Investment can be financed with either debt or equity. Firms are assumed to maintain a constant debt-capital ratio "b", which implies

\[ B_t = bK_t, \quad (3.13) \]

where \( B_t \) is the stock of outstanding debt at time \( t \). This assumption follows Goulder and Summers (1989) and Keuschnigg (1990). It is of course rather strong, especially in the context of a consumption tax reform that would significantly affect the relative costs of debt and equity capital and thus be expected to alter the debt-capital ratio. It is made primarily on simplicity grounds; in particular, it avoids the need to specify a model of the firm's optimal debt-equity ratio. New bond issues in period \( t \), \( BN_t \), are the difference in bonds outstanding in two consecutive periods, or \( BN_t = B_{t+1} - B_t \). Combining (3.11) and (3.13) yields

\[ BN_t = b(K_{t+1} - K_t) = b(I_t - \delta K_t). \quad (3.14) \]

Note that this formulation implies that existing loans are repaid at the rate of depreciation of the existing capital stock; that is, loans outstanding in period \( t+1 \) are \( B_{t+1} = bK_{t+1} = bK_t - \delta bK_t + bI_t \), so that the amount of old debt is \( bK_t \), \( \delta bK_t \) is the amount of this existing debt that is repaid, and \( bI_t \) is the amount of new debt that is accumulated.

The treatment of equity finance depends on whether one adopts the "traditional" or the "new" view of the effects of dividend taxation. Under the traditional view, marginal investments are effectively assumed to be financed with new share issues, and the effective tax rate on equity income at the individual level is a weighted average of the tax rate on
dividends $\tau_d$ and the effective accrual tax rate on capital gains $\tau_g$. In contrast, under the new view, "mature" firms are assumed to finance investment solely with retained earnings, which in turn implies avoidance of the payment of dividends that would be taxable to the individual recipient. (Taxable dividends are assumed to be the only method of distributing earnings to shareholders.) In this case, the benefit of the deferral of tax liability on foregone dividends exactly offsets the future dividend taxes that must be paid when the returns to the investment are eventually distributed. As a result, dividend taxes have no effect on the returns to investment financed with retained earnings. [See Appendix 3E for a discussion on the traditional and new views of dividend taxation.]

Although the "new view" has received a great deal of attention in the literature, it currently seems to be losing support, primarily because most empirical studies are consistent with the predictions of the traditional view. For example, in a review of three recent studies of the effects of corporate-individual tax integration in the U.S., McLure (1991, p. 148-9) notes that "...the new view seems to lack commensurate empirical support, and has recently lost favor. I was struck by the total absence of adherence to the "new view" in these three papers. One suspects that the 'traditional' view will once again dominate whatever debate occurs on integration."

The model in this paper follows the old view closely by assuming that the firm pays dividends equal to a fixed fraction of after tax profits and finance marginal investment by new debt issue, by current earnings, and, if necessary, by new share issues. This implies that the after-tax rate of return to equity investment in period $t$ ($r_h^t$) is

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9 The effective tax rate on capital gains is generally lower than the actual statutory personal tax rate due to the taxation of gains on a realization basis (rather than on accrual) and the exemption of gains transferred at death; however, the taxation of nominal (rather than only real) gains acts to offset these two factors.
\[ r_t = \frac{(1 - \tau_d) \text{DIV}_t + (1 - \tau_g)(V_{t+1} - V_t - VN_t)}{V_t} \]  
(3.15)

where \( V_t \) is the value of the firm, \( VN_t \) is new share issues, \( (V_{t+1} - V_t - VN_t) \) is the capital gain on outstanding shares, and \( \text{DIV}_t \) is dividends paid, all measured in period \( t \).

Total equity earnings in any period \( t \), \( \text{EARN}_t \), are defined as the value of output (with the production good chosen as the numeraire with a price equal to one) less labor costs with wage \( w_t \) and interest payments at rate \( i_t \) on a total level of indebtedness \( B_t \), or

\[ \text{EARN}_t = F(K_t, L_t) - w_t L_t - i_t B_t. \]  
(3.16)

Dividends paid are assumed to equal a constant fraction (\( \zeta \)) of the after-tax earnings of the firm net of economic depreciation, or

\[ \text{DIV}_t = \zeta(\text{EARN}_t - \text{TE}_t - \delta K_t) \]  
(3.17)

where \( \text{TE}_t \) is total corporate taxes paid in period \( t \). This assumption follows Goulder and Summers (1989) and Keuschnigg (1990).

\( \text{TE}_t \) is defined so that all three types of taxes — the income tax and the two forms of the consumption tax — can be analyzed within a single framework. The income tax allows depreciation deductions that assume exponential depreciation at rate \( \delta < \delta \) on the tax basis of the current capital stock \( K_t \). In addition, the value of any investment tax credit (ITC) is deducted from the tax liability in year of purchase. Interest expense is fully deductible, but dividends paid are not deductible.
In contrast, under either of the two consumption tax alternatives, the cash flow tax at the business level allows immediate full deductions or "expensing" for all non-financial business-related expenditures. Equity contributions are not included in the tax base and dividends are not deductible. The business level taxes of the two consumption tax alternatives differ only in their treatment of debt. Under a "R-based" business tax — a tax on only "real" transactions — loan proceeds, repayments of principal, and interest payments are totally ignored.\(^{10}\) Such treatment is clearly consistent with the ITP approach at the individual level; this combination of individual and business level taxes will be referred to as the ITP/R option. By comparison, under a "R+F-based" business tax — a tax on "real and financial" transactions — loans are treated on a cash flow basis, as loan proceeds are included in the tax base and repayments of principal and interest payments are deductible. Such treatment is clearly consistent with the ICF approach, and the combination of these two taxes will be referred to as the ICF/RF approach.

Thus, assuming a corporate business tax rate of \(\tau_b\), total corporate taxes \(TE_t\) are\(^{11}\)

\[
TE_t = \tau_b \{ F(K_t, L_t) - w_t L_t - \Phi I_t - f_1 I_t - f_2 I_t - f_3 b I_t - f_4 \delta b K_t - f_5 \delta^t K_t^t \} - (ITC_t) I_t.
\]

(3.18)

Under an income tax, \(f_1 = f_3 = f_4 = 0\) and \(f_2 = f_5 = 1\); \(ITC_t\) may be positive or zero. Under both of the "consumption-based" business taxes, \(f_1 = 1, f_5 = 0\) and \(ITC_t = 0\). Under the R-

\(^{10}\) The "R" and "R+F" terminology follows the Institute for Fiscal Studies (1978).

\(^{11}\) Adjustment costs are deductible as expenses but are ineligible for investment tax credits.
based cash flow business tax, \( f_2 = f_3 = f_4 = 0 \), while under the R+F-based cash flow business tax, \( f_2 = f_3 = f_4 = 1 \).

Finally, in any period \( t \), cash inflows must equal total disbursements, or\(^{12}\)

\[
\text{EARN}_t + \text{BN}_t + \text{VN}_t = \text{DIV}_t + I_t (1 + \Phi) + \text{TE}_t.
\]

(3.19)

The formulation above implies that there are two financial assets in the model—bonds and equity. The determination of an equilibrium requires a specification of the nature of arbitrage in the model. If arbitrage occurs at the firm level, corporations generate a marginal rate of return on equity-financed investment that equals the after-corporate-tax interest rate, and individual after-tax returns differ across assets. If arbitrage occurs at the individual level, the after-tax returns to debt and equity are equal at the individual level, and the cost of capital to the firm differs across methods of finance.\(^{13}\) Although either choice is somewhat arbitrary, the latter is more consistent with the assumption of a closed economy and, as noted above, greatly simplifies matters since individual asset accumulation can be modeled using a single after-tax rate of return. Accordingly, following Keuschnigg and Goulder and Summers, the model assumes individual level arbitrage, which implies \( r_t = (1 - \tau_t) i_t \). In this case, (3.15) becomes

\[
V_{t+1} = V_t (1 + \theta_t) + VN_t - [(1 - \tau_d) / (1 - \tau_g)] \text{DIV}_t,
\]

(3.20)

\(^{12}\) This formulation does not allow cash accumulation by the firm.

\(^{13}\) In the absence of considerations of uncertainty, both arbitrage conditions generally cannot be satisfied simultaneously; see King and Fullerton (1984) for a discussion of this issue.
where \( \theta = [(1- \tau_i) i] / (1- \tau_g) \). Given myopic behavior and imposing the transversality condition

\[
\lim_{T \to \infty} V_{T+1} \sum_{s=t}^{T} \frac{1}{(1+\theta)^{T-i+1}} = 0,
\]

(which rules out the possibility that the firm may become infinitely large), (3.20) may be solved forward to obtain an expression for the value of the firm

\[
V_t = \sum_{s=t}^{\infty} \frac{[(1- \tau_d)/(1- \tau_g)] \text{DIV}_s - \text{VN}_s}{(1+\theta)^{s-t+1}},
\]

(3.21)

for \( s \geq t \). That is, \( V_t \) equals the present value of all future net distributions to shareholders.\(^{14}\)

With perfect capital markets and in the absence of uncertainty, the firm chooses \( L_s \) and \( I_s \) to maximize its market value (3.21) subject to the constraints (3.7-3.19). As shown in Appendix 3A, this implies maximizing

\[
V_t = \sum_{s=t}^{\infty} \frac{1}{(1+\theta)^{s-t+1}} \{ \Omega(1-\tau_b)[F(K_s, L_s) - w_s L_s] - K_s[\Omega(1-\tau_b f_2) i_3 b - \delta(1-b-\Omega(1-\tau_b f_4 b))] \\
- I_s [1- b + (1-\Omega \tau_b) \Phi_s - \Omega(\tau_b(f_1- f_3 b) + ITC)] + f_3 \Omega \tau_b \delta \Phi K_s^3 \},
\]

(3.22a)

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\(^{14}\) Note that under the assumption of individual arbitrage, the firm's discount rate is increased to reflect the fact that dividend distributions avoid the capital gains tax that arises when the firm retains earnings.
where \( \Omega = [\zeta(1-\tau_d) + (1-\zeta)(1-\tau_g)] / (1-\tau_d) \). Note that \( f_5 \Omega \tau_b \delta \delta^t K_s^t \) reflects the total amount of tax savings from depreciation allowances under the income tax. Since the firm controls only future investments — those made during or after period \( t \) — it is convenient to separate this term into two components — depreciation allowances attributable to past investments (made prior to period \( t \)) and those attributable to future investments. Let \( Z_t = [\Omega \tau_b \delta^t] / ([\theta + \delta^t]) \) denote the tax savings due to depreciation allowances on future investments, and let \( X_t = Z_t K_s^t \) denote the present value of tax savings due to depreciation allowances on existing capital. Substituting these values in (3.22a) yields

\[
V_t = \sum_{s=t}^{\infty} \frac{1}{(1+\theta)^{s-t+1}} \Gamma + f_5 X_t, \tag{3.22b}
\]

where

\[
\Gamma = \Omega(1-\tau_b)(F(K_s, L_s) - w_s L_s) - K_s[\Omega(1-\tau_b f_2)_s b - \delta (1-b-\Omega(1-\tau_b f_4))] - I_s \{1-b-\Omega(\tau_b (f_1-f_3 b) + ITC) + f_5 Z_t + (1-\Omega \tau_b) \Phi^t\}.
\]

The firm maximizes (3.22b) subject to the constraints (3.11) and \( \lim_{T \to \infty} K_T \geq 0 \). The necessary conditions for a maximum are

\[
w_s = F_L \tag{3.23a}
\]

\[
q_{s+1} = 1-b-f_5 Z_t - \Omega[\tau_b(f_1-f_3 b) + ITC] + (1-\Omega \tau_b)(\Phi_s + (1/K) \Phi^t_s)
\]

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15 Asset sales are precluded by assumption.

16 These expressions are derived in Appendix A.
\[ i_s = \frac{\Omega(1-\tau_b)F_K + \delta(1-b-\Omega(1-\tau_b)\alpha)}{\Omega(1-\tau_b)F_2} + (1-\delta)q_{s+1} - q_s + (1-\Omega\tau_b)(I/K)^2q_s \]

\[ \lim_{T \to \infty} K_{T+1} \geq 0; \lim_{T \to \infty} q^*_T \geq 0 \text{ and } \lim_{T \to \infty} K_{T+1}q^*_T = 0. \]

Equation (3.23a) shows that the wage rate equals the marginal product of labor, FL. Equation (3.23b) describes the variable commonly known as Tobin's q — the ratio of the market value of capital to its replacement cost. It demonstrates that the shadow price of additional capital goods \((q_{s+1})\) must equal the after-tax marginal cost of capital goods (the right hand side). Since the investment good is the numeraire, the shadow price is simply one in the absence of debt and taxes.\(^17\) The second term reflects the financing of a fraction \(b\) of the cost of the investment with debt. The third term reflects the reduction in the shadow price of new capital goods due to tax deductions for depreciation. The fourth term reflects any additional tax deductions for expensing (of only the equity financed portion of the investment in the case of the R+F base) and the investment tax credit.\(^18\) The last term reflects the costs of installing new capital goods with immediate expensing of such

\(^{17}\) This results from the assumption of the traditional view of dividend taxation. For details, see Appendix 3E.

\(^{18}\) Thus, under the ITP/R system \((f_3=0, f_1=\Omega=1)\) immediate expensing lowers the shadow price by the tax rate, while under the ICF/RF system \((f_1=f_3=\Omega=1)\), new debt accumulation is taxed so that expensing lowers the shadow price by only \(b(1-\tau_b)\).
adjustment costs. Rewriting this equation, the optimal investment rate for the firm is given by

\[ I/K = 1/\beta \left( (q_{s+1} - 1 + b + f_2 Z_t + \Omega(\tau_b f_1 - f_3 b + ITC))/(1 - \Omega \tau_b) \right) + \mu. \]

(3.23e)

Equation (3.23c) is the Euler equation. It can be written as a difference equation in \( q_b \) which can be solved to yield

\[ q_t = \sum_{s=t}^{\infty} \frac{(1 - \delta)s - t}{(1 + \theta)s - t} \left\{ \Omega(1 - \tau_b f_2) b_2 + \delta(1 - b - \Omega(1 - \tau_b f_4)) \right\} + (1 - \Omega \tau_b)(I/K^{2 \Phi^2}) \].

(3.23f)

A unit of newly installed capital will generate a stream of future income reflecting the productivity of the asset, depreciation allowances, savings in future installation costs and future interest payments. The above equation guarantees that the shadow price of new capital equals the present value of this incremental after-tax income stream. Equation (3.23c) can also be rewritten as

\[ F_K = \frac{\Omega(1 - \tau_b f_2) b_2 + \delta(1 - b - \Omega(1 - \tau_b f_4)) + (1 + \theta)q_s - (1 - \delta)q_{s+1} - (1 - \Omega \tau_b)(I/K)^{2 \Phi^2}}{\Omega(1 - \tau_b)}, \]

(3.23g)
which is the user cost of capital developed by Jorgenson (1963) — the minimum return the investment must yield in order to provide the investor with the same rate of return that would be received from lending at the after-tax interest rate.

Finally, following Hayashi (1982) or Keuschnigg (1990), the assumptions of linear homogeneity of the production function and homogeneity of degree zero in investment and capital of the adjustment cost function, imply the following relationship between marginal q and average q (denoted as Q):

\[ q_s = \frac{V_s-f(X_s)}{K_s}, \quad Q_s = \frac{V_s}{K_s}. \quad (3.24) \]

C. The Government

The government is assumed to maintain a constant level of expenditures per effective unit of labor (GEXP) in all time periods. It finances such expenditures solely with income or consumption tax revenues, and balances its budget on an annual basis. Government expenditures do not enter the individual utility function.\(^{19}\)

As noted above, the annual balanced budget constraint imposes strong restrictions on government behavior. In particular, it precludes the use of debt policy to reduce the differences in the steady state welfare effects of the ICF/RF and ITP/R taxes,\(^{20}\) or to ameliorate the transitional effects of moving to a consumption tax.\(^{21}\) Nevertheless, to

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19 Alternatively, the utility function is separable into public goods and all other consumption.


facilitate comparison with the Summers and AK models, the model assumes annual budget balance. Thus, in any time period \( t \), the government budget constraint is \(^{22}\)

\[
G_t = \tau_w w_t L_t + \tau_c C_t + \tau_d DIV_t + \tau_i i_t B_t + \tau_g (V_{t+1} - V_t - VN_t) + TE_t.
\]

(3.25)

D. Market Equilibria

The model assumes that the labor, goods and asset markets clear in each period. Labor market clearing requires equality of labor demand and supply or

\[
L_t = (1+g)^t \sum_{a=0}^{39} P_t(a).
\]

(3.26)

Capital market clearing requires that the total financial wealth of all individuals (summing across all cohorts alive in period \( t \)) equal the sum of the total market value of equity \( Q_t K_t \) plus the value of all outstanding debt \( B_t \), or

\[
\sum_{a=0}^{49} A_t(a) = Q_t K_t + B_t = (Q_t + b) K_t.
\]

(3.27)

Finally, equilibrium in the goods market requires

\[
F(K_t, L_e_t) = C_t + I_t (1 + \Phi_t) + G_t
\]

(3.28)

\(^{22}\) This assumes that capital gains are taxed at the personal level each period at the effective accrual rate \( \tau_g \).
or that total production is devoted either to consumption, investment in capital goods (including adjustment costs) or government purchases.

E. Measuring Reform-Induced Welfare Changes

Since individual lifetime utility is specified by (3.1), the change in "rest-of-life" welfare that occurs when the income tax is replaced with a consumption tax can be calculated explicitly using an equivalent variation measure, which will be denoted $EV^R$. For a representative individual of cohort "a", $EV^R(a)$ will measure the percentage change in the "rest-of-life" resources — to be defined below — that would be needed in the original income tax equilibrium to produce the same level of "rest-of-life" utility as that obtained under the alternative consumption tax regime. Following AK and Seidman (1983), this equivalent variation measure can be determined as follows.

First, note that the "rest-of-life" utility under the income tax system (denoted as $U^g_Y$) is

$$U^g_Y(a) = \frac{1}{(1-1/\sigma)} \sum_{s=a+t}^{49+t} \frac{C_{Y_{s-a}}(a)(1-1/\sigma)}{(1+r)^{s-a+t}},$$

where $C_{Y_{s-a}}(a)$ is the consumption chosen in period $s-a$ by an individual of age $a$ in period $t$ under the initial income tax regime. Since this utility function is homothetic, the change in the "rest-of-life" resources needed in the original income tax equilibrium to produce the same level of "rest-of-life" utility obtained under an alternative consumption tax regime can be expressed as a proportional change in consumption levels under the income tax in each period from $t$ to $T$. That is, $EV^R(a)$ must satisfy

$$U^R_C(a) = \frac{1}{(1-1/\sigma)} \sum_{s=a+t}^{49+t} \frac{[(1+EV^R(a))C_{Y_{s-a}}(a)](1-1/\sigma)}{(1+r)^{s-a+t}},$$

(3.29)
where \( U^R_C(a) \) is the "rest of life" utility for an individual of age \( a \) at time \( t \) under the consumption tax alternative. Factoring \([1+EVR(a)]^{1/(1-\alpha)}\) out of (3.29) and solving using (3.28) yields

\[
EV^R(a) = [U^R_C / U^R_y]^{1/(1-\alpha)} - 1. \tag{3.30}
\]

III. SIMULATION METHODOLOGY AND PARAMETER VALUES

A. Simulation Methodology

The Steady State

In the steady state, the rate of gross investment must equal the sum of the growth rate (due to population growth and technological advance) and the rate of economic depreciation, or

\[
I/K = (n+g+ng+\delta). \tag{3.31}
\]

Given the assumption of a closed economy, total saving equals investment net of depreciation (with replacement investment financed from returns to the existing capital stock). Total saving is the sum of corporate retained earnings (RE) and aggregate personal saving (PS), or

\[
RE + PS = (n+g+ng)K. \tag{3.32}
\]

Retained earnings and personal saving are straightforward to define except for the role of capital gains. The treatment of capital gains described above implies that capital gains are realized in each period and taxed at the personal level. Accordingly, to avoid double
counting, capital gains are subtracted from the gross earnings of the firm and treated as individual saving. Thus, retained earnings are defined as earnings less depreciation, adjustment costs, corporate taxes, dividends and capital gains or

\[ \text{RE} = \text{EARN} - \delta K - \text{TE} - \text{DIV} - (\Delta V - \text{VN}) - \Phi I, \]  \hspace{1cm} (3.33)

where \( \Delta V \) is the steady state annual change in the value of the firm; this change equals the product of average \( Q \) and the steady state change in the capital stock, or

\[ \Delta V = Q \Delta K = Q(n + g + ng)K. \]  \hspace{1cm} (3.34)

Personal saving is total personal income net of personal taxes minus aggregate consumption, or

\[ \text{PS} = w(1 - \tau_w)L + rA - C(1 + \tau_c). \]  \hspace{1cm} (3.35a)

Using the capital market clearing condition (3.27), personal saving becomes \(^{23}\)

\[ \text{PS} = w(1 - \tau_w)L + r(Q + b)K - C(1 + \tau_c). \]  \hspace{1cm} (3.35b)

Substituting equation (3.33) in equation (3.32) yields

\[ \text{PS} + \text{EARN} - \text{DIV} - \text{TE} - (\Delta V - \text{VN}) = (1 + \Phi)I. \]

\(^{23}\) Note that (3.15) can be used to rewrite this as \( \text{PS} = w(1 - \tau_w)L + (1 - \tau_d)\text{DIV} + (1 - \tau_d)B + (1 - \tau_g)(\Delta V - \text{VN}) - C(1 + \tau_c). \) Substituting this expression along with (3.33) in (3.32) gives us the market clearing condition in the commodity market (3.28).
Subtracting BN and VN from both sides and using (3.19), aggregate personal saving equals the change in the market value of equity plus new bond issues, or

$$PS = AV + BN.$$  

Substituting from (35b), (3.34) and (3.14) yields

$$w(1-\tau_w)L + r(Q+b)K - C(1+\tau_c) = (b+Q)(n+g+ng)K.$$  \hspace{1cm} (3.36)

Rewriting this equation after some manipulation (as described in Appendix 3B)

$$F_K = \frac{[\alpha/(1-\alpha)](r-n-g-ng)(Q+b)}{(1-\tau_w)(\xi-1)},$$  \hspace{1cm} (3.37)

where $\xi = [C/(1-\tau_c)]/[\tau_w]^\omega L$24. The left hand side of (3.37) is the user cost of capital [obtained from (23c)] and, given the initial parameter values and tax rates, is a function of $r$ under the initial steady state conditions ($q_s=q_s$). The steady state values of $Q$ and $\xi$ are also constant depending only on the initial parameter estimates and the value of $r$. [See Appendix 3B.] Expression (3.37) thus reduces to a non-linear equation in $r$ and can be solved by an iterative process. This equation is used to calculate the steady state interest rate under the different tax regimes. Given $r$, the values of the remaining variables are obtained from equations (3.1-3.24).

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24 The term $w^\omega$ is the effective wage rate and, in equilibrium, equals $(1-\alpha)k^{\alpha}$. Although actual wage rate increases at rate $g$, the effective wage rate is constant under any steady state.
The Transition

The working of the model during transition is depicted in Figure 3.1. As described in Appendix 3C, given the initial steady state characterized by an income tax, individual financial wealth (at the beginning of period t=1) is obtainable. Aggregating individual wealth over a given level of population gives aggregate financial wealth. In addition, the initial values of marginal q and average Q can be calculated from (3.11), (23b) and (3.24). With labor supply determined exogenously, total production F(K_t, L_t) and the associated factor marginal products are easily calculated.

FIGURE 3.1. THE SIMULATION METHODOLOGY DURING TRANSITION TO A CONSUMPTION TAX

The government switches to a consumption tax base at period t=1, prompting individuals and firms to recalculate their optimal consumption and investment plans (under the assumption of myopic expectations). Equations (3.6), (23b), (23c), (3.28) and (3.25) are solved simultaneously for values of i_t, \tau_t, C_t, I_t and q_{t+1}. The first three variables
determine individual wealth $A_{t+1}(a)$ in the beginning of the next period; $I_t$ determines $K_{t+1}$ from (3.11) and $q_{t+1}$ determines $Q_{t+1}$. The values of $Q$, $K$ and $A$ satisfy (3.27). This process is repeated each year until the economy reaches a new steady state.

B. Parameter Values

The parameter values used in the simulations are similar to those chosen by Summers and AK. The rationales underlying the values used in this paper are as follow.

**Intertemporal Elasticity of Substitution ($\sigma$):** Empirical estimates of the intertemporal elasticity of substitution ($\sigma$) usually range between 0 and 1 if consumption is considered as the only argument in the utility function. However, while Weber (1975) found $\sigma$ to lie in a high range of 0.56 to 0.75 Hall (1988) found that the best estimate of $\sigma$ is zero.\(^{25}\) Summers uses values of $\sigma$ of 2, 1 and 0.5, while AK choose $\sigma = 0.25$. Following AK, a value of 0.25 is used in the simulations reported below. Lower values of $\sigma$ tend to result in smaller welfare gains under the consumption tax options, since a relatively low savings elasticity implies smaller distortions of the time path of consumption.

**Rate of Time Preference ($\rho$):** There is very little empirical evidence on the value of the rate of time preference $\rho$.\(^{26}\) AK choose $\rho = 0.015$, while Summers uses $\rho = 0.03$; the latter value is used in the simulations. A lower value of $\rho$ would lead to more saving early in life and a larger growth rate of consumption. The population growth rate is $n = 0.015$ and the rate of technology advance is $g = 0.02$.

\(^{25}\) For more details, see Auerbach and Kotlikoff (1987, p. 50-51).

\(^{26}\) See Auerbach and Kotlikoff (1987, p. 51).
**Tax Rates** \((\tau)\): The tax rates used for the initial income tax equilibrium are based on Fullerton (1987, p. 32); for households these are the marginal rates calculated from the TAXISM model of the National Bureau of Economic Research weighted by different sources of income and adjusted to include state taxes with deductibility of state taxes at the federal level. Five percentage points are added to each federal rate to combine the weighted average of states' rate and the deductibility of state taxes at the federal level. These rates are then adjusted to account for banks, nonprofit institutions and insurance companies.\(^{27}\) After such adjustments the effective tax rates on wage income \(\left(\tau_w\right)\), interest earnings \(\left(\tau_i\right)\) and dividends \(\left(\tau_d\right)\) are 0.258, 0.195 and 0.235 respectively.

Under the Tax Reform Act of 1986, realized capital gains are taxed as ordinary income with a maximum rate of 28 percent. Halving the marginal personal tax rate for the advantage of deferral, halving again for the benefit of tax exemption of gains transferred at death, and adjusting for state taxes, Fullerton (1987) estimates annual effective tax rate on capital gains as \(\tau_g=0.091.\(^{28}\)

On the production side, the tax rate for corporate profits \(\left(\tau_b\right)\) reflects the combined effects of the federal corporate income tax rate of 34 percent under the Tax Reform Act of 1986 and a weighted average of state corporate income tax rates, which equals 6.6 percent. Taking into account the deductibility of state corporate taxes from the federal income tax implies \(\tau_b=0.383 \left(=0.34+ 0.066(1-0.34)\right).\)

\(^{27}\) See King and Fullerton (1984, p. 221-226).

\(^{28}\) The 1986 Act has no provision for indexing for inflation and does away with exclusion of long term capital gains.
Depreciation rates ($\delta$): The rate of economic depreciation rate ($\delta$) and the rate of depreciation assumed for tax purposes ($\delta^c$), are drawn from Fullerton and Lyon (1988, p.73-77), who calculate economic and tax depreciation rates for six different types of assets and provide figures on the fraction of the total capital stock accounted for by each asset. Using a weighted average of the rates for depreciable assets (equipment and structures) results in values of $\delta = 0.08$ and $\delta^c = 0.24$. Since, the Tax Reform Act eliminated the investment tax credit, ITC = 0.

Dividend Payout Ratio ($\zeta$) and Debt-Capital Ratio ($b$): The Survey of Current Business (1989) indicates that the fraction of earnings paid out as dividends in the manufacturing sector in 1989 was roughly 48 percent; thus, $\zeta = 0.48$. Fullerton (1987, p.31) estimates that corporations finance 33.7 percent of average investment with debt; thus, $b=0.337$.

Adjustment Cost parameters ($\beta$ and $\mu$): The adjustment cost function in this model is similar to Summers (1981b) and Poterba and Summers (1983). Empirical estimates by Summers suggest $\mu = 0.088$ and $\beta = 32.2$. In this model $\mu$ is chosen to equal the growth rate of the economy in the steady state; this is close to empirically estimated values (Summers, 1981b) and ensures that there are no adjustment costs in the steady state. Although Summers (1981b) estimated $\beta = 32.2$, subsequent researchers, including AK, Abel and Blanchard (1986) and Auerbach and Hines (1987), have argued that this value overestimates adjustment costs. This overestimation is due to inexact measure of $q$ caused by the presence of returns to other factors in the firm's market value, heterogeneity of capital stock and myopic expectations. AK choose $\beta = 10$ while Goulder and Thalmann

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29 For more details see Auerbach and Hines (1987, p. 170).
IV. Simulation Results

The transitional effects of a change to a tax regime with a consumption tax at the individual level and a cash flow tax at the business level reflect the interaction of many factors. To isolate the effects of personal and business taxes, the transition is analyzed in two steps. In the first step, the transition is simulated for a reform of the type analyzed in the Summers-AK models (with business taxation is modeled as an increase in individual level taxation of capital income). Thus, the consumption tax base is either the ICF (rather than ICF/RF) base or the ITP (rather than ITP/R) base. In the second step, the implementation of both an ICF/RF base and an ITP/R base is analyzed within the context of the model described in Section II; both transitional and steady state effects are examined. In this section, we follow Summers and AK in assuming that the consumption tax reform is implemented "cold turkey" — that is, without any special transitional rules; the use of such rules is explored in Section VI.

A. Simulation Results for the ICF and ITP Taxes

Consider first a version of the model that is analogous to those of Summers and AK in that capital income taxation occurs only at the individual level. In this special case, all earnings are paid out (ζ = 1) and taxed at the individual level at rate τ, debt and new share issues are zero, capital does not depreciate, and there are no adjustment costs. The optimality conditions reduce to w = F_L, q = Q = 1 and r = F_K.

First, for purposes of comparison, suppose that the parameter values correspond to those used by Summers in one of his central cases — τ_w = 0.20, τ_i = 0.50, σ = 1 and ρ =
0.03. In this case, the steady state effects of implementing the two forms of consumption
taxes are broadly similar to the very large effects obtained by Summers. Table 3.2A
shows the steady state values of critical variables under the income tax and the two
consumption tax alternatives. Eliminating tax on capital income has significant effects on
the steady state values of the variables. For example, capital per effective unit of labor \((k)\)
increases by 106.7 (74.9) percent and net effective wages \((w)\) increase by 19.9 (3.15)
percent. This increase in capital intensity does not necessarily imply an increase in
consumption and welfare; overaccumulation of capital can cut back on the consumption in
the economy. However, if the interest rate is above the economy's "golden rule" rate,
higher capital intensity leads to higher consumption. Since the gross interest rate in this
model is well above the economy's growth rate, steady state consumption rises as \(k\) grows;
consumption per effective unit of labor \((c)\) rises with increases by 17.4 (13.9) under the
ICF (ITP) tax. Individual welfare increases by 13.3 percent of rest-of-life welfare under
the ICF tax, and by 4.8 percent under the ITP tax.

Table 3.3 track some of the key variables during the transition from an individual
income tax to either of the personal consumption taxes. The welfare gains and losses of
different generations alive during the transition is charted in Figure 3.2. With an
implementation of either of the taxes, there is an immediate reduction in aggregate
consumption. In the second year of conversion, consumption per effective labor drops by
40.4 percent under the ICF tax (and by 20.3 percent under the ITP tax).\(^{30}\) The tax rates
in the initial years are also high; in the second year of reform the ICF tax (inclusive) rate is
43.3 percent (36 percent). However, the economy adjusts quickly to the new steady state.

\(^{30}\) This drastic reduction in the initial consumption is due to the nature of the utility function. It should
be noted that similar reductions occur in studies by Summers, AK and Seidman.
### TABLE 3.2. STEADY STATE VALUES IN SUMMERS AND AK MODELS

#### TABLE A (SUMMERS MODEL)

<table>
<thead>
<tr>
<th></th>
<th>INCOME TAX</th>
<th>ICF TAX</th>
<th>ITP TAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>0.107</td>
<td>0.062</td>
<td>0.071</td>
</tr>
<tr>
<td>r</td>
<td>0.054</td>
<td>0.062</td>
<td>0.071</td>
</tr>
<tr>
<td>$w^e$</td>
<td>0.993</td>
<td>1.191</td>
<td>1.142</td>
</tr>
<tr>
<td>$w^e(1-\tau_w)$</td>
<td>0.794</td>
<td>1.191</td>
<td>0.778</td>
</tr>
<tr>
<td>net consumption</td>
<td>0.851</td>
<td>0.999</td>
<td>0.969</td>
</tr>
<tr>
<td>k</td>
<td>3.073</td>
<td>6.354</td>
<td>5.375</td>
</tr>
<tr>
<td>personal saving</td>
<td>0.082</td>
<td>0.224</td>
<td>0.190</td>
</tr>
<tr>
<td>tax rate</td>
<td>$\tau_w = 0.20; \tau_t = 0.50$</td>
<td>$\tau_c = 0.267$</td>
<td>$\tau_w = 0.2990$</td>
</tr>
<tr>
<td>gexp</td>
<td>0.364</td>
<td>0.364</td>
<td>0.364</td>
</tr>
<tr>
<td>EV</td>
<td>—</td>
<td>13.31%</td>
<td>4.79%</td>
</tr>
</tbody>
</table>

#### TABLE B (AK MODEL)

<table>
<thead>
<tr>
<th></th>
<th>INCOME TAX</th>
<th>ICF TAX</th>
<th>ITP TAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>0.146</td>
<td>0.124</td>
<td>0.138</td>
</tr>
<tr>
<td>r</td>
<td>0.124</td>
<td>0.124</td>
<td>0.138</td>
</tr>
<tr>
<td>$w^e$</td>
<td>0.898</td>
<td>0.948</td>
<td>0.913</td>
</tr>
<tr>
<td>$w^e(1-\tau_w)$</td>
<td>0.763</td>
<td>0.948</td>
<td>0.734</td>
</tr>
<tr>
<td>net consumption</td>
<td>0.945</td>
<td>0.994</td>
<td>0.961</td>
</tr>
<tr>
<td>k</td>
<td>2.054</td>
<td>2.551</td>
<td>2.200</td>
</tr>
<tr>
<td>personal saving</td>
<td>0.072</td>
<td>0.090</td>
<td>0.078</td>
</tr>
<tr>
<td>tax rate</td>
<td>$\tau_w = \tau_t = 0.15$</td>
<td>$\tau_c = 0.153$</td>
<td>$\tau_w = 0.197$</td>
</tr>
<tr>
<td>gexp</td>
<td>0.180</td>
<td>0.180</td>
<td>0.180</td>
</tr>
<tr>
<td>EV</td>
<td>—</td>
<td>5.20%</td>
<td>-2.64%</td>
</tr>
</tbody>
</table>

*Except for wages, interest rates, tax rates and the equivalent variation measure, the remaining variables are expressed per unit of effective labor.*
FIGURE 3.2. EQUIVALENT VARIATIONS BY GENERATION DURING THE TRANSITION TO THE ICF AND ITP TAXES IN A SUMMERS MODEL
(Generations are identified by their age at the time of the tax change with future generations denoted by negative ages)
### TABLE 3.3. TRANSITION TO ICF AND ITP TAXES (SUMMERS MODEL)

#### 3.3a. THE ICF TAX

<table>
<thead>
<tr>
<th>YEAR</th>
<th>k</th>
<th>w (eff.)</th>
<th>c (net)</th>
<th>l (net)</th>
<th>I/K</th>
<th>τ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3.073</td>
<td>0.993</td>
<td>0.800</td>
<td>0.054</td>
<td>0.034</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>3.508</td>
<td>1.026</td>
<td>0.477</td>
<td>0.098</td>
<td>0.154</td>
<td>0.433</td>
</tr>
<tr>
<td>5</td>
<td>4.554</td>
<td>1.096</td>
<td>0.652</td>
<td>0.080</td>
<td>0.100</td>
<td>0.358</td>
</tr>
<tr>
<td>10</td>
<td>5.636</td>
<td>1.156</td>
<td>0.830</td>
<td>0.068</td>
<td>0.062</td>
<td>0.305</td>
</tr>
<tr>
<td>15</td>
<td>6.182</td>
<td>1.183</td>
<td>0.925</td>
<td>0.064</td>
<td>0.047</td>
<td>0.283</td>
</tr>
<tr>
<td>20</td>
<td>6.426</td>
<td>1.194</td>
<td>0.974</td>
<td>0.062</td>
<td>0.039</td>
<td>0.272</td>
</tr>
<tr>
<td>25</td>
<td>6.506</td>
<td>1.198</td>
<td>0.999</td>
<td>0.061</td>
<td>0.035</td>
<td>0.267</td>
</tr>
<tr>
<td>30</td>
<td>6.500</td>
<td>1.198</td>
<td>1.010</td>
<td>0.061</td>
<td>0.033</td>
<td>0.265</td>
</tr>
<tr>
<td>40</td>
<td>6.399</td>
<td>1.193</td>
<td>1.012</td>
<td>0.062</td>
<td>0.032</td>
<td>0.265</td>
</tr>
<tr>
<td>50</td>
<td>6.323</td>
<td>1.189</td>
<td>1.000</td>
<td>0.063</td>
<td>0.034</td>
<td>0.267</td>
</tr>
<tr>
<td>60</td>
<td>6.342</td>
<td>1.190</td>
<td>0.996</td>
<td>0.063</td>
<td>0.035</td>
<td>0.268</td>
</tr>
<tr>
<td>80</td>
<td>6.360</td>
<td>1.191</td>
<td>1.000</td>
<td>0.062</td>
<td>0.034</td>
<td>0.267</td>
</tr>
<tr>
<td>100</td>
<td>6.355</td>
<td>1.191</td>
<td>0.999</td>
<td>0.063</td>
<td>0.034</td>
<td>0.267</td>
</tr>
</tbody>
</table>

#### 3.3b. THE ITP TAX

<table>
<thead>
<tr>
<th>YEAR</th>
<th>k</th>
<th>w (eff.)</th>
<th>c (net)</th>
<th>l (net)</th>
<th>I/K</th>
<th>τ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3.073</td>
<td>0.993</td>
<td>0.800</td>
<td>0.054</td>
<td>0.034</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>3.317</td>
<td>1.012</td>
<td>0.637</td>
<td>0.102</td>
<td>0.105</td>
<td>0.360</td>
</tr>
<tr>
<td>5</td>
<td>3.931</td>
<td>1.056</td>
<td>0.730</td>
<td>0.090</td>
<td>0.080</td>
<td>0.345</td>
</tr>
<tr>
<td>10</td>
<td>4.635</td>
<td>1.101</td>
<td>0.832</td>
<td>0.079</td>
<td>0.058</td>
<td>0.331</td>
</tr>
<tr>
<td>15</td>
<td>5.067</td>
<td>1.125</td>
<td>0.893</td>
<td>0.074</td>
<td>0.047</td>
<td>0.324</td>
</tr>
<tr>
<td>20</td>
<td>5.315</td>
<td>1.139</td>
<td>0.933</td>
<td>0.071</td>
<td>0.041</td>
<td>0.320</td>
</tr>
<tr>
<td>25</td>
<td>5.438</td>
<td>1.145</td>
<td>0.957</td>
<td>0.070</td>
<td>0.037</td>
<td>0.318</td>
</tr>
<tr>
<td>30</td>
<td>5.479</td>
<td>1.148</td>
<td>0.971</td>
<td>0.070</td>
<td>0.035</td>
<td>0.317</td>
</tr>
<tr>
<td>40</td>
<td>5.434</td>
<td>1.145</td>
<td>0.980</td>
<td>0.070</td>
<td>0.033</td>
<td>0.318</td>
</tr>
<tr>
<td>50</td>
<td>5.360</td>
<td>1.141</td>
<td>0.972</td>
<td>0.071</td>
<td>0.033</td>
<td>0.319</td>
</tr>
<tr>
<td>60</td>
<td>5.359</td>
<td>1.141</td>
<td>0.966</td>
<td>0.071</td>
<td>0.034</td>
<td>0.319</td>
</tr>
<tr>
<td>80</td>
<td>5.378</td>
<td>1.142</td>
<td>0.969</td>
<td>0.071</td>
<td>0.034</td>
<td>0.319</td>
</tr>
<tr>
<td>100</td>
<td>5.374</td>
<td>1.142</td>
<td>0.969</td>
<td>0.071</td>
<td>0.034</td>
<td>0.319</td>
</tr>
</tbody>
</table>
Under the ITP tax the steady state is first reached by the year 20. For ICF tax, the convergence is even faster and it takes less than 15 years to first reach the steady state values.

The two forms of consumption tax have different effects on welfare of the generations caught in the transition. Generations older than 18 at the time of enactment of reform have their welfare reduced under the ICF version of the consumption tax. The older the generation, the heavier is the burden with those over 40 years old at the time of enactment of the new tax bearing a loss of over 40 percent of remaining lifetime utility. Future generations gain with generations born in the new steady state gaining over 13 percent of rest-of-life utility. In contrast, the older generations gain under the ITP tax while those born in the steady state lose. Cohorts over the age of 5 at the time of enactment of reform gain with those just retiring gaining over 20 percent of lifetime utility. Future generations do not gain as much as they do under the ICF tax; steady state welfare increases by only 4 percent of rest-of-life utility.

There are three primary reasons for these huge impacts on capital stock, consumption and welfare. First, a 'price effect' or 'incentive effect' occurs because both the consumption tax options eliminate the taxation of capital income lowering the price of future consumption; this causes the usual income and substitution effects as well as a "human wealth effect". The increase in the net interest rate causes a negative income effect and a positive substitution effect rendering an ambiguous behavior on the interest elasticity of savings. However, the human wealth effect, the term \( w(1-\tau_w)M^T_q [(1+g)/(1+i(1-\tau))) \) in equation (3.6), plays a significant role in influencing individual consumption and welfare. An increase in net interest rate in either form of a consumption tax in the early years lowers the present value of this future income. [Compared to the base case value of 5.4 percent, net interest rate in year two of reform rises to 9.8 percent under the ICF tax and to 10.2
percent under the ITP tax.] The consumers react to this decrease in perceived wealth by increasing their savings and future consumption. This causes capital intensity and wages to rise over the transition period and in the final steady states.

Second, a "postponement effect" occurs under the ICF tax but not under the ITP tax system. The ICF tax redistributes the burden of tax to the older generation by allowing the younger generation to postpone tax payments. The younger generations must save more (relative to the ITP tax) in order to pay the tax on future consumption financed from withdrawals of savings and the returns to such savings. This postponement reduces the tax base, causing an increase in the tax rate in the early years of reform (Table 3.3). Since propensity to consume rises with age, the elderly population bears a disproportionate share of the high tax rate at the time of transition and experience a loss in their rest-of-life utility. Larger savings by the younger generations increase the size of the capital stock and consumption over time and lower the steady state tax rate. No such effect exists under the ITP tax. Increases in capital stock and wage rate are comparably smaller, a factor partially responsible for the steady state welfare loss.

Third, the loss to the elderly is further increased under the ICF tax because the ICF tax effectively double taxes assets accumulated under the income tax but withdrawn (and fully subject to tax) under the consumption tax regime. This expansion of the tax base at the time of enactment of reform allows lower future tax rates and thus a higher steady state level of welfare. In marked contrast, under the ITP tax the elderly generations enjoy a windfall gain as their capital income is no longer subject to the tax. This reduction in the tax base at the time of enactment of the reform implies higher future steady state tax levels.
While all the three factors imply a higher steady state welfare gain under the ICF tax, the second and third factors partially offset the human wealth effect under the ITP tax reform to create much smaller steady state welfare gains.

Next, note that the AK model differs from the Summers model (and the one constructed in this chapter) in many ways. However, to show the effects of the more conservative values for various critical parameters used by AK, suppose that \( \tau_w=\tau_i=0.15 \), \( \sigma = 0.25 \) and \( \rho = 0.015 \). As seen from Table 3.2B, the steady state effects of implementing a consumption tax are considerably smaller, and are closer to those obtained in the AK simulations. For example, \( k \) increases by 24.2 (7.1) percent, \( w \) increase by 5.6 (1.7) percent, and \( c \) increases by 5.2 (1.7) percent under the ICF (ITP) tax. Steady state welfare increases by 5.2 percent under the ICF tax, but declines by 2.6 percent under the ITP tax. Figure 3.3 traces the changes in rest-of-life welfare for the transitional generations: the impact on different generations are similar to those obtained in Figure 3.2 but the magnitudes of the equivalent variation measure are reduced considerably. For example, as in Figure 3.2, older generations lose under the ICF tax reform but the maximum loss to any generation is not more than 15 percent of rest-of-life utility. Again, older generations gain under the ITP tax reform but the maximum gain to any generation is not more than 10 percent of rest-of-life utility.

This version of the model, which provides for only individual level taxation, is used to construct the base case for our model. With the parameter values and tax rates described in Section III.B, Table 3.4 indicates that in the steady state \( k \) increases by 42.1 (9.7) percent, \( w \) increases by 10.2 (3.5) percent, and \( c \) increases by 9.9 (3.8) percent
### TABLE 3.4. TRANSITION TO ICF AND ITP TAXES (BASE CASE)

#### 3.4a. THE ICF TAX

<table>
<thead>
<tr>
<th>YEAR</th>
<th>k</th>
<th>w (eff.)</th>
<th>c (net)</th>
<th>l (net)</th>
<th>l/K</th>
<th>τ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.531</td>
<td>0.834</td>
<td>0.800</td>
<td>0.140</td>
<td>0.034</td>
<td>0.232</td>
</tr>
<tr>
<td>2</td>
<td>1.594</td>
<td>0.843</td>
<td>0.748</td>
<td>0.176</td>
<td>0.073</td>
<td>0.257</td>
</tr>
<tr>
<td>5</td>
<td>1.759</td>
<td>0.864</td>
<td>0.783</td>
<td>0.164</td>
<td>0.062</td>
<td>0.248</td>
</tr>
<tr>
<td>10</td>
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<td>0.825</td>
<td>0.151</td>
<td>0.051</td>
<td>0.238</td>
</tr>
<tr>
<td>15</td>
<td>2.083</td>
<td>0.901</td>
<td>0.851</td>
<td>0.144</td>
<td>0.043</td>
<td>0.233</td>
</tr>
<tr>
<td>20</td>
<td>2.156</td>
<td>0.909</td>
<td>0.867</td>
<td>0.141</td>
<td>0.039</td>
<td>0.229</td>
</tr>
<tr>
<td>25</td>
<td>2.195</td>
<td>0.913</td>
<td>0.877</td>
<td>0.139</td>
<td>0.037</td>
<td>0.227</td>
</tr>
<tr>
<td>30</td>
<td>2.212</td>
<td>0.915</td>
<td>0.882</td>
<td>0.138</td>
<td>0.035</td>
<td>0.226</td>
</tr>
<tr>
<td>40</td>
<td>2.202</td>
<td>0.914</td>
<td>0.885</td>
<td>0.138</td>
<td>0.033</td>
<td>0.226</td>
</tr>
<tr>
<td>50</td>
<td>2.177</td>
<td>0.911</td>
<td>0.881</td>
<td>0.140</td>
<td>0.033</td>
<td>0.227</td>
</tr>
<tr>
<td>60</td>
<td>2.170</td>
<td>0.910</td>
<td>0.879</td>
<td>0.140</td>
<td>0.034</td>
<td>0.227</td>
</tr>
<tr>
<td>80</td>
<td>2.177</td>
<td>0.911</td>
<td>0.880</td>
<td>0.140</td>
<td>0.034</td>
<td>0.227</td>
</tr>
<tr>
<td>100</td>
<td>2.177</td>
<td>0.911</td>
<td>0.880</td>
<td>0.140</td>
<td>0.034</td>
<td>0.227</td>
</tr>
</tbody>
</table>

#### 3.4b. THE ITP TAX

<table>
<thead>
<tr>
<th>YEAR</th>
<th>k</th>
<th>w (eff.)</th>
<th>c (net)</th>
<th>l (net)</th>
<th>l/K</th>
<th>τ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.531</td>
<td>0.834</td>
<td>0.800</td>
<td>0.140</td>
<td>0.034</td>
<td>0.232</td>
</tr>
<tr>
<td>2</td>
<td>1.547</td>
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<td>0.787</td>
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<td>0.045</td>
<td>0.309</td>
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<tr>
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FIGURE 3.4. EQUIVALENT VARIATIONS (AS PERCENTAGE OF REST-OF-LIFE WELFARE) BY GENERATION DURING THE TRANSITION TO THE ICF AND ITP TAXES

(Generations are identified by their age at the time of the tax change with future generations denoted by negative ages)
under the ICF (ITP) tax.\textsuperscript{31} Steady state welfare increases by 9.9 percent under the ICF tax, but decreases by 4.1 percent under the ITP tax.

Table 3.4 also tracks some of the key variables during the transition from an individual income tax to either the ICF or the ITP tax. In both cases, aggregate consumption declines significantly immediately after the enactment of reform. For example, in year 2, \( c \) declines by 6.5 (1.7) percent under the ICF (ITP) tax, and in both cases \( c \) remains below its initial level for more than six years.\textsuperscript{32} The elimination of capital income taxation increases \( k \) by 14.9 (3.7) percent and \( w^e \) by 3.6 (0.96) percent under the ICF (ITP) by year 5. Compared to the initial value of \( r=0.14 \), the net interest rate in year two of reform rises to 0.176 (0.18) under the ICF (ITP) tax. Convergence to the new steady state occurs in roughly 25 (3.30) years under the ICF (ITP) tax. Equivalent variations by generation are shown in Figure 3.4. With implementation of the ICF tax, roughly half of the population (the older generations) existing at the time of the tax change experiences a reduction in welfare, due to the "double taxation" and "postponement" effects described earlier; in particular, the retired elderly suffer a losses of roughly 15-25 percent of remaining lifetime utility. The younger half of the population and future generations benefit from the reform, with a steady state gain of nearly 10 percent of rest-of life utility.

In marked contrast, under the ITP tax, the older and middle-aged generations at the time of enactment gain from the elimination of income taxation of the returns to existing assets, with those just retiring (who enjoy the longest period of entirely tax-free income)

\textsuperscript{31} Note from (3.37) that \( r \) and \( w \) under the ICF tax are the same as in a no-tax economy. The ICF tax reduces consumption in such a way that the sum of consumption plus tax remains unaltered. Also, (3.37) can be used to show that if the tax rates on labor and capital are the same under an income tax system, the same net interest rate obtains under all the three tax systems.

\textsuperscript{32} Similar reductions in consumption occur in the Summers and AK models.
gaining over 16 percent of rest-of-life utility. On the other hand, younger and future generations are net losers from reform, primarily due to relatively high tax rates in the short and long runs and due to the relatively low capital intensities and wages attributable to the absence of a postponement effect under the ITP tax; the steady state welfare loss is roughly 4 percent of rest-of-life utility.

B. Simulation Results for the ICF/RF and ITP/R Taxes

The addition of a cash flow business tax to both of the consumption tax proposals affects the ultimate steady state values as well as the transitional intergenerational redistributions in many ways. Four of these are particularly important. First, immediate implementation without any transition rules implies that depreciation deductions on existing investments are lost. This results in a windfall loss for the predominantly elderly holders of existing capital.

Second, the changes in the tax treatment of interest expense and the repayment of existing debt create additional windfall gains and losses. Under the ITP/R tax, the elimination of interest deductions on existing loans adds to the windfall losses suffered by the elderly. The treatment under the ICF/RF tax is more difficult to model. Strict implementation of an immediate movement to cash flow taxation with no transition rules would imply that taxpayers would get deductions for repayments of existing debt, which would act to offset the windfall loss due to the loss of depreciation deductions. (However, since it seems rather unlikely that this would occur, we consider in Section VI the case in
which special transition rules disallow deductions for repayment of principal on outstanding debt, but allow deductions for depreciation on existing capital.)

Third, the cash flow business tax results in a "postponement effect" similar to that described in the introduction for the case of individual-level cash flow taxation. Specifically, replacement of a business income tax with a cash flow tax results in additional deductions (and tax postponement) due to immediate expensing. Young and future generations, the primary owners of new investment, benefit the most from this provision. However, this postponement effect lowers the tax base and increases the tax rate in the initial years after the enactment of reform, and thus has a disproportionately large adverse effect on generations that are elderly at the time of enactment of the reform. In addition, the increased level of investment increases future capital intensity, lowers future tax rates and increases the steady state welfare level. It is interesting to note, however, that the postponement effect under the ICF/RF reform is comparably smaller than under the ITP/R reform as investors get deductions for repayment of principal and interest under the ICF/RF base.

Fourth, the implementation of the business level cash flow tax changes the value of existing equity (in theoretically ambiguous ways that depend on the nature of the reform as well as the parameter values chosen). These windfall changes disproportionately affect the elderly, who are the primary owners of equity when the reform is enacted.

---

33 Proposals for introducing an ICF/RF tax typically do not allow deductions for the repayment of principal on old debt. The treatment of depreciation deductions on existing capital varies across proposals.

34 The decrease in the tax base due to immediate expensing is partially offset by the increase due to the disallowance of depreciation deductions on old capital (and, under the ITP/R base, deductions for interest expense on old loans).
The ICF/RF Tax

Table 3.5 tracks several key variables during the transition from an income tax to an ICF/RF tax. After implementation of reform, c drops by more than 4 percent (in year 2) and does not return to its initial level until 11 years later. The investment-capital ratio initially increases by over 19 percent and then declines gradually to close to its steady state value in roughly 30 years. In the final steady state, personal saving increases by 27 percent while retained earnings increase by 138 percent. Steady state consumption increases by slightly more than 6 percent.

Initially, the decline in the business tax base due to immediate expensing and the sudden allowance of deduction for repayment of debt principal outweighs the increase in the base due to the sudden disallowance of depreciation allowance and inclusion of new debt. This shrinkage in the corporate tax base, in combination with the drop in aggregate consumption, results in an increase in the tax rate to approximately 40 percent (the initial business tax rate is 38.3 percent); as the economy moves toward the new steady state, consumption increases, the investment rate falls and the tax rate approaches a steady state value of around 35 percent.

The value of q jumps from 0.42 to 0.56 and then drops slowly to a steady state value of 0.43. In the first few years after reform, the increase in marginal cost due to loss of depreciation allowance on new investment is more than offset by immediate expensing. However, the marginal cost increases due to inclusion of new debt in the tax base and the high initial adjustment costs caused by the high initial investment rate. As the economy moves towards the new steady state the investment rate drops lowering adjustment costs and the tax rate decreases. The net effect causes the average equity price Q to increase in the initial years before reaching a lower steady state value.
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FIGURE 3.5. EQUIVALENT VARIATIONS (PERCENT OF REST-OF-LIFE WELFARE) BY GENERATION DURING THE TRANSITION TO THE ICF/RF AND ITP/R TAXES

(Generations are identified by their age at the time of the tax change with future generations denoted by negative ages)
Figure 3.5 shows the change in individual rest-of-life welfare, by cohort, after implementation of the ICF/RF tax reform. Individuals who are of age 11 and above at the time of enactment are net losers from reform. The loss is especially severe for the older generations, with those of age 40 and older losing roughly 20 percent of rest of life utility. These losses occur because older generations (1) are double-taxed on their existing assets as discussed above, (2) face a relatively high consumption tax rate during the first few years after implementation as reductions in the corporate tax base and in average consumption offset the increase in the tax base due to the "double taxation effect", (3) suffer from the elimination of depreciation deductions on the existing capital stock, which is only partly offset by deductions on repayment of old loans on the debt-financed portion of the capital stock, and (4) do not gain from either the generous treatment of saving and of investment under the ICF/RF tax because they are dissaving or from subsequent reductions in tax rate attributable to the postponement effect. These losses are only partially offset by the capital gain on equity value in response to the reform. Thus, only relatively young (those of age 11 or less) and future generations gain from the implementation of the ICF/RF tax. These generations enjoy the efficiency gains from consumption-based taxation over most or all of their lifetimes, and are nearly or completely unaffected by the transitional effects that have such a negative effect on the elderly. The final steady state welfare gain is approximately 8.7 percent; this is fairly close to the gain of 9.9 percent that occurred with implementation of the ICF tax.

The ITP/R Tax

Table 3.6 shows the transition from the income tax system to an ITP/R tax. The drop in initial consumption (and thus the increase in saving) and the increase in the rate of investment are far less dramatic than under the ICF/RF tax, as consumption falls by only 1.5 percent and the investment-capital ratio rises by only 8.7 percent in year two; as noted
above, these smaller effects are primarily due to the absence of a postponement effect under the individual portion of the ITP/R tax.

The price of equity is again lowered due to disallowance of depreciation deductions on old capital. The marginal cost of equity (which equals Tobin's q) increases slightly from the initial value of .42 before declining to a steady state value of .38. In the first few years after enactment of reform, the increase in marginal cost due to loss of depreciation allowance on new investment is more than offset by immediate expensing. However q increases because the adjustment costs rise sharply in these initial years. The adjustment costs decrease as the economy converges to the new steady state lowering the value of q. The net effect causes the average equity price Q to decrease uniformly over time. This decrease in equity price lowers the value of equity creating an initial capital loss. The equity value rises with rise in capital stock but the new steady state value of equity per effective labor is less than before.

Figure 3.5 also shows the impact across generations of the ITP/R reform. Transitional redistributions are generally much smaller than under the ICF/RF reform, as virtually all generations experience smaller windfall gains or losses. This occurs primarily because the gain to elderly generations due to the elimination of the taxation of the income attributable to existing assets is offset to a significant extent by the elimination of deductions for depreciation on existing assets and for interest expense. The existing generations also lose due to the capital loss suffered through changes in the price of existing equity. The latter effects imply that tax rates are generally lower under the ITP/R tax than under the ITP alternative. As a result, the younger generations experience relatively small losses (on the order of 2 percent of rest-of-life welfare) and future generations enjoy a steady state welfare gain of nearly 3.8 percent (in comparison to a loss of 4 percent under the ITP tax); this is also partly attributable to the existence of a
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<td>0.998</td>
<td>0.595</td>
<td>0.108</td>
<td>0.346</td>
<td>0.930</td>
</tr>
</tbody>
</table>
postponement effect under the business cash flow tax. Moreover, note that all the redistributions that occur under the ITPR tax are relatively small in comparison to those that occur with implementation of the ICF/RF tax.\textsuperscript{35,36}

V. SENSITIVITY ANALYSIS

Figures 3.6 - 3.9 consider the sensitivity of the model to the choice of the adjustment cost factor $\beta$, and the debt capital ratio $b$. As discussed previously, $\beta$ plays a crucial role in determining the demand for capital. Since the adjustment cost function is convex and linearly homogeneous in investment and capital the cost of installing additional capital rises with the rate of capital accumulation and prevents any big jumps in investment. This is especially useful for myopic models in which reforms are usually accompanied by large initial swings in saving and investment. Figure 3.6 shows the equivalent variation for different generations for the ICF/RF tax reform for values of $\beta=0, 10$ and 20. The path for $\beta=10$ is the base case simulation. However, if there is no cost of installing capital ($\beta=0$) there is an initial big jump in investment. The resulting postponement effect on the business sector is comparably bigger than the base case and the elderly generation is hit harder; some generations who are retired at the time of enactment of reform lose more than 35 percent of the rest-of-life utility. However, the speed of convergence to the new steady state is much faster. In contrast, a large cost of installing capital ($\beta=20$) lowers the initial jump in investment, causes a smaller postponement effect and lowers the welfare loss to the

\textsuperscript{35} The burden on existing generations created by the cash flow business tax is sensitive to the adjustment cost parameters. With zero adjustment costs, this effect is quite large. With high adjustment costs, the initial jump in investment is smaller, resulting in smaller burden to the older generations.

\textsuperscript{36} The kink in the equivalent variation measure at age 39 is, again, due to the changing value of $Q$ which increases uniformly for 9 years before decreasing.
FIGURE 3.6. EQUIVALENT VARIATIONS BY GENERATION DURING THE TRANSITION TO THE ICF/RF FOR DIFFERENT VALUES OF BETA
(Generations are identified by their age at the time of the tax change with future generations denoted by negative ages)

* The figure assumes base case values for other parameters.
FIGURE 3.7. EQUIVALENT VARIATIONS BY GENERATION DURING THE TRANSITION TO THE ITP/R FOR DIFFERENT VALUES OF BETA
(Generations are identified by their age at the time of the tax change with future generations denoted by negative ages)

* The figure assumes base case values for other parameters.
elderly. The speed of convergence to the new steady state is also slower than the base case simulation.

Figure 3.7 shows the equivalent variation for different generations for the ITP/R tax reform for values of $\beta=0$, 10 and 20. For the base case simulation ($\beta=10$) the windfall gain to the elderly due to the unexpected termination of taxation of income from saving outweighs the windfall loss to the elderly due to losses depreciation deduction on old capital and interest deductibility on old debt as well as the postponement effect of the cash flow business tax. These generations gain from the ITP/R reform with some generations gaining over 3 percent of rest-of-life utility. For bigger values of $\beta(=20)$ the postponement effect of the cash flow business tax is smaller and the welfare gains to the elderly generations comparably bigger; some generations gain over 7 percent of rest-of-life utility. However, as explained in the above paragraph, the speed of convergence to the new steady state is much slower than the base case simulation. In contrast, if $\beta=0$ the postponement effect on the business sector is big enough to outweigh the windfall gain to the elderly; all generations over 27 years old at the time of enactment of reform have their rest-of-life welfare reduced by the tax. Once again, however, the speed of convergence to the new steady state is much faster.

The effect of different values of the debt capital ratio $b$, on the change in rest-of-life welfare of generations during the transition to either of the consumption tax reforms is traced in figures 3.8 and 3.9. Figure 3.8 shows the welfare effects caused by the ICF/RF tax reform for different values of $b$. The value of $b$ affects the steady state values as well as the transitional intergenerational redistributions in two separate ways. First, the ICF/RF tax reform which allows taxpayers to get deductions for repayment of existing debt creates windfall gains which partially offset the windfall loss due to the loss of depreciation deductions on existing investment. Thus, for $b=0$ the primary elderly holders of old capital
FIGURE 3.8. EQUIVALENT VARIATIONS BY GENERATION DURING THE TRANSITION TO THE ICF/RF FOR DIFFERENT VALUES OF DEBT-CAPITAL RATIO

(Generations are identified by their age at the time of the tax change with future generations denoted by negative ages)

* The figure assumes base case values for other parameters.
FIGURE 3.9. EQUIVALENT VARIATIONS BY GENERATION DURING THE TRANSITION TO THE ITP/R FOR DIFFERENT VALUES OF DEBT-CAPITAL RATIO

(Generations are identified by their age at the time of the tax change with future generations denoted by negative ages)

* The figure assumes base case values for other parameters.
have no offsetting windfall gains and lose heavily due to the tax reform with some losing as much as 30 percent of rest-of-life utility. In contrast, for b=0.6 the windfall gains due to deductions for repayment of large existing debt largely offsets the windfall losses and results in much smaller welfare losses to the elderly population.

Second, the cash flow business tax results in a postponement effect which mostly benefits the young and future generations. This effect is sensitive to values of b under the RF reform as loans are included in the tax base and repayment of principal and interest are deductible from the tax base. For b=0 loans do not play any role in the model and the business postponement effect is at its maximum; steady state welfare gains are 12 percent of lifetime utility. However, for b=0.6 the possibility of deductibility of repayment of principal and interest lowers the postponement effect; steady state welfare gains is only 5 percent of lifetime utility.

Under the ITP/R reform, the elimination of interest deductions on existing loans adds to the windfall losses suffered by the elderly and higher values of b implies bigger windfall losses to these generations. This is shown in Figure 3.9. For b=0 the windfall losses due to elimination of depreciation deductions on old capital is offset by the windfall gains due to elimination of tax on capital income and elderly generations gain as much as 10 percent of rest-of-life utility. For b=0.6, however, elimination of interest deductibility creates additional windfall losses and creates welfare losses to the elderly. The postponement effect is, however, insensitive to b since loans have no tax consequence under the R base reform. As shown in Figure 3.9, different values of b have identical steady state welfare gains.
VI. THE EFFECTS OF TRANSITION RULES

Thus far, the analysis has considered consumption tax reforms in the absence of any transition rules. However, it seems unlikely that such a major tax reform would be enacted without some transition rules designed to reduce reform-induced windfall losses (and perhaps gains). There are a wide variety of such rules that might be utilized in a consumption tax reform. However, the most likely candidates would appear to be transition rules allowing depreciation deductions on existing capital, and interest deductions on existing debt (under the ITP/R tax), and a disallowance of any deductions for principal repayment on existing debt (under the ICF/RF tax).

Consider first the case of a move to an ICF/RF base with transition rules that disallow deductions for repayment of principal on existing debt. As discussed before, proposals introducing an ICF/RF reform typically do not allow such deductions. Figure 3.10 shows the intergenerational transitional effects of this reform package; the "G1" subscript denotes the equivalent variation under such a grandfathering rule. The transition rules increase the welfare losses of the elderly population, as disallowing deductions for the repayment of principal on existing debt no longer offsets the cost of losing depreciation deductions on existing capital. The net effect of these transition rules is larger on these generations with some generations losing over 20 percent of rest-of-life utility.

Consider next the case of a move to an ICF/RF base with transition rules that allow depreciation deductions on existing capital but disallow deductions for repayment of principal on existing debt. Figure 3.10 also shows the intergenerational transitional effects of this reform package; the "G2" subscript denotes the equivalent variation under such a grandfathering rule. The transition rules slightly reduce the welfare losses of the elderly population, as the benefit of continuing depreciation deductions on existing capital
FIGURE 3.10. EQUIVALENT VARIATIONS BY GENERATION DURING THE TRANSITION TO THE ICF/RF WITH AND WITHOUT TRANSITION RULES
(Generations are identified by their age at the time of the tax change with future generations denoted by negative ages)
outweigh the cost of disallowing deductions for the repayment of principal on existing debt. However, the net effect of these transition rules is quite small.

Third, consider the case of a move to an ITP/R tax with transition rules that allow depreciation deductions on existing capital and deductions for interest expense on old debt. Figure 3.11 shows the intergenerational transitional effects of this reform package; the "G1" subscript denotes the equivalent variation under such a grandfathering rule. These transition rules, which benefit existing (primarily elderly) capital owners, significantly increase the welfare gain enjoyed by elderly generations; for example, cohorts just retiring gain over 15 percent of lifetime utility, in comparison to a gain of less than 5 percent under the ITP/R base, in the absence of any transition rules. However, the transition rules result in a smaller corporate tax base in the years immediately after reform is enacted, and thus require a larger comparably larger increase in the tax rate; this lowers the welfare of middle-aged generations (those of age 30 or below) by as much as 5 percent of lifetime utility (compared to a maximum loss of 1.7 percent in the absence of transition rules). The steady state welfare gain is unchanged, as the effects of the transition rules are offset by rate changes each year, and these effects disappear in the long run.

Last, consider the case of a move to an ITP/R tax with transition rules that allow depreciation deductions on existing capital and deductions for interest expense on old debt but include associated interest income in the tax base. Figure 3.11 also shows the intergenerational transitional effects of this reform package; the "G2" subscript denotes the equivalent variation under such a grandfathering rule. These transition rules, again, benefit the capital owners but (compared to G1) the welfare gains to the elderly generations are smaller as the interest income from existing debt is taxable. The corporate tax base does not shrink as much as it does in G1 (Figure 3.11) and the welfare loss to the young generations are smaller. The steady state values, once again, remains unaltered.
FIGURE 3.11. EQUIVALENT VARIATIONS BY GENERATION DURING THE TRANSITION TO THE ITP/R WITH AND WITHOUT TRANSITION RULES
(Generations are identified by their age at the time of the tax change with future generations denoted by negative ages)
VII. CONCLUSION

Summers (1981a) and Auerbach and Kotlikoff (1987) have argued that the ICF form of direct consumption tax is superior to the ITP approach in the sense that it results in significantly higher steady state welfare levels. This chapter suggests that this particular argument for the ICF tax is likely to be considerably overstated, since the Summers and AK conclusion is based on analyses of models in which business taxation is ignored and all capital income taxation occurs at the individual level. In contrast, this chapter analyzed a model in which both consumption tax approaches include a cash flow business tax; these approaches — the ICF/RF and ITP/R taxes — are consistent with those advocated in the recent literature by a wide variety of consumption tax proponents. The results suggest that a significant portion of the differences in steady state welfare levels can be eliminated when the transitional effects of changing from income taxation to cash flow taxation at the business level are considered explicitly.

There is a second reason that the ITP/R tax may be more attractive than the ICF/RF alternative. Specifically, the analysis suggests that implementation of the ITP/R option may result in relatively small transitional redistributions across generations. In contrast, implementation of the ICF/RF tax results in very large redistributions from elderly generations to very young and future generations.\(^{37}\) Although such redistributions imply a higher steady state welfare level, the political feasibility of a reform that imposes significant costs on relatively wealthy elderly generations in order to confer benefits that accrue primarily to unborn generations is certainly open to question. The pattern of redistributions suggested above with implementation of the ITP/R tax — relatively small gains to the

\(^{37}\) That is, such redistributions are an important source of the steady state efficiency gains obtained under such a tax; see Gravelle (1991) for an examination of this issue.
elderly, small losses to the young and middle-aged, and a gain to unborn generations that is significant (but smaller than that under the ICF/RF approach) would appear to be a more viable option from a political standpoint. This analysis also suggests that the intergenerational transitional problems caused by implementing an ITP/R tax may be smaller than suggested by the opponents of direct taxation of consumption.\footnote{The analysis in this paper obviously ignores intragenerational redistributions; for a discussion of these issues, see Sarkar and Zodrow (1993).}

In addition, the chapter shows that transitional rules — neglected in previous analyses — can play an important role in changing the pattern of intergenerational redistributions. The effects of the particular rules analyzed in this paper are relatively small in the case of the ICF/RF tax. However, in the case of the ITP/R tax, properly designed transition rules significantly increase the gains experienced by the elderly and the losses experienced by the young and middle-aged generations. Such an exacerbation of intergenerational redistributions suggests that such transitional rules may well be undesirable, and should be used with caution.\footnote{A similar conclusion is reached in the context of a general analysis of grandfather rules by Zodrow (1992).}
APPENDIX 3A

The Optimizing Behavior of the Firm

With perfect capital markets and the absence of uncertainty the firm maximizes its market value given by equation (3.21) subject to the constraints imposed by equations (3.7) to (3.19). Substituting (3.12), (3.16) and (3.18) in (3.17) dividends can be expressed as

$$\text{DIV}_t = \zeta \left[ F(K_t, L_t) - w_t L_t - i_t b_t - \tau_b \{ F(K_t, L_t) - w_t L_t - f_t I_t - \Phi \tau_b I_t - f_2 t b K_t + f_3 b I_t - f_4 b \delta K_t - f_5 \delta^t K_t^t\} - (ITC_t) I_t - \delta K_t \right].$$

Rearranging the terms,

$$\text{DIV}_t = \zeta \left[ (1 - \tau_b) F(K_t, L_t) - w_t L_t - (1 - \tau_b f_2) i_t b K_t - \delta K_t (1 - \tau_b f_4 b) - \Phi \tau_b I_t + \tau_b I_t (f_1 - f_3 b) + f_4 \tau_b \delta^t K_t^t + (ITC_t) I_t \right]. \quad (3A-1)$$

The financial identity of the firm, given in equation (3.19), can be used to express new share issues in terms of the other variables, i.e.,

$$\text{VN}_t = \text{DIV}_t + I_t (1 + \Phi) + \text{TE}_t - \text{EARN}_t - \text{BN}_t.$$ 

Using equations (3.13) and (3.14) the above equation can be redefined as:

$$\text{VN}_t = \left\{ \text{DIV}_t (\zeta - 1)/\zeta \right\} + I_t - \delta K_t - b (I_t - \delta K_t). \quad (3A-2)$$

Substituting equation (3A-2) in equation (3.21)
\[
V_t = \sum_{s=t}^{\infty} \frac{1}{(1+\theta)^{s-t+1}} \left\{ \frac{(1-\tau_d)}{(1-\tau_g)} \text{DIV}_s \cdot \left[ \left\{ \text{DIV}_s(\zeta^{-1})/\zeta \right\} + I_s(1+\Phi) \cdot \delta K_s + b(I_s - \delta K_s) \right] \right\}.
\]

Substituting the value of dividends from equation (3A-1), this can be written as:

\[
V_t = \sum_{s=t}^{\infty} \frac{1}{(1+\theta)^{s-t+1}} \left\{ \Omega(1-\tau_b)(F(K_s, L_s) - w_s L_s) \right\}
\]

- \[K_s[\Omega(1-\tau_b)I_{b-b} - \delta\{1-b-\Omega(1-\tau_b+f_4b)\}] - I_s[1-b+(1-\Omega)\Phi - \Omega(\tau_b(f_1-f_3b) + ITC)]\]

+ \[f_5\Omega\tau_b\delta^s K_s^T\].

where \(\Omega = \frac{\zeta(1-\tau_d) + (1-\zeta)(1-\tau_g)}{(1-\tau_g)}\). \hspace{1cm} (3A-3)

The term \(\Omega\tau_b\delta^s K_s^T\) indicates the amount of tax savings from depreciation allowances which include those attributable to past investments (previous to time t) and those attributable to future investments after time t. In maximizing the present value of future net payments (to the owners) the firm needs to choose only the optimal path of future investments. As such, it is necessary to distinguish between the present value of depreciation allowances on old capital and the present value of depreciation allowances on future investments.

To separate out these two effects from the term \(f_4\tau_b\delta^s K_s^T\) it is necessary to trace out the time path of the tax basis of \(K_t\). This path differs from the true capital accumulation path due to the generous provisions in the tax laws that allows the firm to deduct depreciation allowances at a higher rate than the true economic depreciation.

For \(s \geq t\), the time path of \(K^T\) follows the equation
\[ K^{\tau}_{s+1} = I_s + (1-\delta^\tau)K^{\tau}_s + \ldots \]

\[ = I_s + (1-\delta^\tau) \{ I_{s-1} + (1-\delta^\tau)K^{\tau}_{s-1} \} \]

In other words,

\[ K^{\tau}_s = \sum_{u=s-1}^{t} I_u (1-\delta^\tau)^{s-1-u} + (1-\delta^\tau)^{(s-t)}K^{\tau}_t \]

The present value of tax savings from depreciation allowances,

\[ \sum_{s=t}^{\infty} \frac{1}{(1+\theta)^{s-t+1}} (f_5\Omega t_b\delta^\tau K^{\tau}_s), \]

can be rewritten as

\[ \sum_{s=t}^{\infty} \frac{f_5\Omega t_b\delta^\tau}{(1+\theta)^{s-t+1}} \left( \sum_{u=s-1}^{t} (1-\delta^\tau)^{s-1-u} I_u + (1-\delta^\tau)^{(s-t)}K^{\tau}_t \right). \]  

(3A-4)

The first term in the above equation is the tax savings from future investments:

\[ \sum_{s=t}^{\infty} \frac{f_5\Omega t_b\delta^\tau}{(1+\theta)^{s-t+1}} \left( \sum_{u=s-1}^{t} (1-\delta^\tau)^{s-1-u} I_u \right). \]

Expanding this expression yields

\[ \frac{f_5\Omega t_b\delta^\tau}{(1+\theta)^2} (I_t) + \frac{f_5\Omega t_b\delta^\tau}{(1+\theta)^3} (I_{t+1} + I_t(1-\delta^\tau)) \]

\[ + \frac{f_5\Omega t_b\delta^\tau}{(1+\theta)^4} (I_{t+2} + I_{t+1}(1-\delta^\tau) + I_t(1-\delta^\tau)^2) + \ldots \]

\[ = \frac{f_5\Omega t_b\delta^\tau}{(1+\theta)} \sum_{s=t}^{\infty} \frac{I_s(1+\theta)}{(1+\theta)(1+\theta)^{s-t+1}(\theta + \delta)} \]
\[ Z_t = f_Z Z_t \sum_{s=t}^{\infty} \frac{I_s}{(1+\delta)^{s-t+1}} , \]

where \( Z_t \) denote the tax savings due to depreciation allowances and equals \((\Omega t_b \delta^t)/(\theta + \delta)\).

The second expression in (3A-4) is the present value of tax savings due to depreciation allowances on existing capital and equals

\[ f_Z \Omega t_b \delta^t K_t^t / (\theta + \delta) , \]

\[ = f_Z X_t , \]

where \( X_t = Z_t K_t^t \).

Substituting these values in (3A-3), the value of the firm is

\[ V_t = \sum_{s=t}^{\infty} \frac{1}{(1+\theta)^{s-t+1}} [\Gamma] + f_Z X_t , \]

where \( \Gamma = \Omega(1-\tau_b)(F_3 - w_3 L_3) - K_3[\Omega(1-\tau_b f_2) i_b - \delta(1-b-\Omega(1-\tau_b f_2))] - I_s[1-b - \Omega(\tau_b(f_1 f_3) + \pi C)] - f_Z Z_t + (1-\Omega t_b)Q_3] . \)

The firm maximizes (3.32) subject to the constraints \( K_{s+1} = I_s + (1-\delta)K_s \) and

\[ \text{lim}_{T \to \infty} K_T \geq 0. \] Setting up the Lagrangian

\[ \mathcal{L} = \sum_{s=t}^{\infty} \frac{1}{(1+\theta)^{s-t+1}} [\Gamma] + q^* s_{s+1} \{ I_s + (1-\delta) K_s - K_{s+1} \} \]
\[
= \sum_{s=1}^{\infty} \frac{1}{(1+\theta)^{s-1}+1} \{ [\Gamma] + q_{s+1} ( I_s + (1-\delta)K_s - K_{s+1} ) \},
\]

where \( q_{s+1} = (1+\theta)^{s-1}q^*_{s+1} \).

The necessary conditions for a maximum are

\[
w_s = F_L
\]

\[
q_{s+1} = 1 - b - f_5Z_4 - \Omega(\tau_b(f_1-f_3b) + ITC) + (1-\Omega\tau_b)[\Phi +(1/K)\Phi'] ;
\]

\[
i_s = \frac{\Omega(1-\tau_b)F_K + \delta(1-b-\Omega(1-\tau_bf_4b)) + (1-\delta)q_{s+1} - q_s + (1-\Omega\tau_b)(1/K)^2\Phi'}{\Omega(1-\tau_bf_2) + [(1-\tau_i)q_d/(1-\tau)]}
\]

\[
\lim_{T \to \infty} K_{T+1} \geq 0 ; \lim_{T \to \infty} q^*_{T+1} \geq 0 \text{ and } \lim_{T \to \infty} K_{T+1}q^*_{T+1} = 0.
\]
APPENDIX 3B

Steady State Value of $r$

Equation (3.36) can be rewritten as

$$[r - (n + g + ng)](Q + b)K = C(1 + \tau_c) - w(1 - \tau_w)L.$$  

Dividing both sides by $w(1 - \tau_w)L$ and using the fact that $wL = w^eLe$,

$$\frac{[(r - n - g - ng)(Q + b)k]}{w^e(1 - \tau_w)} = \xi - 1, \quad (3B-1)$$

where $k$ denotes capital per effective labor and $\xi = [C(1 - \tau_c)]/(1 - \tau_w)w^eLe$.

Since $w^e = (1 - \alpha)k^\alpha$, (3B-1) can be rewritten as

$$\frac{[(r - n - g - ng)(Q + b)]}{(1 - \alpha)k^{\alpha - 1}(1 - \tau_w)} = \xi - 1.$$  

Substituting the value of the marginal product of capital, $F_K = \alpha k^{\alpha - 1}$,

$$F_K = \frac{(\alpha/(1 - \alpha))[(r - n - g - ng)(Q + b)]}{(1 - \tau_w)(\xi - 1)}.$$
APPENDIX C

Individual Asset Accumulation in the First Year of Reform

Consider an economy with no taxes. In such an economy, individual wealth at the beginning of time \((t+1)\) of a person of age \((a+1)\) is given by the difference in the present value of cumulative wage and cumulative consumption from birth to time \((t+1)\):

\[
A_{t+1}(a+1) = (1+r)^{a-1} \left[ \sum_{s=1}^{x} W_{t+s-a} - \sum_{s=1}^{a} C_{t+s-a} \right]
\]

where \(x=a\), for \(1 \leq a \leq 40\) and \(x=40\) for \(a>40\). Cumulative wage discounted to birth of an individual of age \('a\'\) born at time \((t-a)\) equals

\[
w_{c}(1+g)^{t-(a-1)} \sum_{s=1}^{x} \left[ \frac{(1+g)}{(1+r)} \right]^{s-1}.
\]

Similarly, cumulative consumption is given by

\[
\frac{(w_{c}(1+g)^{t-(a-1)} \sum_{s=1}^{40} \left[ \frac{(1+g)}{(1+r)} \right]^{s-1})}{\sum_{s=1}^{50} \sum_{s=1}^{a} \left[ z_{n} \right]^{s-1}}.
\]

Thus, assets at time \((t+1)\) are given by

\[
A_{t+1}(a+1) =
\]
APPENDIX 3D

Steady State Value of Q

With \( q \) defined in (3.35), the value of \( Q \) (equal to \( q + X/K \)) can be obtained if the ratio \( X/K \) is known. With \( X \) defined as \( 2K^\tau \) the ratio \( X/K \) requires the knowledge of the ratio \( K^\tau/K \).

From (3.16), investment can be defined as

\[
I = \Delta K + \delta K,
\]

where \( \Delta K \) is constant at steady state and equals \( (n+g+\nu g) \). Alternatively, investment can be defined from (3.29):

\[
I = \Delta K^\tau + \delta K^\tau,
\]

where \( \Delta K^\tau \) is constant at steady state and also equals \( (n+g+\nu g) \).

From the above two equations

\[
\frac{K^\tau}{K} = \frac{n+g+\nu g+\delta\nu}{n+g+\nu g+\delta^\tau}
\]
APPENDIX 3E

The Alternative Views of Dividend Taxation

The real and financial policies of a firm depend crucially on whether one assumes the "new" view or the "traditional" view of dividend taxation. The disagreement between the two views centers on the validity of the traditional view that dividend taxes at the personal level implies a 'double tax' on corporate income attributable to investment financed through retained earnings. The new view suggests that such taxes have no effect on marginal investment financed with retained earnings and this logic weakens the rationale for corporate/individual tax integration. The choice of any one of the two alternative views has important implications that can be observed through the value of q.

To understand this, consider a firm behavior as outlined in the chapter but with some simplifications: Assume that investment is fully financed with equity (b=0) and that there are no costs of installing capital (β=0). However, the rate of return to equity investment is still given by (3.15) and the value of the firm in period t by (3.21):

\[ V_t = \sum_{s=t}^{\infty} \frac{(1-\tau_d)}{(1-\tau_g)} \frac{DIV_s \cdot VN_s}{(1+\theta)^{s-t+1}} \]  \hspace{1cm} (3E-1)

where \( \theta = r/(1-\tau_g) \). The firm maximizes V subject to constraints which depend on the assumptions of the model. There are, however, four essential constraints: the investment equation (3.11), the cash flow accounting identity of the firm

\[ F - wL + VN = DIV + I + \tau_b(F - wL) \]  \hspace{1cm} (3E-2)
and two inequality constraints: $\text{DIV}_t \geq 0$ and $\text{VN}_t \geq \text{VN}^*$, where $\text{VN}^* \leq 0$. The last two constraints are restrictions on the firm's financial policy: dividends cannot be negative and there is a limit to repurchasing of shares by the firm.

Substituting (3E-2) in (3E-1) and maximizing the value of the firm

$$V_t = \sum_{s=t}^{\infty} \frac{1}{(1+\theta)^{s-t+1}} \left[ ((1-\tau_d)(F_s - w_sL_s) - I_s - \text{VN}_s) (1-\tau_d)/(1-\tau_g) - \text{VN}_s ight.$$

$$
\left. - q_{s+1}(K_{s+1} - I_s - (1-\delta)K_s) - \lambda_1(\text{VN}_s - \text{VN}^*) - \lambda_2((1-\tau_d)(F_s - w_sL_s)
\right]$$

- $I_s - \text{VN}_s \} \right].$

The first order conditions for investment, new share issues and dividend payments are:

$$q = ((1-\tau_d)/(1-\tau_g) - \lambda 2), \quad (3E-3)$$

$$(1-\tau_d)/(1-\tau_g) - 1 - \lambda 1 - \lambda 2 \geq 0, \quad (\text{VN- VN}^*) \geq 0,$$

$$((1-\tau_d)/(1-\tau_g) - 1 - \lambda 1 - \lambda 2)(\text{VN} - \text{VN}^*) = 0, \quad (3E-4)$$

$$\text{DIV} \geq 0, \quad \lambda 2 \geq 0, \quad (\text{DIV})\lambda 2 = 0. \quad (3E-5)$$

From equation (3E-2), it is observable that suitable alterations of dividends and new issues can leave earnings and investment unaffected ($d\text{VN} = d\text{DIV}$). The change in share value caused by a change in dividends satisfying the condition $d\text{VN} = d\text{DIV}$ is (obtainable from 3E-1)

$$dV_t = -\frac{(\tau_d - \tau_g)}{(1-\tau_g)}d\text{DIV}_t(1+\theta)\cdot(1+s+1).$$
If $r_d > r_g$, reducing dividends will always raise the value of the firm.\textsuperscript{40}

If reducing dividends raises the value of the firm then dividend payments should be the last option of the firm. If investment exceeds earnings (net of corporate tax) firms should issue new shares \[(3E-2).\] Again, if investment falls below net earnings firms should repurchase shares (i.e., $VN < 0$). Only after exhausting all these channels should a firm pay dividends. However, reality presents a different picture. Many firms pay dividends in spite of having alternative means of distributing earnings. This is the well-known "dividend puzzle" which has led to alternative views of the effects of dividend taxation.\textsuperscript{41}

**The New View**

New view models typically assume that a firm cannot find tax free channels, like repurchasing its own shares, to distribute income to shareholders so that the constraint $VN = VN^e$ binds. Equity is 'trapped' within the firms in the sense that the only way the shareholders can receive any income from the equity investment is through dividends. This has serious implications on the marginal investment by the firm and can be best observed through the value of $q$. In the absence of any constraints, one would expect the equilibrium value of $q=1$ if firms act to maximize shareholder's value. Specifically, if $q>1$, firms could increase $V$ by issuing new shares; analogously, if $q<1$, firms could increase $V$ by repurchasing shares. However, if firms are precluded from repurchasing shares as

\textsuperscript{40} See Poterba and Summers (1985), p. 232-235.

\textsuperscript{41} For a comprehensive survey on the traditional and new views see Zodrow (1991).
assumed by the new view, q<1 is possible. Allowing DIV>0 in (3E-5) implies λ2=0 and the value of q from (3E-3) is

\[ q = [(1-\tau_d)/(1-\tau_g)]. \]

As long as \( \tau_d > \tau_g \), q<1 and firms do not issue new shares but invest through retained earnings.

If firms invest through retained earnings dividend taxes have no impact on marginal investment. From an shareholder's perspective a dollar not distributed but retained allows the firm to reinvest \( 1/(1-\tau_d) \). This gives rise to capital gains of an equal amount that is effectively subject to tax at the rate \( \tau_g \). When the return to this is paid out as dividends, the effective tax rate is \( [r - r(1-\tau_d)(1-\tau_g)/(1-\tau_d)]/r = (1-\tau_g) \). In other words, the tax deferral obtained by retaining earnings offsets the future dividend tax liability. As long as \( \tau_g \) is less than \( \tau_d \) (as is the case in the United States) retained earnings are a less costly form of finance than new share issues. Future dividend taxes are capitalized into share prices and dividend taxes have no impact on marginal investment. This behavioral pattern is observed among established firms going through a period of "internal growth" and in "mature" firms.

The new view is subject to two main criticisms. First, if VN* is assumed to be zero, as it is usually assumed, firms have no alternative means of distributing income other than taxable dividends. This does not describe reality as firms engage in share repurchases, takeovers and purchases of other companies. Such means of distributing cash to shareholders have become increasingly important in recent years. Bagwell and Shoven show that dividends accounted for 80 percent of total cash distribution in 1977, but
accounted for only 40 percent in 1986. Under such situations, the new view can not accurately describe the effects of dividend taxation.

Second, under the new view, firms operate with the expectation that they will never have to rely on new share issues. This, again, is a questionable assumption.

The Traditional View

The traditional view assumes marginal investment is financed through new share issues. As mentioned earlier, if \( \tau_d > \tau_g \) and the firm issues new shares, dividend payment should be zero. From (3E-3)-(3E-5), this implies the equilibrium value of \( q=1 \). In equilibrium, the investors are indifferent between equity finance in the form of retained earnings or in the form of new share issues and investment at the margin is independent of \( \tau_d \) or \( \tau_g \).

To explain why firms still pay dividends, the traditional view assumes that shareholders derive a positive benefit from receiving dividends and these dividends constitute a fixed fraction of corporate income. Two primary explanations characterize such behavior. One is that firms receive a positive benefit from paying dividends. It may be that dividend distributions act as a signal of the firm's profit or future profit opportunities. Alternatively, it may be that dividend distributions allow more control by the shareholder over management; that is, such payments reduce managerial discretion over the use of profits. The lack of such benefits in retained earnings finance offsets its above discussed tax advantage. Thus the opportunity cost of one dollar worth of investment with such finance to simply a dollar (instead of \( 1/(1-\tau_d) \) as above). This in turn implies that firms are indifferent between equity finance in the form of retained earnings and new share issues. Since dividends constitute a fixed fraction of corporate income marginal investment are effectively financed with new share issues and, in addition to the tax at the business
level, all forms of equity finance are subject to an effective tax rate which is a weighted average of the tax rates on dividends and capital gains.\footnote{This fraction depends on the dividend tax rate.}

The old view is criticized mainly on two grounds. First, as new share issues constitute a negligible fraction of equity finance the assumption that marginal equity-financed investment is done through such issues seems counterfactual. However, it should be noted that new share issues are defined broadly in this view, incorporating share repurchases, takeovers and purchases of stocks of other companies. Also, it is possible that even though new share issues constitute a small fraction of equity finance it is still the marginal source of financing the investment.

Second, the very reasons cited under this view for distributing profits seem rather expensive when cheaper methods, such as share repurchases, are available.

There is no general consensus as to which of these two views represent the economy more accurately. The empirical literature on this is also inconclusive. Alan Auerbach (1984) studied the relationship between the cost of capital and the use of new share issues to finance investment (for a sample of U.S. firms over a certain period of time) and argued that such sources have a higher cost than retained earnings. This result supports the new view. However, studies by Gordon and Bradford (1980), Poterba and Summers (1985), Poterba (1987), and Nadeau (1988) tend to favor the traditional argument. This gives the old view an edge in the debate. As noted in the text, recent literature show a marked inclination towards adopting the old view.
CHAPTER FOUR

CONSUMPTION TAX AND DIFFERENT SAVING VEHICLES

I. INTRODUCTION

Using models that ignore the possibility of implementing transition rules in a consumption tax reform to reduce the windfall gains and losses experienced by different generations, Summers and AK models show that such reforms involve significant redistributions across generations. This substantiates the claim made by many consumption tax critics that the transition to a consumption tax from an existing income tax would be so difficult that such a reform is infeasible. However, as mentioned in chapter 3, it seems unlikely that a reform as major as a shift to consumption taxation, which involves large intergenerational redistributions, would not be accompanied by at least some transition rules designed to reduce these redistributions. Specifically that chapter showed how properly designed transition rules for the tax treatment of capital and debt can alter the redistributive patterns. It seems equally plausible that practically feasible transition rules would be designed for the tax treatment of different types of individual savings to reduce intergenerational redistributions. It seems unlikely that existing assets accumulated out of after-tax income would be fully included in the ICF tax base; similarly, it seems doubtful that income attributable to existing assets would be entirely tax exempt under the ITP approach. This chapter analyzes the welfare effects of such transition rules in the context of the simple Summers model.

Summers and AK models fail to distinguish between old assets purchased out of pre-transition saved (after tax) income and new assets purchased out of after-transition income. As a result of this assumption old assets held by the elderly at the time of the
enactment of reform are taxed when they are consumed under the ICF approach; the double taxation of these assets creates significant welfare loss to these generations. In marked contrast, under the ITP approach, there is no taxation of the return to existing assets which confers a windfall gain to the elderly owners of such assets since the returns to these assets would have been taxed under an income tax system. The purpose of this chapter is to show that if old assets are allowed to be taxed as they would have been under the pre-reform income tax system while new assets are given consumption tax treatment the windfall gains and losses are eliminated and intergenerational redistributions are reduced considerably. The chapter also shows that it is possible to design transition rules such that an optimizing consumer would behave similarly under either ICF or ITP tax reforms.

In this chapter, under the ICF tax reform old assets are declared as non-qualified and are taxed as under the income tax; new assets are allowed to be saved into qualified accounts with an immediate deduction on deposited funds and taxation of withdrawals from such funds. To prevent individuals from depositing all their wealth in qualified accounts, transferring funds from non-qualified to qualified accounts is not permitted. Given such restrictions wage earners at the time of enactment of reform would consume first out of non-qualified accounts and save all their earnings in qualified deposits. Only after their consumption exhausted non-qualified wealth would the individuals consume out of their wage income and qualified savings.1 On the other hand, those retired at the time of the enactment of reform cannot have any qualified wealth; they escape the double taxation of their wealth but are taxed on their asset income. Such behavior of the

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1 An alternative assumption would be to allow individuals to transfer funds from one form of saving to the other but limit deposits in qualified accounts. If the value of the limit equals the wage rate, the assumption is equivalent to the chosen for the model.
consumers dramatically affect the tax revenues in the initial years of reform. Under a balanced budget policy this requires a sharp increase in tax rates. To prevent such unreasonable hikes in tax rates this model departs from the previous models but follows McGee (1991) and assumes that the government maintains a constant tax rate over the transition period and balances its budget in present value terms.

The assumption of constant tax rate policy has important implications for the model. First, it eliminates the subsidy to savings caused by a declining tax rate in the transition to the ICF tax under a balanced budget policy with a fixed annual revenue. Second, it reduces the intergenerational transfer caused by the high initial tax rates imposed on the older generations in previous models. Third, a constant tax rate assumption seems more politically acceptable than a policy which requires the government to constantly adjust the tax rate.

Under the ITP tax reform old assets are are taxed as under the income tax; new assets are allowed to be saved into "tax-free" accounts with income from such accounts accruing tax free. For the same reasons as above transferring funds from old assets to "tax-free" accounts are not permitted. Likewise the ICF tax reform, wage earners at the time of enactment of reform would consume first out of old accounts and save their earnings in "tax-free" deposits; only after their consumption exhaust old wealth would the individuals consume out of their wage income and qualified savings. On the other hand, those retired at the time of the enactment of reform cannot have any qualified wealth; these generations do not receive the windfall gain they would have received in ITP tax reforms which do not distinguish old assets from new. The additional revenue obtained

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2 Since consumption at time t is taxed at a higher rate than consumption at time (t+1), the after tax return to delaying consumption exceeds the rate of return; this constitutes a subsidy to savings.
from taxing income from old assets would lower tax rates in the usual balanced-budget
assumption. However, to be consistent with the ICF approach, we assume the tax rate to
be constant.

The chapter is organized as follows. Section II presents the details of the basic
model with and without the transition rules; it, also analyzes the conditions under which
the two consumption taxes are equivalent. Section III simulates the economy under
typical parameter values to examine the changes in transition paths under the different
transition rules. Section IV summarizes the results and offers some conclusions.

II. THE MODEL

The starting point of this analysis is the Summers (1981) model described in
chapter 3. A brief description of the model is as follows. The model describes a closed
economy that consists of three sectors — households, firms and the government. It is
constructed in a discrete time frame and the following convention is adopted:
Consumption, prices and taxes are measured at end of period, but individual asset
accumulation and capital stock are measured at beginning of period, reflecting wages,
consumption and investment in previous period. Present values are taken at the end of
each period. Further, the model assumes that individuals are myopic expecting that
wages, interest rates and tax rates will remain indefinitely at their values in that period.
As these variables change during the transition from one steady state to another in
response to a change in the tax system the consumers recalculate the optimal
consumption plan in each period.

Household behavior follows the strict life cycle model in which individuals
maximize a CES lifetime utility function
\[ U = \frac{1}{(1-1/\sigma)} \sum_{s=0}^{49} \frac{C_s 1-1/\sigma}{(1+\rho)^s}, \]  

(4.1)

(where \( C_s \) denotes consumption at time \( s \), \( \sigma \) is the intertemporal elasticity of substitution and \( \rho \) is the pure rate of time preference) subject to a lifetime budget constraint. In the absence of taxes and transfers, the individual lifetime budget constraint is

\[ \sum_{s=0}^{49} \frac{C_s}{(1+i_t)^s} = \sum_{s=0}^{39} \frac{w_s}{(1+i_t)^s}, \]  

(4.2)

where \( T=39 \) is the age at which the individual retires, \( w_s \) is the wage rate in period \( s \) and \( i_t \) is the interest rate in period \( t \). The wage rate, which is the same for all workers in any time period, increases over time at the rate of technological growth \( g \), so that \( w_s = (1+g)^s \cdot i^t \), where \( w_t \) is the wage rate in period \( t \).

The economy has a single production sector characterized by a Cobb-Douglas production function

\[ F(K_t, L_t) = K_t^\alpha L_t^{1-\alpha}, \quad 0 < \alpha < 1, \]  

(4.3)

where \( K_t \) and \( L_t \) denote inputs of capital and effective labor used for production in period \( t \) and \( \alpha \) is the capital share parameter in the production function. Labor supply \( L_t \) is assumed to be exogenous and the size of the population of any age, \( P(a) \), is assumed to grow at a constant rate \( n \). Technological growth takes place in purely labor augmenting form at a constant rate \( g \). Thus, in period \( t \),

\[ \text{The constant interest rate is implied by the assumption of myopic expectations.} \]
\[ L_t = \sum_{s=0}^{39} P_t(s), \]  
(4.4)

\[ P_t(a) = (1+n)P_{t-1}(a), \]  
(4.5)

while

\[ Lc_t = L_t(1+g)^t. \]  
(4.6)

The government uses either income or consumption taxes to finance its expenditure. However, instead of balancing its budget every year, the government chooses a present value budget constraint.

**Optimal Consumption Path**

Without any transition rules on individual saving, the optimal consumption path chosen by individuals is described in chapter 3. However, rules determining the tax treatment of existing assets change the asset accumulation pattern and influences the optimizing behavior of consumers. The following two subsections derive the rest-of-life budget constraints of individuals whose assets accumulated under the income tax regime continue to receive the same treatment as before.

**ICF Tax Reform With Grandfathering of Old Assets**

If old assets are designated as non-qualified and treated under the old income tax system while new assets are designated as qualified with any deposits in the account deductible and any withdrawals taxable the consumption at any time \( t \) of an individual of age \( a \) is
\[ C_t(a) = (1+i_t(1-\tau_t))NQ_t(a) - NQ_{t+1}(a) + [(1+i_t)Q_t(a) - Q_{t+1}(a) + w_t](1-\tau_c) \]  

(4.7)

where \( C_t(a) \) denotes consumption, \( NQ_t(a) \) denotes non-qualified asset and \( Q_t(a) \) denotes qualified asset for an individual of age \( a \); \( w_t \) is the wage rate, \( i_t \) is the interest rate and \( \tau_c \) is the tax rate under the ICF tax and \( i(1-\tau_t) \) is the after tax rate of return on non-qualified asset.

Accumulation of new qualified assets is given by

\[ Q_{t+1}(a) \leq (1+i_t)Q_t(a) + w_t \]  

(4.8)

As income from qualified assets accumulate tax free consumers desire to shift their entire saving to qualified accounts. This would generate windfall gains to holders of large saving accumulated under the income tax. To prevent such redistributions, transferring funds from one saving to another is prohibited and deposits into qualified accounts are limited to the wage earned at any time.

Given such restrictions, the consumption behavior remains unaltered for those already retired at the time of enactment of reform as old assets continue to be treated as before. For the newly born individuals with zero non-qualified wealth consumption behavior is the same as the "no-transition rule" economy. However, those currently employed shelter their new saving and consume out of non-qualified assets as long as possible; for most of these individuals, except the very young, (4.8) binds for a certain period of time. Assuming for simplicity that consumption always exceeds after-tax interest income from \( NQ_t \), non-qualified assets decline over time reaching zero in the beginning of period \( (m+t+1) \).
The present value of non-qualified and qualified assets at the beginning of period \((m+t)\) are

\[
NQ_{m+t}(a) / ((1+i_t(1-\tau_{it}))^{m-1} - a) = (1+i_t(1-\tau_{it}))NQ_t(a) - \sum_{s=a+t}^{m+t-1} \frac{C_s}{(1+i_t(1-\tau_{it}))^{s-a-t}}
\]

(4.9)

\[
Q_{m+t}(a) / ((1+i_t)\cdot a) = (1+i_t)Q_t(a) + \sum_{s=a+t}^{m+t-1} \frac{w_s}{(1+i_t)^{s-a-t}}
\]

(4.10)

In period \((m+t)\) desired consumption exceeds non-qualified deposits and (4.8) no longer binds. Rearranging (4.7) and noting that \(NQ_{m+t+1}(a)=0\), gives

\[
C_{m+t}(a) = (1+i_t(1-\tau_{it}))NQ_{m+t}(a) + [(1+i_t)Q_{m+t}(a) - Q_{m+t+1}(a) + w_{m+t})(1-\tau_{ct})
\]

(4.11)

From period \((m+t+1)\) to death at period \((t+49)\), consumers have only qualified savings and the present value of the remaining lifetime budget constraint from \((m+t+1)\) is

\[
\sum_{s=m+t+1}^{t+49} \frac{C_s/(1-\tau_{ct})}{(1+i_t)^{s-m-t-1}} = (1+i_t)Q_{m+t}(a) + \sum_{s=m+t+1}^{t+39} \frac{w_s}{(1+i_t)^{s-m-t-1}}
\]

(4.12)

Substituting (4.11) in (4.12)

\[
\sum_{s=m+t}^{t+49} \frac{C_s/(1-\tau_{ct})}{(1+i_t)^{s-m-t}} = (1+i_t)Q_{m+t}(a) + \sum_{s=m+t}^{t+39} \frac{w_s}{(1+i_t)^{s-m-t}} + (1+i_t(1-\tau_{it}))NQ_{m+t}(a)/ (1-\tau_{ct})
\]
Substituting (4.10) in the above equation

\[ I \sum_{s=m+t}^{t+49} \frac{C_s/(1-\tau_{ct})}{(1+i_t)^{s-m-t}} = I \sum_{s=m+t}^{t+39} \frac{w_s}{(1+i_t)^{s-m-t}} + I \frac{(1+i_t(1-\tau_{it}))NQ_{m+t}(a)/(1-\tau_{ct})}{(1+i_t)^{s-m-t}} \]

\[ + \sum_{s=a+t}^{m+t-1} \frac{w_s}{(1+i_t)^{s-a-t}} + (1+i_t)Q_t(a) \]

where \( I = 1/(1+i_t)^{m-a} \). Substituting (4.9) in the above equation gives the lifetime budget constraint of the individual

\[ I \sum_{s=a+t}^{m+t-1} \frac{C_s/(1-\tau_{ct})}{(1+i_t(1-\tau_{it}))^{s-a-t}} + RI \sum_{s=m+t}^{t+49} \frac{C_s/(1-\tau_{ct})}{(1+i_t)^{s-m-t}} \]

\[ = R \sum_{s=a+t}^{t+39} \frac{w_s}{(1+i_t)^{s-a-t}} + I(1+i_t(1-\tau_{it}))NQ_t(a)/(1-\tau_{ct}) + R(1+i_t)Q_t(a) \]

\[(4.13)\]

where \( R = 1/(1+i_t(1-\tau_t))^{m-a} \).

**ITP Tax Reform With Grandfathering of Old Assets**

If, for purpose of simplicity, old assets are also denoted by \( NQ \) and treated under the old income tax system while new "tax-free" assets are denoted as \( Q \) with income from such accounts tax exempt individual consumption at any time \( t \) of an individual of age \( a \) is

\[ C_t(a) = [1+i_t(1-\tau_{it})]NQ_t(a) - NQ_{t+1}(a) + (1+i_t)Q_t(a) - Q_{t+1}(a) + w_t(1-\tau_{wt}) \]
where \( \tau_w \) is the tax rate under the ICF tax and \( i(1-\tau_i) \) is the after-tax rate of return on non-qualified asset.

Accumulation of new qualified assets is given by

\[
Q_{t+1}(a) \leq (1+i_t)Q_t(a) + \omega_t(1-\tau_w) \tag{4.15}
\]

Similar to the situation under the ICF tax reform, if income from qualified assets accumulate tax free consumers desire to shift their entire saving to qualified accounts. This occurs under the ITP tax reform with no transition rules and allows primarily elderly holders of existing assets to get windfall gains. To prevent such redistributions, transferring funds from one saving to another is prohibited.

Under such restrictions, those currently employed behave in the same manner as they would have under the ICF tax reform with the transition rules described in the above subsection; they shelter their new saving and consume out of non-qualified assets as long as possible. Thus for most of these individuals, except the very young, (4.15) binds for a certain period of time. Assuming for simplicity that consumption always exceeds after-tax interest income from \( NQ_t \), non-qualified assets decline over time reaching zero in the beginning of period \((m+t+1)\).

The present value of non-qualified and qualified assets at the beginning of period \((m+t)\) are

\[
NQ_{m+t}(a)/((1+i_t(1-\tau_{t}))^{m-1-a} = (1+i_t(1-\tau_{t}))NQ_t(a) - \sum_{s=\alpha+t}^{m+t-1} \frac{C_s}{(1+i_t(1-\tau_{t}))^{s-a-i}}
\]
\( \frac{Q_{m+1}(a)}{(1+i_t)^{m-1}a} = (1+i_t)Q_t(a) + \sum_{s=a+t}^{m+t-1} \frac{w_s(1-\tau_{wt})}{(1+i_t)^{s-a-t}} \quad (4.17) \)

In period \( (m+t) \) desired consumption exceeds non-qualified deposits and (4.15) no longer binds. Rearranging (4.14) and noting that \( NQ_{m+t+1}(a)=0 \), gives

\[ C_{m+t}(a) = (1+i_t(1-\tau_{tt}))NQ_{m+t}(a) + (1+i_t)Q_{m+t}(a) - Q_{m+t+1}(a) + w_{m+t}(1-\tau_{wt}) \quad (4.18) \]

From period \( (m+t+1) \) to death at period \( (t+49) \), consumers have only qualified savings and the present value of the remaining lifetime budget constraint from \( (m+t+1) \) is

\[ \sum_{s=m+t+1}^{t+49} \frac{C_s}{(1+i_t)^{s-m-t-1}} = (1+i_t)Q_{m+t}(a) + \sum_{s=m+t+1}^{t+39} \frac{w_s(1-\tau_{wt})}{(1+i_t)^{s-m-t-1}} \quad (4.19) \]

Substituting (4.16), (4.17), (4.18) in (4.19) yields

\[ \sum_{s=a+t}^{m+t-1} \frac{C_s}{(1+i_t(1-\tau_{tt}))^{s-a-t}} + RI \sum_{s=m+t}^{t+49} \frac{C_s}{(1+i_t)^{s-m-t}} = R \sum_{s=a+t}^{t+39} \frac{w_s(1-\tau_{wt})}{(1+i_t)^{s-a-t}} + I(1+i_t(1-\tau_{tt}))NQ_t(a) + R(1+i_t)Q_t(a) \quad (4.20) \]

**Optimal Consumption**

At any time \( t \), an individual of age \( a \) plans \( C_{s-a}(a) \) for \( s = a+t, \ldots, T+t \), to maximize rest-of-life utility.
subject to the "rest-of-life" budget constraint (4.13) or (4.20), expressed in a single equation as

\[
\begin{align*}
& \frac{1}{(1-1/\sigma)} \sum_{s=a+t}^{t+49} \frac{C_{S-a}(1-1/\sigma)}{(1+i_{t+1}a-t)} \quad \text{subject to the } \text{"rest-of-life" budget constraint (4.13) or (4.20), expressed in a single equation as} \\
& \sum_{s=a+t}^{m+t-1} \frac{C_{S} l/(1-\tau_{Cl})}{(1+i_{t}(1-\tau_{Cl}))^{s-a-t}} + \text{RI} \sum_{s=m+t}^{t+49} \frac{C_{S} l/(1-\tau_{Cl})}{(1+i_{t})^{s-m-t}} \\
& = R \sum_{s=a+t}^{t+39} \frac{w_{S}(1-\tau_{wl})}{(1+i_{t}(1-\tau_{wl}))^{s-a-t}} + I(1+i_{t}(1-\tau_{wl}))N_{w}(a)/(1-\tau_{Cl}) + R(1+i_{t})Q_{t}(a) \\
\end{align*}
\]

The Lagrangian for the consumer optimization problem is thus

\[
\begin{align*}
\mathcal{L} &= \frac{1}{(1-1/\sigma)} \sum_{s=a+t}^{49+t} \frac{C_{S-a}(1-1/\sigma)}{(1+i_{t})^{s-a-t}} \\
& - \lambda_{t} \left( \sum_{s=a+t}^{m+t-1} \frac{C_{S} l/(1-\tau_{Cl})}{(1+i_{t}(1-\tau_{Cl}))^{s-a-t}} + \text{RI} \sum_{s=m+t}^{t+49} \frac{C_{S} l/(1-\tau_{Cl})}{(1+i_{t})^{s-m-t}} \\
& - R \sum_{s=a+t}^{t+39} \frac{w_{S}(1-\tau_{wl})}{(1+i_{t}(1-\tau_{wl}))^{s-a-t}} - I(1+i_{t}(1-\tau_{wl}))N_{w}(a)/(1-\tau_{Cl}) - R(1+i_{t})Q_{t}(a) \right). \\
\end{align*}
\]

(4.21)

where \( \lambda_{t} \) is the shadow price of the lifetime budget constraint in period \( t \) and equals the marginal utility of income. Solving for the optimal time path of \( C_{S-a} \) yields

\[
\begin{align*}
C_{S-a}(a) &= [\lambda_{t}l/(1-\tau_{Cl})]^{-\sigma} \phi^{a-t}, \quad s=a+t, \ldots, m+t-1. \\
\end{align*}
\]

(4.22a)
\[ C_{s,a}(a) = [\lambda_t/(1-\tau_{ct})]^{\cdot \sigma} \phi^{s-m+1}, \ s=m+t, \ldots, t+49. \quad (4.22b) \]

where \( \phi = [(1+i(1-\tau_{it}))/\sigma] \) and \( \phi^* = [(1+i)/(1+p)]^{\cdot \sigma}. \)

Substituting the optimal \( C_{s,a}(a) \) into the budget constraint (4.21) yields

\[
[\lambda_t/(1-\tau_{ct})]^{\cdot \sigma} = \\
(1-\tau_{ct})[I(1+i(1-\tau_{it}))NQ_t(a)/(1-\tau_{ct})+R(1+i)Q_t(a) \\
+R[w_t(1-\tau_{wt})M_{a,T}^T][(1+g)/(1+i)] / \{ M_{a,m+t+1}^T[z] + M_{m+t}^T[z^*] \}
\]

where \( z = \phi/[1+i(1-\tau_{it})] \), \( z^* = z = \phi/[1+i] \), and for any argument \( x \) of the function \( M_a \),

\[
M_{a,T}^T[x] = \sum_{s=a}^{T*} x_s = (x^{T*+1} - x^a) / (x - 1), \ x \neq 1.
\]

The time path of consumption can thus be simplified to

\[
C_{s,a}(a) = [C_t(a)]^{\phi^{s-a-t}}, \ s=a+t, \ldots, m+t-1, \quad (4.23a)
\]

\[
C_{s,a}(a) = [C_m(a)]^{\phi^{s-m-t}}, \ s=m+t, \ldots, m+t-1, \quad (4.23b)
\]

where \( C_t(a) = C_m(a) = \\
(1-\tau_{ct})[I(1+i(1-\tau_{it}))NQ_t(a)/(1-\tau_{ct})+R(1+i)Q_t(a) \\
+R[w_t(1-\tau_{wt})M_{a,T}^T][(1+g)/(1+i)] / \{ M_{a,m+t+1}^T[z] + M_{m+t}^T[z^*] \} \quad (4.24)\]
Individuals holding only qualified accounts would choose a consumption profile reflecting the untaxed interest rate; individuals holding non-qualified accounts would choose a consumption profile reflecting both taxed and untaxed interest rates with a kink at age m.

_Equivalence of ICF and ITP Taxes_

The consumption equation (4.24) shows the equivalence between the ICF and ITP tax reforms under alternative transition rules — if the tax rates under the two consumption tax alternatives are equal the only difference in optimal consumption under the two tax regimes is the difference in the tax treatment of qualified asset $Q_t(a)$. Since the initial equilibrium under a comprehensive consumption tax has no qualified assets the consumption for each age cohort remains unchanged under either consumption-based taxes.\(^4\)

It should be noted, however, that although consumption patterns are similar under the two tax systems the transition paths of the economy will differ due to differences in capital accumulation patterns. Only if the government varies the rate of debt accumulation such that the capital accumulation pattern is the same under both consumption taxes, the above transition rules would ensure equivalence between the consumption taxes.

\(^4\) If the initial equilibrium is a hybrid of income and consumption tax systems, as is seen in most countries, $Q_t(a)$ is not zero at the time of enactment of reform and consumption will differ under the two consumption tax systems. Equivalence under such situation can be obtained if qualified accounts existing from the old income tax system is grandfathered even under the ITP tax reform.
III. Simulation Results

To demarcate the effects of a change in the tax regime with and without transition rules, the transition is analyzed in three steps. First, the transition path obtained in base case of the model in chapter 3 is replicated; that is, the transition as described in Table 3.4 and Figure 3.4 is reproduced. Next, we simulate the model from the same initial equilibrium to ICF and ITP taxes with constant tax rates. The tax rates chosen are the ones obtained in the final steady state under the two consumption taxes. Finally, we examine the transition to the consumption taxes (with constant tax rates) under alternative transition rules.

Table 4.1 tracks some key variables during the transition from an initial income tax state to both ICF and ITP taxes under the parameter values described in Section III.B of chapter 3 with government raising a fixed per capita annual revenue. In both cases, aggregate consumption declines significantly immediately after the enactment of reform. For example, in year 2, $c$ declines by 6.5 (1.7) percent under the ICF (ITP) tax, and in both cases $c$ remains below its initial level for more than six years. The elimination of capital income taxation increases $k$ by 14.9 (3.7) percent and $w^e$ by 3.6 (0.96) percent under the ICF (ITP) by year 5. Compared to the initial value of net $i = 0.14$, the net interest rate in year two of reform rises to 0.176 (0.18) under the ICF (ITP) tax. Convergence to the new steady state occurs in roughly 25 (30) years under the ICF (ITP) tax. Steady state $k$ increases by 42.1 (9.7) percent, $w$ increases by 10.2 (3.5) percent, and $c$ increases by 9.9 (3.8) percent under the ICF (ITP) tax.

---

5 Similar reductions in consumption occur in the Summers and AK models.
### TABLE 4.1. TRANSITION TO ICF AND ITP TAXES (BASE CASE)

#### 4.1a. THE ICF TAX

<table>
<thead>
<tr>
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<th>k</th>
<th>w (eff.)</th>
<th>c (net)</th>
<th>l (net)</th>
<th>I/K</th>
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FIGURE 41. EQUIVALENT VARIATIONS BY GENERATION DURING THE TRANSITION TO THE ICF AND ITP TAXES IN A SUMMERS MODEL.
(Generations are identified by their age at the time of the tax change with future generations denoted by negative ages.)
Equivalent variations by generation are shown in Figure 4.1. With implementation of the ICF tax, roughly half of the population (the older generations) existing at the time of the tax change experiences a reduction in welfare; the younger half of the population and future generations benefit from the reform, with a steady state gain of nearly 10 percent of rest-of-life utility. In marked contrast, under the ITP tax, the older and middle-aged generations at the time of enactment gain from the elimination of income taxation of the returns to existing assets, with those just retiring (who enjoy the longest period of entirely tax-free income) gaining over 16 percent of rest-of-life utility. On the other hand, younger and future generations are net losers from reform and the steady state welfare loss is roughly 4 percent of rest-of-life utility.

As described in chapter 3, the underlying reasons behind these transitions are (i) the "human wealth" effect which encourages saving and higher future capital intensity. (ii) the "postponement" effect under the ICF tax which causes high initial tax rates and a steady state tax rate which is much smaller compared to the ITP steady state tax rate, and (iii) "double taxation" of existing assets under the ICF tax which harms the elderly in contrast to exemption of income from existing assets under the ITP tax which provides a boon to the elderly.

Table 4.2 tracks the transition from an initial income tax state to both ICF and ITP taxes under the same parameter values but with constant tax rates. The tax rates chosen are the tax rates obtained in the final steady state in Table 4.1. For the given parameter values, the constant tax rates do not alter the transition path significantly. For example, the constant tax rate of 22.3 (29.9) percent under the ICF (ITP) tax reform is not significantly different from 25.7 (30.9) percent obtained in year 2 of the fixed-revenue yield reform. Thus changes in c, k and wτ and i are approximately the same as the changes observed in Table 4.1. Equivalent variations by generation shown in Figure 4.2
### TABLE 4.2. TRANSITION TO ICF AND ITP TAXES WITH CONSTANT TAX RATES

#### 4.2a. THE ICF TAX

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#### 4.2b. THE ITP TAX

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</table>
FIGURE 4.2. EQUIVALENT VARIATIONS BY GENERATION DURING THE TRANSITION TO THE ICF AND ITP TAXES IN A SUMMERS MODEL WITH CONSTANT TAX RATES
also remain fairly unchanged. However, the number of generations gaining under either of the reforms increases as individuals less than 32 years old (more than 19) at the time of enactment of reform gain under the ICF (ITP) tax. Also, the percentage loss in rest-of-life utility for the transitional generations who are losing is smaller than before; the maximum loss to any generation goes down by 5 (1) percentage points under the ICF (ITP) tax reform.\footnote{The central simulation in McGee (1991) comparing the transition to ICF tax under balanced budget and under constant tax rate also show very little difference.}

Table 4.3 tracks some key variables under both consumption tax reforms which distinguishes between qualified and non-qualified assets and provides income tax treatment to non qualified assets. Compared to the earlier simulations c increases by 6.4 percent in year 2 under the ICF tax reform as the holders of existing assets do not postpone the consumption of such assets. Capital per effective falls initially as low initial tax revenue creates initial government debt. High private saving and declining government deficit encourages capital formation quickly and k increases by 7.7 percent, \(w^e\) increases by 1.9 percent by year 5; net interest rate increases from 14 percent to 18.9 percent in year 2 before dropping to the steady state rate. The initial drop in consumption is also smaller under the ITP tax reform as c remains virtually unchanged in year 2 as it drops by only 0.5 percent; consumption crosses the initial level by year 15. Capital per effective labor and \(w^e\) drop initially before rising; net interest jumps up to 18.4 percent before falling to the new steady state level of 16.4 percent.

The effect on welfare is traced in Figures 4.3 and 4.4 by measuring equivalent variation by generation. Figure 4.3 shows the equivalent variation by generation under the ICF tax reform. Grandfathering of non-qualified assets lowers the welfare loss of the
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FIGURE 4.3. EQUIVALENT VARIATIONS BY GENERATION DURING THE TRANSITION TO THE ICF TAXES IN A SUMMERS MODEL WITH AND WITHOUT TRANSITION RULES.
FIGURE 4.4. EQUIVALENT VARIATIONS BY GENERATION DURING THE TRANSITION TO THE ITP TAXES IN A SUMMERS MODEL WITH AND WITHOUT TRANSITION RULES
(elderly) generations having a large amount of non-qualified assets. The maximum loss
to any generation is less than 10 percent of rest-of-life utility as compared to nearly 20
percent in Figure 4.2. Interestingly enough, the maximum loss is suffered by those just
retiring compared to Figure 4.2 where the maximum loss was suffered by the most
elderly generation.\footnote{In the absence of transition rules those just retired could postpone consumption to some extent and lessen their welfare loss. However, under the present circumstances, this postponement effect is lost.} For future generations with zero non-qualified wealth and young
generations with very little non-qualified wealth, the equivalent variation measure
remains approximately unaltered.

Figure 4.4 traces the equivalent variation by generation under the ITP tax reform.
The huge windfall gains to the elderly are largely eliminated by taxing the income from
non-qualified assets. Generations 20-38 years old at the time of enactment of reform gain
as they postpone the consumption from qualified assets with tax exempt income and
consume initially from the non-qualified assets. However, their gain is less than the gains
under the ITP tax reform with no rules. For future generations with zero non-qualified
wealth and young generations with very little non-qualified wealth, the equivalent
variation measure remains approximately unaltered. However, the initial drop in capital
intensity and wage rate creates slightly higher windfall losses to the young generations.

IV. CONCLUSIONS

Summers and AK show that the pattern of transitional redistributions across
generations after a consumption tax reform depends on whether an ICF tax or an ITP tax
is adopted. Specifically, they show that the ICF tax reform hurts the elderly generations
alive at the time of the enactment of reform; in contrast, the ITP tax reform creates

\footnote{In the absence of transition rules those just retired could postpone consumption to some extent and lessen their welfare loss. However, under the present circumstances, this postponement effect is lost.}
windfall gains to the elderly. This chapter argued how proper transition rules can redistribute these gains and losses across generations without affecting the final steady state values. The chapter analyzed a model that differed from Summers (1981) model in two respects. First, it relaxed the assumption of balanced budget requirement by the government and introduced a policy of constant tax rates with budget balanced in present value terms. Second, the model differentiated between tax treatment of assets saved from pre-reform income taxed state and assets newly accrued under a consumption tax state; it granted pre-reform tax treatment to the old assets while treating new assets consistent with consumption taxation.

Two important results are obtained from the chapter. First, under these transition rules, the optimizing consumer chooses similar consumption paths for both forms of consumption tax. However, the transition paths are not equivalent under the two consumption taxes due to difference in timing of tax collection. The postponement effect under the ICF tax reform allows the economy to obtain higher capital stock. However, it if the government uses debt policy to obtain similar rates of capital accumulation under the two consumption taxes, the two taxes will produce equivalent results under the above transition rules.

Second, the transition rules reduce intergenerational redistributions to a considerable degree. Since it seems likely that a consumption tax reform would be accompanied by such transitional rules, the chapter concludes that Summers and AK had overstated the redistributioonal impact of such reforms.
CHAPTER FIVE

DIRECTIONS FOR FUTURE RESEARCH

The thesis analyzed the robustness of two important results of a comprehensive reform to a direct consumption tax in the context of models popularized by Summers and AK. First, it showed that explicit incorporation of a business sector and a business cash flow tax can eliminate a significant portion of the differences in steady state welfare levels obtained under the two forms of consumption tax. Second, departing from the usual conclusions made from these models, the results also suggested that ITP/R tax may be more attractive than the ICF/RF alternative. Specifically, the analysis suggests that implementation of the ITP/R option may result in relatively small transitional redistributions across generations. In contrast, implementation of the ICF/RF tax results in very large redistributions from elderly generations to very young and future generations. Finally, the thesis showed that transitional rules — neglected in previous analyses — can play an important role in changing the pattern of intergenerational redistributions. Properly designed transition rules can reduce intergenerational redistributions without influencing the final steady state values.

Before concluding it should be noted that these results should of course be viewed with caution. Given the highly stylized nature of the models used in the analysis it would be foolhardy to use these for economic predictions or for providing explicit policy recommendations. First, it should be noted that these models are usually very sensitive to parameter values implying the need for accurate parameter estimates. Although the models use parameter values consistent with empirical literature, obtaining precise parameter estimates is beyond the scope of this thesis.
Second, the models used in this paper could be extended in a wide variety of directions. For example, it would be useful to extend the model by allowing individuals to hold a large number of different types of assets that are taxed differently under current law. Moreover, the model could incorporate labor-leisure choice in the utility function. Finally, a wide variety of the more restrictive assumptions of the model could be relaxed, including the absence of bequests and inheritances, and the assumptions of myopic expectations, a closed economy and a fixed debt-equity ratio.
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