Capital Income Taxation and Resource Allocation

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Chapter 9: Taxation and Economic Growth

Chapter 9

TAXATION AND ECONOMIC GROWTH

Capital's-avoidance reactions in response to taxation are the theme of this book. In the short and medium run, these reactions are mostly manifested through the reallocation of existing capital among competing uses. Examples, referring to the intersectoral and international structure of capital, were studied in Chapters 6 and 7. In the long run, however, the process of accumulating capital may be no less important. Over time, the elasticity of the supply of capital resulting from the households' consumption–savings decisions may well exceed the elasticity resulting from restructuring existing wealth. Abstracting from intersectoral and international problems, this and the following chapters study the influence of taxation on the process of capital accumulation.

The discussion is based on the formal model developed in the previous chapter which itself was derived from the laissez-faire model of economic growth presented in Chapter 2 and from the analysis of the firm's reactions to taxation in Chapters 3, 4, and 5. The reader should be familiar with these chapters.

After some introductory remarks in the first section showing how the present approach relates to the literature, a uniform tax on all kinds of capital income, a tax on the stock of capital, and the depreciation problem will be considered. The heart of this chapter is Section 9.5 where attention focusses on the individual components of capital income taxation. The discussion concludes with remarks on the expenditure tax and a criticism of alternative theoretical results achieved in other studies.

9.1. Relationship to the Literature

The problem of intertemporal tax distortions is not a new one. At least since Kaldor (1955) popularized the idea of replacing the income tax with an expenditure tax, there has been an ongoing debate on the usefulness of

taxing savings and capital income. Initially, the focus of the debate was the ethical problem of whether those who contribute to the production process through savings, rather than withdraw resources from this process through consumption, should be punished by a tax on capital income. Later, however, the interest shifted more and more to allocative aspects, with particular emphasis on the distortions in the growth path of the economy brought about by capital income taxation. The recent research on this problem can be divided into two groups.

One group uses Samuelson's (1958) overlapping-generations model that Diamond (1965) extended by introducing a production sector. The papers by Atkinson and Sandmo (1980), King (1980), and Rose and Wiegard (1983) should be mentioned here. The primary concern of these studies is a comparison between a capital income tax and a wage or consumption tax. Following Feldstein (1978a), they try to find a compromise between the distortions in the labor–leisure and consumption–savings decisions, but in addition they incorporate the goal of approaching some predetermined optimal growth path. This literature is exclusively concerned with steady states.

The other group, including Chamley (1981), Abel and Blanchard (1983), Becker (1983, 1985), and Sinn (1980b, 1981), uses decentralized versions of the neoclassical model of optimal growth or reinterprets this model from the viewpoint of a market economy. The basic ingredients are perfect foresight, infinitely lived consumers, and taxation with lump-sum rebates. Unlike the overlapping-generations literature, these studies do not incorporate a labor–leisure choice, but they are able to determine the full adjustment path towards a new steady state that will result from a change in the tax rate on capital income.

The conceptual differences between the overlapping-generations models and the infinitely-lived-consumer models were pointed out in Chapter 2. The last section of the present chapter will take up the previous discussion and extend the criticism of the overlapping-generations model. It will be argued that, in that model, the distortions in the labor–leisure and consumption–savings decisions do not play the dominant role that they seem to have at first sight, but are, in fact, overridden by a strange interaction of income effects on private savings.

This book does not follow the overlapping-generations literature but is an extension of the infinitely-lived-consumer approach. The formal part of this extension was provided in Chapters 2 and 8 by introducing an infinitely-lived firm that can choose between alternative methods of finance and by allowing for a richer set of taxes. The economic part is provided here.

All studies mentioned, that is, the overlapping-generations literature and the infinitely-lived-consumer models, have in common that the only capital income tax system considered is a fully integrated Schanz–Haig–Simons system, the Teilhabersteuer.[1] There is a uniform tax rate on all kinds of capital income and true economic depreciation is allowed for tax purposes. While this system is a useful starting point for analyzing the intertemporal distortions from capital income taxation it abstracts from most of those aspects of this type of taxation that seem to be of political concern.

The model tax that applies uniformly to all kinds of capital income earned is not found anywhere in the world, and true economic depreciation is a bad idealization of the tax laws of most countries. In reality, there are complex systems of capital income taxation as described in Chapter 3, differing in the generosity of tax depreciation rules and the degree of integration between personal and corporate taxation. Does corporate income tax create intertemporal distortions similar to those created by a tax on interest income? Will an integration between corporate and personal income taxation stimulate economic growth? What is the significance of depreciation allowances for the speed of growth? What is the role of capital gains taxation? Does the taxation paradox carry over to a growth setting? These are important questions, but they have been given little or no attention in the theoretical literature.

The analysis of this chapter tries to provide answers to them and related questions. It complements the existing literature in that it concentrates on the structural elements of capital income taxation. Separate taxes on retained profits, capital gains, dividends, personal interest income, the stock of capital, and consumption as well as alternative depreciation rules are considered. The goal is to paint a recognizable, albeit abstract, picture of the distortions in the growth path brought about by the tax systems established in Western industrial countries.

The goal is not to find an optimal mix of wage taxation and capital income taxation which will maximize the overall efficiency of the tax system. Before such a problem can meaningfully be studied, it is necessary to understand the distortions created by capital income taxation itself. Clearly, for example, it would not make sense to follow Kaldor's recommendations by abolishing corporate income tax if it turned out that this tax creates different distortions from those of the uniform model tax on all kinds of capital incomes that he had in mind.

[1] Cf. Chapter 3.1.2. There is, however, a paper by Bradford (1981) that employs an overlapping-generations model to study a tax on corporate distributions as the only tax in the economy.

Because of this limitation of scope, weighing the distortions in the consumption–savings decision against those in the labor–leisure choice is not essential for the analysis. It can be assumed with good conscience that the labor supply is inelastic. While this assumption does not sacrifice much generality for the purposes described, it greatly simplifies the analysis of tax distortions in an intertemporal general equilibrium model of a growing economy.

Despite the apparent lack of theoretical work that shows an interest in intertemporal distortions created by alternative structures of capital income taxation, there are a number of empirical and policy-oriented studies that address this issue. Perhaps the foremost of these is the study of Fullerton et al. (1981) where a sequential numerical model of general equilibrium is used to estimate the welfare changes resulting from alternative proposals for a reform of capital income taxation. One of the results of this study is that the present value of the dynamic welfare gain from a full integration of corporate and personal taxation would have been between \$253 bill. and \$551 bill. for the United States in 1973. For a partial integration like the German full imputation system, a gain of slightly less than half, but still more than \$100 bill. is calculated. These are huge numbers. It is impossible to examine their precise magnitudes on the basis of a purely theoretical model. However, in Section 9.5.4 there will be an opportunity to find out whether at least their signs can be confirmed.

9.2. Introductory Results

9.2.1. Basic Formulas

Given the properties of intertemporal general equilibrium derived in the last chapter, it will suffice for the present discussion to interpret the two differential equations (8.36) and (8.45) and the steady-state equations (8.46) and (8.47). In the realistic case where firms are allowed to deduct debt interest these equations become

$$\dot{k} = \varphi(k) - (\delta + n + g)k - c, \tag{9.1}$$

$$\dot{c} = \frac{c}{\eta}\left(\frac{\varphi'(k) - \delta - \tau_k}{\tilde{P}_K} - (\rho + \eta g)\right), \tag{9.2}$$

$$\varphi'(k^\infty) - \delta = (\rho + \eta g)\tilde{P}_K + \tau_k, \tag{9.3}$$

and

$$c^{\infty} = \varphi(k^{\infty}) - (\delta + n + g)k^{\infty}, \tag{9.4}$$

where

$$\tilde{P}_K = \frac{1 - \alpha_1 \tau_r - \sigma^*}{\max(\theta_d^*, \theta_r^*)} + \frac{\sigma^*}{\theta_p} \tag{9.5}$$

is the wedge parameter introduced in (8.40). Alternative scopes of financial flexibility of the firm are modelled through

$$\sigma^* = 1 - \alpha_1 \tau_r - \varepsilon^*, \tag{9.6}$$

$$\varepsilon^* \geq \alpha_1 W \max(\theta_d^*, \theta_r^*) \tag{9.7}$$

such that both the case where the minimum marginal equity–asset ratio ε^* is exogenously determined and the case where it is endogenously determined by the firms' attempts not to violate their loss-offset constraints are admissible. Recall that, according to (8.52), the growth factor W is a constant that cannot be affected by tax reforms.

9.2.2. *A Uniform Tax on all Kinds of Capital Income*

One of the basic results of the taxation theory derived from the partial analytic model of the firm is the Johansson–Samuelson theorem.[2] According to this theorem, a perfectly integrated Schanz–Haig–Simons system – that is, a system that taxes the representative shareholder's part of retained and distributed profits at the same rate as his personal interest income – is investment neutral provided debt interest is tax-deductible and true economic depreciation is employed for tax purposes: *given the time path of the (gross) market rate of interest* the size of the tax rate has no influence on the amount of capital employed by the firm. The theorem implies that an application of fully integrated Schanz–Haig–Simons systems of capital income taxation would bring about neither *intersectoral* nor, provided the residence and destination principles apply, *international* distortions in the structure of capital even when different tax rates are applied to different countries and firms. It does not imply that there are no intertemporal distortions in the formation of capital, that is, distortions in the growth path of the economy.

[2]See Chapter 5.3.2.

Indeed, it can easily be shown that such distortions must occur in an intertemporal general equilibrium where the time paths of the factor prices, including the market rate of interest, are endogenously determined.[3] Let θ, $\theta = \theta_p = \theta_d^* = \theta_r^*$, indicate the uniform tax factor for the three types of capital income and assume true economic depreciation ($\alpha_1 = 0$). In this case, the wedge parameter becomes

$$\tilde{P}_K = 1/\theta \tag{9.8}$$

regardless of the financial constraint σ^*, and thus

$$d\tilde{P}_K/d\tau = 1/\theta^2 > 0. \tag{9.9}$$

In connection with (9.2) and (9.3), this differential quotient shows that the tax rate increase induces a change in the market equilibrium path in the (c, k) diagram. This change is illustrated in Figure 9.1.

Because of (9.3), (9.9) reveals that, in comparison to the laissez-faire model, the economy approaches a steady state with a higher marginal productivity of capital and that the steady-state capital intensity is falling – say from k_1^∞ to k_2^∞. Since the market equilibrium path intersects the $(\dot{k} = 0)$ curve at the steady-state point from below, and since there is only one such point, it is immediately obvious that this path shifts upwards in the whole range $k_2^\infty \leq k \leq k_1^\infty$. It is not so obvious though whether this will also happen outside this range.

The information necessary to answer this question is provided by (9.7). Suppose first that, in the range $k < k_2^\infty$, the new equilibrium path is not everywhere above the laissez-faire path. Then a point (c, k) with $0 < c < \varphi(k) - (\delta + n + g)$ and $0 < k < k_2^\infty$ should exist where the slope $\dot{c}/\dot{k}$ is larger than or as large as it would be in the absence of taxes. Since $\dot{k}$ is uniquely determined by k and c and since $\dot{k} > 0$ when $c < \varphi(k) - (\delta + n + g)$ this requires that $d\dot{c}/d\tilde{P}_K \geq 0$. Because of (9.2), the latter cannot be the case, however. Suppose, on the other hand, that, in the range $k > k_1^\infty$, the new equilibrium path is not everywhere above the laissez-faire path. In this case, a point (c, k) with $c > \varphi(k) - (\delta + n + g)$ and $k > k_1^\infty$ should exist with the property that the slope $\dot{c}/\dot{k}$ is less than or as large as in the laissez-faire model. Since $\dot{k} < 0$ for $c > \varphi(k) - (\delta + n + g)$ this again requires that $d\dot{c}/d\tilde{P}_K \geq 0$ and, provided that $\varphi'(k) - \delta > 0$, this again cannot be true. Thus, when a tax reform drives up $\tilde{P}_K$ – and a rise in a uniform capital income tax rate *is* such a reform – the market equilibrium

[3]The discussion follows Sinn (1980b, 1981).

path has to shift upwards in the range where the marginal product of capital is strictly positive. In the following, it will always be assumed that, at the time of the tax reform, the economy is in this range; i.e., that it is in a situation where the capital intensity of production is below, at, or not too far beyond, the Golden-Rule level. This assumption is automatically satisfied if we assume that the economy is in a steady state before the tax reform is carried out, for it was shown in the previous chapter that only steady states to the left of the Golden-Rule point can occur.

While this reasoning referred to "small" variations in a uniform capital income tax rate, Figure 9.1 depicts the case of a "large variation" where a new tax is introduced, starting from a laissez-faire steady-state path. This extension is clearly justified. Any marginal increase in the wedge parameter, regardless of the level it starts from, induces the described marginal upward shift in the growth path; thus, more than marginal increases in $\tilde{P}_K$ unambiguously induce more thzn marginal upward shifts in the growth path. Analogously, small or large reductions in $\tilde{P}_K$ would induce corresponding downward shifts in the growth path.

The result illustrated in Figure 9.1 spoils the favorable impression which the fully integrated Schanz–Haig–Simons system made with regard to the intersectoral and international structure of capital. It is true that the capital income tax rate does not drive a wedge between the marginal product of

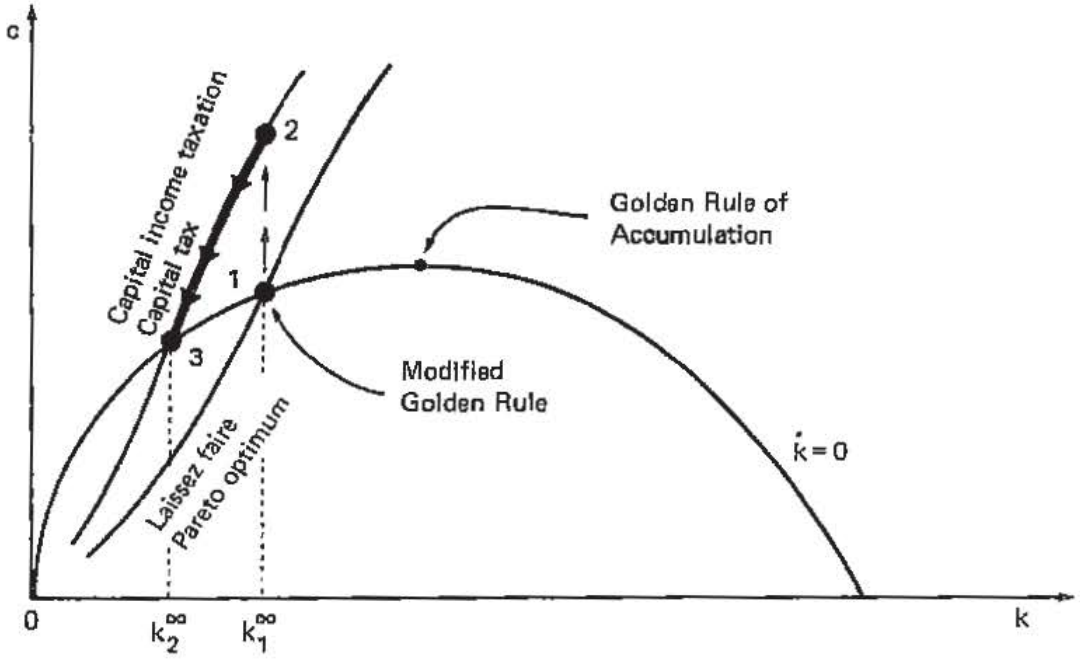

Figure 9.1. Growth losses* through tax reforms that raise $\tilde{P}_K$ and/or τ_k. (* As in the following figures, 1 denotes the steady state immediately before the tax reform, 2 the situation immediately after the reform, and 3 the new long-run steady state.)

capital, $\varphi' - \delta$, and the market rate of interest, r. However, it does drive a wedge between the market rate of interest and the consumers' rate of time preference, γ, and it is the overall distance between the marginal product of capital and the rate of time preference that counts for the influence of taxation on economic growth.

In the short run, when the capital intensity and hence the marginal product of capital are given, the tax reform implies a reduction in the net-of-tax market rate of interest, $r\theta$. This reduction induces households to anticipate consumption, so savings and investment fall in comparison to what they otherwise would have been. After the reform, the growth rate of capital is lower than otherwise and so are the growth rates of production and consumption. In the long run, however, all growth rates return to the level of the steady-state growth rate $n + g$ and, as the marginal product of capital rises with the fall in the capital intensity of production, the net-of-tax market rate of interest returns to the constant level of the steady-state rate of time preference, $\rho + \eta g$. Despite the recovery of growth rates, growth is now taking place on lower paths. The stock of capital, the level of production, and the level of consumption are all smaller than they would have been without the tax reform.

Table 9.1 summarizes these results with regard to the normalized values of capital, production, and consumption. Since the table will also be used for an analysis of other tax reforms that operate in a similar way, it indicates differential quotients that relate these values to the wedge parameter $\tilde{P}_K$ rather than to the tax rate τ. The corresponding differential quotients with regard to τ follow from multiplying those given in the table with the quotient $d\tilde{P}_K/d\tau$ given in (9.9).

It is not difficult to evaluate the distortions in the growth path of the economy from a welfare theoretic point of view. Thanks to the congruence

Table 9.1
The influence of tax reforms that operate via a change in the wedge parameter on the growth path[a].

	$dk/d\tilde{P}_K$	$d\varphi/d\tilde{P}_K$	$dc/d\tilde{P}_K$
Short run	0	0	>0
Long run	$(\rho + \eta g)/\varphi'' < 0$	$(\varphi + \eta g)\varphi'/\varphi'' < 0$	$(\rho + \eta g)[\varphi' - (\delta + n + g)]/\varphi'' < 0$

[a]In this and the following tables, the long-run results refer to changes in steady-state values and the short-run results refer to those effects that follow the tax reform instantaneously; that is, at $t = 0$.

between the laissez-faire path and the Pareto-optimal growth path that was demonstrated in Chapter 2.6, it can be unambiguously stated that the slowdown of economic growth brought about by a uniform capital income tax results in a welfare loss: the post-tax growth path produces a lower present value of utility for the representative household than the path the economy would otherwise have taken.

The reason for the comparative loss in utility is not that the household transfers part of its resources to the government – the resource transfer through taxation is after all fully compensated by lump-sum rebates from the government. Rather, the only reason for the loss is the household's attempt to avoid part of the tax burden through a change in its savings behavior; the loss in utility is a pure excess burden. The single household believes it has no influence on other households' reactions and considers the aggregate tax revenue and the government's transfer payments as exogenous to its own decisions. It can therefore reasonably expect to improve its situation by reducing its own savings volume. However, this does not mean that it will be better off than in a situation where no one reacts to the tax. On average, the household simply recoups the money it loses through other households' avoidance reactions and the consequent reduction in government transfers. The *representative* household neither gains nor loses cash, but it does lose utility because its futile avoidance reaction means a deviation from its "true" optimal intertemporal consumption plan. Absence of collective rationality produces the dynamic welfare loss of capital income taxation.

The separation between corporate and personal taxation that characterizes the tax systems of most countries, in particular the double taxation of corporate dividends, has been seen by many authors as the major cause of the tax system impeding economic growth, and a stronger integration of corporate and personal taxation has frequently been recommended. Some authors want to mitigate the degree of double taxation, some recommend a complete abolition, and others go so far as to call for a perfect integration between corporate and personal taxation so that even the marginal tax rate on retained profits is adjusted to the marginal personal tax rate of the shareholder household. Goode (1947), the Carter Commission (1966), and Engels and Stützel (1968), who took up an old proposal of Dietzel (1859), should be mentioned here. The results reported in Table 9.1 and Figure 9.1 show the limitations of all the proposals that go in the direction of increased integration between corporate and personal taxation. Whether or not there is a distortion in the growth path that can be attributed to a lack of integration: the fully

integrated system of capital income taxation is itself an obstacle to economic growth and creates intertemporal welfare losses.

9.2.3. On the Interest Elasticity of Savings

The allocative result reported in the previous section depends crucially on the fact that a reduction in the net-of-tax market rate of interest induces a substitution of present for future consumption. Since income effects were excluded through the assumption of lump-sum transfers, this also means that the current volume of aggregate savings, defined as the portion of national income not consumed, falls as the capital income tax rate rises.

This is not equivalent to saying that private savings, defined as the difference between disposable income (in the accounting sense) and consumption, will fall. It would only be equivalent if the tax payments were simultaneously compensated with transfer payments, but this was not assumed.[4] The compensation was merely required in present-value terms. When the government compensates in the present for capital income taxes that will be collected in the future, private savings may rise even though aggregate savings fall.

It is also not true, of course, that the substitution of present for future consumption means that an uncompensated fall in the net-of-tax market rate of interest would reduce private savings. Uncompensated interest rate changes induce income and substitution effects and, as is well known, the net effect is theoretically ambiguous. Provided the household is a net saver, the income effect that results from a rise in the capital income tax rate in itself induces the household to save more out of current income to meet its future tax liabilities. This effect may well overcompensate the direct substitution effect and increase the private savings volume.

All these possibilities, however, by no means invalidate the results achieved in the last section. First, as explained in the introduction to this book, a welfare evaluation of a tax can only be based on its direct substitution effect, and of course this effect is meant here as an intertemporal substitution in consumption, not as a substitution between consumption and savings. Only the direct substitution effect thus understood is the source of the excess burden capital income taxation causes and, given the specification of the household's utility function, it unambiguously shows up in the present model. Secondly, even the

[4]This point was clarified in a discussion between Sandmo (1981) and Feldstein (1978b).

prediction that the imposition of a uniform capital income tax will slow down economic growth is a useful positive result that retains its meaning when the assumption of lump-sum transfers is removed. The correct way of interpreting this result is to see it as a building block for a differential tax analysis. There are many potential taxes that can be used to finance a given stream of government expenditure, and most of these taxes distort the allocation of resources. The slowdown of economic growth is the specific distortion that follows from a uniform Schanz–Haig–Simons tax. To find out about the economy's overall reaction to a tax reform, the net effect from this distortion and the distortion resulting from the tax for which the Schanz–Haig–Simons tax is substituted must be considered. Exploring tax-specific distortions is indispensible for constructing a rational tax system, but worrying about income effects is often unnecessary as they will neutralize each other.

The degree of retardation of economic growth and the size of the welfare loss depend crucially on the strength of the intertemporal substitution effect. Not very much empirical work has been done to estimate this effect, but some evidence is available. A correct measure of the substitution effect is the simultaneously compensated elasticity of private savings with respect to the net-of-tax market rate of interest. Wright (1969, p. 295) calculated values in the range between 0.18 and 0.27 for this elasticity. This means that doubling the net-of-tax market rate of interest and compensating for the corresponding wealth increase at the time the interest income is earned raises private savings by an amount between 13 and 21%.[5] A more recent study by Boskin (1978, p. 16) yields even higher values.[6] According to this study the *compensated* interest elasticity of savings is in the range between 0.2 and 0.6 where the author "for statistical reasons" – whatever they may be – prefers the value 0.4. This value implies that savings rise by 32% if the interest rate doubles. At first sight this does not look very different from Wright's results. Note, however, that, according to what has been said, the value of the uncompensated interest elasticity is likely to understate the sought value of the simultaneously compensated elasticity. Even an uncompensated elasticity of zero would be evidence for the existence of the required intertemporal substitution effect. Whatever the true size of this

[5]The relative increase in savings is $(1 + x)^{\eta} - 1$ if x is the relative increase in the rate of interest and η is the interest elasticity of savings.

[6]Lower elasticities were calculated by Blinder (1975); however, unlike Wright and Boskin, he did not consider the influence of taxation on the net-of-tax market rate of interest. High values have also been found in an investigation, not available to the author, by Boskin and Lau from the year 1978 that is cited by Sandmo (1985).

substitution effect, the estimates of both Wright and Boskin lend empirical support to the theoretical result that a fully integrated Schanz–Haig–Simons system would be a significant obstacle to the process of capital formation.

9.3. Braking Economic Growth through the Tax on the Stock of Capital

The partial analysis of Chapter 5.4.4 showed that the tax on the stock of capital is non-neutral. This tax requires a marginal product of capital above the market rate of interest and hence, given the market rate of interest and given the employment of labor, it reduces the amount of capital the firm chooses to employ. The tendency of this result carries over to an intertemporal general equilibrium.[7]

This is obvious from Equations (9.2) and (9.3). Both these equations show that τ_k plays a role similar to that of the wedge parameter $\tilde{P}_K$. An increase in $\tilde{P}_K$ analytically is about the same as an increase in τ_k. For the same reason as described in the context of the fully integrated Schanz–Haig–Simons tax, an increase in the tax rate on the stock of capital shifts the market equilibrium path in the (c, k) diagram upwards and obviously the effect that is brought about by capital income taxation is reinforced.

The implications of (9.1), (9.2), and (9.3) for the impact of τ_k on the growth path of the economy are summarized in Table 9.2. The welfare theoretic evaluation of these results does not differ in principle from that of the implications of a uniform capital income tax.[8]

Table 9.2
Growth effects of change in the tax rate on the stock of capital.

	$dk/d\tau_k$	$d\varphi/d\tau_k$	$dc/d\tau_k$
Short run	0	0	> 0
Long run	$1/\varphi'' < 0$	$\varphi'/\varphi'' < 0$	$[\varphi' - (\delta + n + g)]/\varphi'' < 0$

9.4. Depreciation Allowances to Mitigate Misallocation

A general and uniform tax on all kinds of capital income will only be

[7] Cf. Nachtkamp (1986) for an analysis of a much richer set of stock taxes in the context of this intertemporal general equilibrium model.

[8] There are, however, differences with regard to the time path of the market rate of interest. Cf. Chapter 10.

investment neutral from a partial-analytic point of view if the present value of tax depreciation on the marginal investment project equals the present value of true economic depreciation, that is, only if $\alpha_1 = 0$. In Chapter 3.1.3 it was already found that this condition is usually not satisfied in practice. In the Anglo-Saxon countries in particular, the case $\alpha_1 > 0$ seems typical as these countries offer very generous tax depreciation allowances to their investors.[9]

It is obvious from (9.2), (9.3), and (9.5) that accelerated depreciation allowances operate through the wedge parameter $\tilde{P}_K$. In the case of a uniform marginal tax burden on all kinds of capital income ($\theta = \theta_p = \theta_d^* = \theta_r^*$) it follows from (9.5) that

$$\tilde{P}_K = (1 - \alpha_1 \tau_r)/\theta \tag{9.10}$$

and hence

$$d\tilde{P}_K/d\alpha_1 = -\tau_r/\theta < 0. \tag{9.11}$$

Applying this differential quotient to the general results reported in Table 9.1 shows that introducing more generous depreciation allowances reduces consumption in the short run ($dc/d\alpha_1 < 0$), but increases capital, output, and consumption in the long run ($dk/d\alpha_1$, $d\varphi/d\alpha_1$, $dc/d\alpha_1 > 0$).

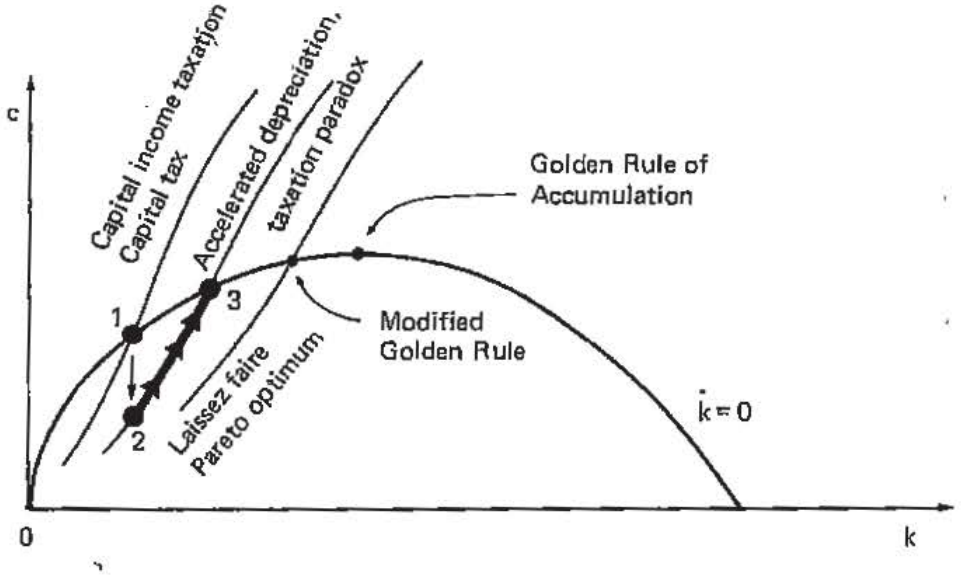

Figure 9.2. Accelerated depreciation as a means of mitigating growth losses/the role of the taxation paradox.

[9] Cf. Chapter 3.1.3.

Depreciation allowances are an effective means of achieving an active growth policy. A Schanz–Haig–Simons tax on all kinds of capital income and a tax on the stock of capital slow down economic growth. By introducing accelerated depreciation allowances ($\alpha_1 > 0$), that is, depreciation allowances that are more generous than true economic depreciation, growth can be accelerated again. The generous tax depreciation allowances provided in most countries can therefore be interpreted as an attempt to mitigate the impediments to economic growth brought about by capital income taxation and the taxation of the stock of capital. Figure 9.2 illustrates this interpretation.[10]

9.5. The Components of Capital Income Taxation

The analysis now turns to the roles of the single components of capital income taxation; that is, to the corporate tax, the capital gains tax, and the personal income tax on dividends and interest income. It is a popular belief among economists that these components operate in similar ways and can therefore be lumped together.[11] Frequently, theoretical or empirical models use an "effective" capital income tax rate that is defined simply as the aggregate capital income tax revenue divided by the volume of capital income taxes, and the view is held that this effective tax rate carries the necessary information for evaluating the tax system's impact on the process of capital accumulation. Although this view might seem plausible at first sight, it does not withstand a closer scrutiny. The following sections will demonstrate the differences in the way the different components affect economic growth. Some are highly distortionary, one is fairly neutral, and another could even act as a stimulus to economic growth.

9.5.1. Personal Income Taxation

Suppose the water of a river is dammed by three parallel weirs of different heights. Which of these weirs is the most effective means for achieving marginal variations in the flow of water? – Clearly the lowest one. Most water passes over the lowest weir and the water flow is obviously more responsive to the height of this weir than to that of the others.

[10]The conditions under which a complete removal of the allocative distortions is possible will be discussed in Chapter 11. For the time being, attention is confined to the case of moderate depreciation allowances where only part of these distortions is compensated.

[11]Cf., e.g., Harberger (1962, pp. 235 n.), Feldstein (1974a, p. 511; 1978a, p. 48), Chamley (1981, p. 484), or Ballentine (1981).

Although it is an imperfect analogy, this example might help to explain the role of personal income taxation. The three weirs are the three elementary sources of finance – debt, retentions, and new issues – and the lowest weir is debt financing. As the tax system favors debt financing $[\theta_p \geq \max(\theta_d^*, \theta_r^*)]$ it can be expected that this source of finance is frequently used and that a marginal variation of the tax burden imposed on it will significantly affect the formation of real capital. The personal income tax is a tax on interest income and a tax on debt financing. Variations in its rate are variations in the height of the lowest weir![12]

Inspection of Equation (9.5) confirms this view. Assume first the firm enjoys full financial flexibility within the legal constraints; that is, assume the minimum marginal equity–asset ratio is zero. In this case the wedge parameter becomes

$$\tilde{P}_K = (1 - \alpha_1 \tau_r)/\theta_p \qquad (\varepsilon^* = 0), \tag{9.12}$$

and obviously it rises with an increase in the personal income tax rate. In connection with Table 9.1, this implies that an increase in the personal tax rate induces a slowdown in economic growth just as the increase in a uniform Schanz–Haig–Simons tax rate does. In the short run, consumption will rise, but in the long run consumption, capital, and output will all be lower than they otherwise would have been.

The influence of the personal income tax rate may be weaker in the case of limited financial flexibility. This can be seen from Equation (9.5) which, because of (9.6), can be written as

$$\tilde{P}_K = \frac{\varepsilon^*}{\max(\theta_d^*, \theta_r^*)} + \frac{\sigma^*}{\theta_p},$$

where $\varepsilon^* + \sigma^* + \alpha_1 \tau_r = 1$. In the classical and closely related systems where $\theta_d^* < \theta_r^*$, the personal tax factor θ_p only shows up in the second item and clearly its influence on $\tilde{P}_K$ is lower the lower the maximum marginal debt–asset ratio σ^*. In the special case where the firm is not allowed to use any debt financing at all it even disappears completely:[13]

$$\tilde{P}_K = (1 - \alpha_1 \tau_r)/\theta_r^* \qquad (\theta_r^* > \theta_d^*, \sigma^* = 0). \tag{9.13}$$

[12] Note that the assumption $\theta_p \geq \max(\theta_d^*, \theta_r^*)$ includes the case of equality between the cost of debt financing and that of equity financing, in particular the empirically important case $\theta_p = \theta_r^*$. As a matter of logic, a marginal variation in the personal tax rate in this case must be a marginal *decline*.

[13] It is assumed here that a variation in the personal income tax rate occurs with a given capital gains tax rate. If the latter also varies, $\tilde{P}_K$ will no longer stay constant. See Section 9.5.3 for a discussion of an isolated change in the capital gains tax rate.

On the other hand, the personal income tax rate will stay effective despite a reduction in financial flexibility if $\theta_d^* > \theta_r^*$ as is possible in full imputation or closely related partial imputation systems. If debt financing is proscribed, (9.5) becomes

$$\tilde{P}_K = (1 - \alpha_1 \tau_r)/\theta_d^* \qquad (\theta_d^* > \theta_r^*, \sigma^* = 0), \tag{9.14}$$

and, as $\theta_d^* = \theta_d \theta_p$, a rise in τ_p will again raise $\tilde{P}_K$ and slow down economic growth. The reason that the personal income tax stays effective despite the absence of debt financing is that this tax is also a tax on dividends and hence a tax on new issues of shares. If the lowest weir is closed, the river will pass over the second lowest weir and, when $\theta_d^* > \theta_r^*$, this weir is new issues of shares. With $\theta_d^* > \theta_r^*$, a variation in the personal income tax rate is a change in both the lowest and the second lowest weir.

The case of no financial flexibility is theoretically illuminating, but it is not realistic. Without any doubt, firms do have the possibility of financing large parts of their net investment with debt. Equity capital is necessary, but it is not the only source of finance and, empirically, it is not even the most important one.[14] Thus it is safe to assume that $\sigma^* > 0$. For this case, it follows unambiguously from (9.5)–(9.7), regardless of whether σ^* is exogenously or endogenously determined and regardless of whether new issues or retentions are the preferred marginal source of equity finance, that a tax rate increase will raise the wedge parameter:

$$d\tilde{P}_K/d\tau_p \geq \sigma^*/\theta_p^2 > 0 \qquad \text{for } \sigma^* > 0. \tag{9.15}$$

Thus, the personal tax on capital incomes is an effective means of controlling the speed of economic growth. An increase in its rate will produce the kinds of reactions described in the context of a uniform Schanz–Haig–Simons tax (see Table 9.1 and Figure 9.1).

9.5.2. Is the Corporate Income Tax an Obstacle to Economic Growth?

In terms of the number of pertinent publications, the most frequently criticized component of capital income taxation is the corporate income tax. Herbert Giersch, the first chairman of the German Council of Economic Advisors, pointedly expressed the opinion that was shared by many:[15]

[14] Cf. Table 4.1.

[15] Giersch (1963, p. 257), translated by the author.

> The more economic growth is carried by firms that are organized as corporations the more can it be expected that the corporation income tax is an obstacle to economic growth. For if it results in corporate profits being taxed more heavily than the profits of non-corporate firms – because of high tax rates or because of the double taxation of dividends – it will impede the formation of capital.... These considerations suggest that the requirements of an uncompromising growth policy include the stepwise removal of this tax.

Implicitly, this quotation refers to two elements of capital income taxation: the degree of integration between corporate and personal taxation given the corporate tax rate and the size of the corporate tax rate given the degree of integration. Both these elements will now be discussed.

9.5.2.1. Double Taxation of Dividends and Economic Growth

For a change in the degree of double taxation of dividends to affect economic growth, it would be necessary for the dividend taxes to affect the wedge, if there is any, between the marginal product of capital, $\varphi'(k) - \delta$, and the market rate of interest, r, which capital income taxation creates. Given the personal interest income tax, this change would then affect the overall wedge between the marginal product of capital and the consumer rate of time preference γ so that ultimately private savings and capital accumulation would be altered, too. However, it is one of the basic results of Chapter 5, also extensively discussed in Chapters 6 and 7, that this cannot, in general, be expected.[16]

In the classical and closely related systems of capital income taxation that are characterized by a high degree of, or even full, double taxation of dividends, it holds that $\theta_r^* > \theta_d^*$. Thus new issues of shares are dominated by retentions as the marginal source of finance and θ_d^* cannot enter the firm's investment decision. Equations (9.1)–(9.7) show this. Obviously, the growth path of the economy is unaffected by the tax burden on dividends.

The result is not derived from a particular assumption on the firm's degree of financial flexibility, let alone from the assumption that debt is the marginal source of finance. Clearly, the size of the maximum marginal debt–asset ratio σ^* is irrelevant for the disappearance of θ_d^* from the wedge parameter $\tilde{P}_K$ in (9.5). Even when the firm must choose 100% equity finance at the margin ($\sigma^* = 0$) the degree of double taxation of dividends will not affect the speed of economic growth.

An assumption that *is* needed for this neutrality result is that retained

[16] The reader is strongly advised to read Sections 6.2.4 and 6.2.5.

profits are large enough to provide the required equity finance. As discussed in Chapter 4.3.2, this assumption will always be satisfied if the initial equity endowment is large enough and, regardless of the initial conditions, it will at least hold in the neighborhood of a steady state. In general, and this is the easiest empirical test of its validity, the assumption is satisfied if the firm pays dividends. A firm that pays dividends cannot be forced to use new issues of shares as the marginal source of equity finance.

This has important repercussions on the "effective tax rate" view. Those who argue that the actual tax payments of the industry are an indicator of tax discrimination against capital formation overlook the fact that paying dividend taxes in a classical or a closely related system of capital income taxation signals sufficient retainable profits. Possibly the degree of integration between personal and corporate taxes on dividends affects the firms' investment decisions when no dividend taxes are paid and dividend taxes do not contribute to the size of the empirically measurable "effective tax rate" on capital incomes. But when firms pay dividend taxes and when these taxes enter the "effective tax rate", then dividend taxation will definitely *not* affect the firms' investment decisions and it is neutral with regard to the growth path of the economy. This may sound paradoxical to the casual reader. However, it follows straightforwardly from the neutrality of dividend taxation that was discussed in various places in this book.[17] It stands the "effective tax rate" view on its head.

The neutrality of dividend taxation does not prevail under all circumstances though. Marginal variations in the taxation of dividends are certainly "growth neutral" under the classical or closely related systems of capital income taxation, but such variations can affect the firm's investment activity and hence economic growth if $\theta_d^* > \theta_r^*$ as is possible in the full imputation or closely related partial imputation systems. With this magnitude relationship of the tax factors, new issues of shares are preferred to retentions as a marginal source of equity finance, and when the firm is not allowed to escape into debt financing ($\varepsilon^* > 0$) the tax factor for dividends, θ_d^*, appears via the term $\max(\theta_d^*, \theta_r^*)$ in Equations (9.5) and (9.7). An increase in the corporate tax rate on dividends reduces this term. Regardless of whether $\varepsilon^* > 0$ is exogenously given or whether it is endogenously determined through the firms' attempts to avoid exhausting their loss-offset possibilities under accelerated depreciation [$\varepsilon^* = \alpha_1 W \max(\theta_d^*, \theta_r^*) > 0$], this will increase the size of the wedge parameter $\tilde{P}_K$. It will hence induce the kinds of reactions that were shown

[17] Cf. e.g. Chapters 5.42 and 6.2.4.

above to result from an increase in a uniform Schanz–Haig–Simons tax and that are illustrated in Figure 9.1. The equilibrium path shifts upward and induces the economy to move towards a steady-state point with a lower level of consumption per efficiency unit of labor, c, a lower level of production per efficiency unit of labor, φ, and a lower capital intensity, k.

The two cases considered are formally summarized by[18]

$$\frac{d\tilde{P}_K}{d\tau_d}\begin{cases}=0\\ \geq \varepsilon^*/\theta_d^* > 0\end{cases}\quad \text{for}\quad \begin{cases}\theta_r^* > \theta_d^*\\ \theta_d^* > \theta_r^*\end{cases}\quad \text{and}\quad \varepsilon^* > 0 \tag{9.16}$$

in connection with Table 9.1 that describes the general reaction pattern of the growth path after a tax reform that increases the wedge parameter $\tilde{P}_K$. The differential quotients reported in the table follow from Equations (9.1)–(9.4), and the differential quotient (9.16) follows from (9.5)–(9.7). A multiplication of the differential quotients gives the change in the growth path that was being sought.

Obviously the case $\theta_d^* > \theta_r^*$, $\varepsilon^* > 0$, does provide some theoretical basis for Giersch's proposal to remove the double taxation of dividends. Starting from a classical system, a moderate reform would be useless, but a radical, complete removal of double taxation could indeed be successful. It might reduce the overall wedge between the marginal product of capital and the rate of time preference, thus stimulating private capital formation. Unfortunately, however, this theoretical basis is not particularly firm. There are at least three reasons why even a radical reform might fail to achieve the expected ends.

First, the firm might have *more* financial flexibility than assumed. If true economic depreciation is required ($\alpha_1 = 0$) and the firm can optimize its financial decisions within the legal constraints, then $\varepsilon^* = 0$ and, according to the general neutrality result of Chapter 5.3.3, the laissez-faire investment condition $\varphi' - \delta = r$ holds regardless of the ordinal magnitude relationship between θ_d^* and θ_r^*. In particular, when $\theta_d^* > \theta_r^*$, it holds true that $\theta_p \geq \theta_d^*$ (as $\theta_d^* = \theta_p\theta_d$) so that a firm that uses debt – the cheapest marginal source of finance – would not experience a reduction in its cost of capital. Clearly, $d\tilde{P}_K/d\tau_d = 0$ despite $\theta_d^* > \theta_r^*$, and even a complete removal of double taxation would not be able to stimulate economic growth.

Second, firms might enjoy *less* financial flexibility than assumed. Suppose, for reasons exogenous to the model – perhaps because there are additional financial costs not considered here – the removal of double taxation does

[18]The inequality sign is explained by the fact that, in the case $\theta_d^* > \theta_r^*$, $d\tilde{P}_K/d\tau_d = \varepsilon^*/(\theta_d^*\theta_d)$ when $\varepsilon^* =$ constant and $d\tilde{P}_K/d\tau_d = \varepsilon^*/\theta_d^*$ when $\varepsilon^* = \alpha_1 W\theta_d^*$. A similar remark is true in other cases in this chapter where lower or upper bounds for differential quotients are reported.

not induce the firms to change their financial behavior and replace retentions with new issues of shares. Then the way through which a removal of double taxation could enter the firms' investment decisions again is closed off.

Third, the industry might be in a Miller equilibrium. As the Miller equilibrium is characterized by $\theta_r^* = \theta_p$, it would be impossible to produce the case $\theta_d^* > \theta_r^*$ by removing double taxation. Even the introduction of a full imputation system with $\tau_d = 0$ would merely result in the constellation $\theta_d^* = \theta_r^* = \theta_p$ and would therefore not be able to reduce the firm's cost of capital. Again, the cost of capital would be the cost of debt financing, but, unlike before, this would be true even when the single firm is forced to use equity at the margin. There would be no wedge between $\varphi' - \delta$ and r that the reform could possibly reduce, and of course the formation of capital could not be stimulated either.

All of this reduces the case for tax reforms that aim at mitigating the double taxation of dividends. Such reforms do not seem to belong to "the requirements of an uncompromising growth policy".

9.5.2.2. The Role of the Corporate Tax Rate: The Case of True Economic Depreciation

Given the degree of integration between corporate and personal taxation, that is, given the ratio τ_r/τ_d, an increase in "the" corporate tax rate will typically increase the corporate tax burden on both retained and distributed profits. Only in the limiting case of a full imputation system where $\tau_d = 0$ will the tax burden on distributed profits not be affected. Thus, the tax rate increase typically discriminates against both retentions and new issues of shares as marginal sources of finance, and when equity capital is required at the margin ($\varepsilon^* > 0$), while accelerated depreciation allowances are not granted ($\alpha_1 = 0$), this discrimination must carry over to a discrimination against the formation of real capital. Equations (9.2), (9.3), (9.5), and (9.6) show this. Differentiating (9.5) and using (9.6) it follows that

$$\left.\frac{d\tilde{P}_K}{d\tau_r}\right|_{\tau_d/\tau_r = \text{constant}} = \begin{Bmatrix} \varepsilon^*/(\theta_r\theta_r^*) \\ \varepsilon^*(\tau_d/\tau_r)/(\theta_d\theta_d^*) \end{Bmatrix} > 0$$

$$\text{for} \begin{Bmatrix} \theta_r^* > \theta_d^* \\ \theta_d^* > \theta_r^* \end{Bmatrix}, \quad \varepsilon^* = \text{constant} > 0, \quad \alpha_1 = 0, \quad \tau_d > 0. \tag{9.17}$$

Together with Table 9.1, this implies that an increase in the corporate tax

rate will induce the familiar reaction pattern illustrated in Figure 9.1. The traditional view that the corporate income tax is an obstacle to economic growth is strongly supported by the result.

An important assumption underlying (9.17) is that firms are not perfectly flexible with regard to their choice of financial instruments: regardless of tax advantages, a certain proportion $\varepsilon^* > 0$ of net investment must be financed with equity capital. Suppose, on the contrary, firms enjoy full financial flexibility in the sense that $\varepsilon^* = 0$. In this case, the cost of finance is the cost of debt financing, and no wedge can be driven by the corporate tax rate between the marginal product of capital and the market rate of interest. As (9.5) and (9.6) reveal that

$$d\tilde{P}_K/d\tau_c|_{\tau_d/\tau_r = \text{constant}} = 0 \quad \text{when } \varepsilon^* = 0,$$

the partial analytic investment neutrality described in Chapter 5.3.3 again carries over to a growth setting: a change in the corporate tax rate, given the degree of integration between corporate and personal taxation, will not be able to affect the process of capital accumulation.

This neutrality result is informative as it clarifies the role of a particular assumption that underlies the traditional view on the growth effects of capital income taxation, but surely it cannot claim much empirical relevance. Most readers would probably agree that a strictly positive value of the minimum marginal equity–asset ratio approximates reality more closely than a value of zero. But what does this imply? Does it mean that (9.17) is a safe result for the existing systems of capital income taxation? What if the firm's preference for equity financing is endogenously explained by the interaction between accelerated depreciation and a limited loss offset? The next few pages go into this.

9.5.2.3. Equity Finance, Taxation Paradox, and Economic Growth

This section studies the question of whether equity financing at the margin is sufficient to support the view that a rise in the corporate tax rate will slow down the process of economic growth. Suppose, instead of being exogenously imposed, the minimum marginal equity–asset ratio is endogenously explained by the hypothesis

$$\varepsilon^* = \alpha_1 W \max(\theta_d^*, \theta_r^*) \tag{9.18}$$

from (9.7). This hypothesis was derived in Chapter 5.2 from the interaction between accelerated depreciation and a limited loss-offset, phenomena that

characterize most of the existing systems of capital income taxation. Equity capital is necessary to have accounting profits and, in a growing economy, accounting profits are needed to enjoy the advantages of accelerated depreciation allowances.

Assume, so as to explain $\varepsilon^* > 0$, that $\alpha_1 > 0$ (accelerated depreciation) and $W > 0$ (economic growth). Under these circumstances the conditions for the taxation paradox (of Type B) that was discussed in Chapter 5.4.3 apply. By definition it follows from (9.5) and (5.52) (for the case $\alpha_2 = \alpha_3 = 0$) that

$$\tilde{P}_K \equiv P_K/\theta_p, \tag{9.19}$$

and hence the previous result (5.63) implies that a rise in the corporate tax rate reduces the wedge parameter:

$$d\tilde{P}_K/d\tau_r|_{\tau_d/\tau_r = \text{constant}} < 0 \quad \text{for} \quad \alpha_1 > 0 \quad \text{and} \quad (9.18). \tag{9.20}$$

In connection with Table 9.1, the reduction in the wedge parameter indicates a reaction pattern that is opposite to that implied by (9.17). In qualitative terms, it is identical with the one that follows from an introduction of accelerated depreciation, given the tax rate. Figure 9.2 illustrates this. The rise in the corporate tax rate induces a short-run decline in consumption and an acceleration of capital accumulation which drives capital, output, and, in the long run, even consumption towards growth paths that are above those the economy would otherwise have taken. As well as the inversion of the Harberger result and the tax-induced import of capital, now another remarkable implication of the taxation paradox that justifies its name!

The result demonstrates that equity finance at the margin is not sufficient to legitimate the traditional view on the growth effects of corporate taxation. Not only is equity financing compatible with the taxation paradox under accelerated depreciation, but, what is more, as both have a common cause, the use of equity finance can even be seen as indicating that the conditions for the taxation paradox apply. Of course, this indication is very indirect and not particularly strong – clearly there can be many other reasons for equity finance in addition to the one considered here. However, in a sense, it would be possible to argue that raising the corporate tax rate is the "requirement of an uncompromising growth policy" in an economy where equity capital contributes to financing marginal investment projects.

To qualify this statement some remarks on the working of the taxation paradox seem appropriate. The details cannot be discussed here; for this the reader is referred to Chapter 5.4.3. However, it is useful to recall that, under

accelerated depreciation, a rise in the corporate tax rate creates both subsidy and discrimination effects. With debt financing up to the legal constraints ($\varepsilon^* = 0$, $\sigma^* = 1 - \alpha_1\tau_r$) the firm can avoid the discrimination effect but the subsidy effect remains in full. The subsidy effect stimulates the firm's investment activity with any given rate of interest and, as has now been shown, it also accelerates economic growth when the time path of the market rate of interest is endogenously explained by the requirements of an intertemporal general equilibrium. When the scope for debt financing is narrowed down as specified by (9.18), the discrimination effect no longer disappears completely. However, it is still too weak to dominate the subsidy effect. This is the essence of (9.20). In fact, as was shown in Chapter 5.4.3, it would even be possible to allow for values of ε^* higher than that defined by (9.18). The taxation paradox is compatible with a minimum marginal equity–asset ratio high enough to ensure that the corporate tax base will always be strictly positive and grow in proportion to the other aggregates of the economy.

On the other hand, there are limits to the admissible values of ε^*, and this is a theoretical basis for the traditional view. In (5.60) the values $\alpha_1\theta_r$ for the classical and closely related systems and $\alpha_1\theta_d\tau_r/\tau_d$ for sufficiently generous partial imputation systems (with $\theta_d^* > \theta_r^*$) were shown to be such limits. Higher values of ε^* exclude the taxation paradox and produce the conventional result that a rise in the corporate tax rate slows down the growth process.

Whether ε^* is above or below these limits is an empirical matter. With $\theta_r = 0.54$ and the stylized fact[19] $\alpha_1 = 0.5$, the critical value of the minimum marginal equity–asset ratio for the United States before the 1986 tax reform would have been 0.27. Compared to the average equity–asset ratio of the typical U.S. corporation,[20] which is in the neighborhood of $\frac{1}{2}$, this seems to be low, supporting the traditional view. However, a *marginal* ratio is not the same as an *average* ratio,[21] and a *minimum* marginal ratio is not the same as an *actual* marginal ratio. Perhaps many firms were close to a situation where $\theta_p = \theta_r^*$ and where the debt–equity choice was hence indeterminate. Under such circumstances, the observable financial behavior cannot reveal much about the extent to which firms would be prepared to escape into debt financing if they were confronted with an isolated increase in the corporate tax rate.

[19]This value can be attributed to the Accelerated Cost Recovery System introduced in 1981. See Chapter 3.1.3.

[20]Cf. Table 4.1, Chapter 4.

[21]The sharp decline in the average ratio that was reported in Table 4.1 clearly demonstrates the importance of this distinction.

The empirical problem cannot be resolved here, but it should be clear now that there *is* a problem. The traditional view on the role of the corporate tax rate is clearly not beyond all doubt. It is not obvious that a rise in the corporate tax rate retards the growth process, and the mere observation that firms use equity finance at the margin is no evidence whatsoever in support of this view.

9.5.2.4. The Taxation Paradox and the Miller Equilibrium

As a final step in analyzing the role of corporate income taxation this section extends the discussion to the case of a Miller equilibrium.[22] Suppose the personal tax rate is varied together with the corporate tax rate such that the equality $\theta_p = \theta_r^*$, which characterizes an equivalence between debt and retentions, is maintained. How will this affect the growth path of the economy in the realistic case of accelerated depreciation? Will the intertemporal version of the taxation paradox survive or will the traditional view on the role of corporate taxation find support?

At various places in this book it turned out that the step from an isolated change in the corporate tax rate to a simultaneous change of both the corporate and personal tax rates strengthened the taxation paradox in that it made the respective inverted allocation results invulnerable to assumptions on the degree of financial flexibility. For example it was found that, while a capital import *could* result from a rise in the corporate tax rate if accelerated depreciation is allowed, this must definitely occur if the personal income tax rate rises in addition to the corporate tax rate. The reason for the strengthening of the taxation paradox was a portfolio composition effect. The increase in the personal tax rate in itself induces shareholders to substitute real investments within their corporations for personal capital market investments. In a partial analysis, where the rate of interest is given, and in models of market equilibrium that study the sectoral structure of capital this effect works in the same direction as the taxation paradox.

In an intertemporal context, the portfolio composition effect is not operative though. What matters here is that a rise in the personal tax rate increases the wedge between the market rate of interest and the consumer rate of time preference. As shown above, this slows down the speed of economic growth and hence works against the taxation paradox. To find

[22] Cf. Chapter 4.3.4.

out about the net effect, consider Equation (9.5). When $\theta_p = \theta_r^* \geq \theta_d^*$, the wedge parameter becomes

$$\tilde{P}_K = (1 - \alpha_1 \tau_r)/\theta_r^* \qquad \text{(Miller equilibrium)} \tag{9.2.1}$$

and its sensitivity with regard to τ_r is given by[23]

$$\frac{d\tilde{P}_K}{d\tau_r} = \frac{1 - \alpha_1}{\theta_r^* \theta_r} \left\{ \begin{matrix} > \\ = \end{matrix} \right\} 0 \text{ for } \alpha_1 \left\{ \begin{matrix} < \\ = \end{matrix} \right\} 1 \qquad \text{(Miller equilibrium).} \tag{9.22}$$

This expression reveals that an inverted reaction by the economy can no longer be expected.

In the special case of an immediate write-off ($\alpha_1 = 1$) the net effect from corporate and personal taxation is zero. Here, a simultaneous change in both tax rates which maintains the condition $\theta_p = \theta_r^*$ will just be neutral with regard to the growth path chosen by market forces.[24] However, in the realistic case of less generous depreciation allowances ($\alpha_1 < 1$), including the case of true economic depreciation ($\alpha_1 = 0$), the retardation effect resulting from personal income taxation becomes dominant. The simultaneous rise in both tax rates unambiguously increases the value of the wedge parameter and, according to Table 9.1, this indicates a slowdown in the growth process as described in Figure 9.1.

Obviously, the Miller equilibrium broadly supports the traditional view on the influence of corporate taxation on economic growth, and perhaps it is the strongest support that can be given. There is, however, a nuance in the way corporate income taxation becomes effective that is certainly not what holders of the traditional view have in mind. Essential to the traditional argument against corporate taxation is the fact or supposition that corporate profits are taxed more heavily than other kinds of capital income. It has been shown above that this aspect is not particularly alarming. An asymmetric taxation will distort the financial decisions, but for this very reason it will not necessarily distort the real allocation of resources. In contrast, the result derived in this section depends crucially on the fact that, in a Miller equilibrium, the marginal tax burden on retained profits and interest income is the same. A rise in the corporate tax rate slows down economic growth not because it discriminates against equity

[23] It is assumed for this derivation that τ_c = constant. If τ_c rises together with τ_r and τ_p then $d\tilde{P}_K/d\tau_r > (1 - \alpha_1)/(\theta_r^* \theta_r)$ and the taxation paradox vanishes for an even stronger reason.

[24] This property will be useful in Chapter 11 for the construction of a growth neutral tax system.

relative to debt, but because it discriminates against debt just as much as against equity.

There are reasons enough to doubt the real existence of a Miller equilibrium. In particular it can be argued that the marginal personal tax rate is not sufficiently elastic to maintain the equality $\theta_p = \theta_r^*$. The case of an isolated variation in the corporate tax rate may therefore fit reality better. Nevertheless, the Miller equilibrium is an attractive theoretical concept that may help to illuminate some of the entangled paths through which capital income taxation could affect the allocation of resources.

Apart from this, the case of a simultaneous change in the corporate and personal tax rates may be interesting in its own right. It is a case that is relevant for practical tax reforms even when the Miller mechanism is not operative. Despite accelerated depreciation, a policy of cutting all tax rates can unambiguously be expected to stimulate private savings and the process of capital accumulation nourished by these. It is true that this policy will have perverse effects on international capital movements when accelerated depreciation is allowed, but with regard to its implications for the growth path of a closed economy there is nothing that could be called paradoxical.

At first glance it may seem that this result is directly applicable to the U.S. tax reform of 1986 which dramatically reduced the corporate and personal tax rates. Such a conclusion might be too hasty, however. Before the 1986 tax reform can be meaningfully analyzed we first have to consider another tax that also has an important role to play.

9.5.3. Capital Gains Taxation, Growth, and the 1986 U.S. Tax Reform

The taxation of capital gains from company shares is an indirect taxation of retained profits and it can therefore be expected that it creates distortions similar to those of the corporate tax on retained profits. There is, however, one important difference. While corporate taxation brings about a subsidy effect in addition to a discrimination effect when accelerated depreciation is allowed, capital gains taxation is unable to produce a subsidy effect, either explicitly or implicitly. As the capital gains result from market valuations, the capital gains tax is implicitly a tax on retained earnings where true economic depreciation is applied. For this reason, the growth effect of capital gains taxation must be negative, if it exists at all.

This statement can be formally proved by using (9.5)–(9.7). For the case of a strictly positive minimum marginal equity–asset ratio, regardless of whether this ratio is a constant or endogenously explained by the attempt

to avoid exhausting the loss-offset possibilities, it follows that

$$\frac{d\tilde{P}_K}{d\tau_c}\begin{cases}\geq \varepsilon^*/(\theta_p\theta_c) > 0\\ =0\end{cases}\quad \text{for}\quad \begin{cases}\theta_r^* > \theta_d^* \text{ and } \varepsilon^* > 0\\ \theta_d^* > \theta_r^* \text{ and/or } \varepsilon^* = 0\end{cases}, \tag{9.23}$$

where use is made of the fact that $\theta_p \geq \theta_r^*$.

For the classical and related partial imputation systems where retentions are the cheapest source of equity finance ($\theta_r^* > \theta_d^*$) this expression reveals that the wedge parameter will rise after an increase in the capital gains tax rate. It thus follows from Table 9.1, which specifies the general reaction pattern of the economy, that the growth process will be retarded. Again, Figure 9.1 illustrates the case.

However, when new issues of shares are the cheapest source of equity finance, as is possible in the full imputation and closely related partial imputation systems ($\theta_d^* > \theta_r^*$), firms will avoid profit retentions and growth neutrality of capital gains taxation can be expected for the simple reason that there are no capital gains. The same is true a fortiori when firms enjoy full financial flexibility ($\varepsilon^* = 0$) so that they could even avoid financing marginal investment projects with new issues of shares. The second line of (9.23) refers to these cases.

The capital gains tax is essential for the growth repercussions resulting from the 1986 U.S. tax reform. Among other things, this reform reduced the corporate and personal income tax rates and removed some of the depreciation allowances that had been introduced with the Accelerated Cost Recovery System in 1981. In addition, however, it implies that, from 1988 onwards, all realized capital gains will be included in the personal income tax base instead of only 40% of them as was the case before the reform. According to the discussion of Chapter 3.1.2, good guesses for the pre- and post-reform capital gains tax rates in the U.S. might be $\tau_c = 0.25 \cdot \tau_p = 0.1$ and $\tau_c = 0.6 \cdot \tau_p = 0.17$, respectively. Despite a cut in the representative shareholder's personal tax rate from 40% to 28%, the effective tax rate on accrued capital gains therefore seems to have risen considerably.

Suppose for a moment that, contrary to this observation, the rules for taxing realized capital gains remained the same as before the reform so that the capital gains tax rate falls in line with the personal income tax rate: $\tau_c = 0.25 \cdot \tau_p = 0.07$. Using the stylized facts reported in Chapter 3 for the time before and after the reform ($\tau_p = 0.4, 0.28$; $\tau_r = 0.46, 0.34$; $\alpha_1 = 0.5, 0.3$), it can then be calculated from (9.5) that the reform would have lowered the wedge parameter $\tilde{P}_K$ for any given pre-reform value of σ^* in the range between $\sigma^* = 0$ and $\varepsilon^* = 0$ (or, equivalently, $0 \leq \sigma^* \leq 1 - \alpha_1\tau_r$). For example, the wedge parameter would have fallen from 1.35 to 1.32 if

$\sigma^* = 0.6$. Maintaining the half-year speculation period and the 40% inclusion of capital gains in the personal tax base that characterized the U.S. economy for a long period of time therefore would have ensured that, despite the prolongation of depreciation periods, the cuts in personal and corporate tax rates stimulate economic growth. This confirms what has been said in the context of the Miller equilibrium.

In fact, however, given the change in capital gains taxation that was enacted by the 1986 reform, such a favorable outcome is dubious. If it is assumed not that the reform reduces τ_c from 0.1 to 0.07 but increases τ_c from 0.1 to 0.17, then (9.5) unambiguously implies that the wedge parameter rises for any given value of σ^*. For example, if $\sigma^* = 0.6$, it follows that $\tilde{P}_K = 1.38$, a value that is clearly above the corresponding pre-reform value 1.35. Thus, it seems that the joint effect of all those aspects of the reform that are captured in the wedge parameter will be growth retarding if U.S. corporations continue to finance the same fraction of net investment with debt as they did before the reform. This does not harmonize well with the intention behind the President's tax reform proposal[25] for "Fairness, Growth, and Simplicity" which was the basis of the 1986 tax reform.

Fortunately, there is yet another aspect of this reform that gives rise to more optimism. This aspect is that, according to (9.6) and (9.7), the scope for debt financing will be increased. On the one hand, given the stylized facts assumed, the tax deferrals per unit of real net investment ($\alpha_1 \tau_r$) fall from 0.23 to 0.1. On the other hand, the minimum marginal equity–asset ratio which just satisfies the loss-offset constraints, $\alpha_1 W \max(\theta_d^*, \theta_r^*)$, declines from $W \cdot 0.24$ to $W \cdot 0.16$. Both of these effects work in the same direction and they should be sufficiently strong to overcompensate the rise in $\tilde{P}_K$ that would result with a given value of σ^*. In fact, using the stylized figures for the time periods before and after the reform, it can easily be calculated from (9.5)–(9.7) that, when σ^* is allowed to vary, $\tilde{P}_K$ will fall with any given value of the growth factor[26] W in the admissible range $0 < W \leq 1$, and this will be so even when the minimum marginal equity–asset ratio is a given multiple of $\alpha_1 W \max(\theta_d^*, \theta_r^*)$ provided only that $0 \leq \sigma^* \leq 1 - \alpha_1 \tau_r$. Suppose again, for example, that $\sigma^* = 0.6$ before the reform, but assume this value is endogenously determined by $\sigma^* = 1 - \alpha_1 \tau_r - \alpha_1 W \theta_r^*$, where $W = 0.63$. The reform would then result in a jump of σ^* to the value 0.79. Accordingly, $\tilde{P}_K$ would fall from 1.35 to 1.29

[25]U.S. Department of the Treasury (1985).

[26]Note that W is a constant that, under the assumptions of the model, cannot be affected by a tax reform.

which is even less than the value to which $\tilde{P}_K$ would have fallen with a given value of σ^* and a given tax treatment of capital gains relative to personal income. Taking the endogenous change in the firm's scope for debt financing into account therefore suggests a positive net effect on economic growth.

The reader should be warned that these are not ultimately reliable conclusions on the growth effects of the 1986 tax reform. The calculations are merely based on numerical examples, and they do not capture all relevant effects that can be expected.[26a] In particular, they neglect all international repercussions. In Chapter 7, capital flight was shown to be an unambiguous implication of the reform. In the short and medium run this is likely to produce more visible economic effects than the savings incentives that play the dominant role in the closed-economy model studied in this chapter.

9.5.4. The "Welfare Gain" from Integrating Corporate and Personal Taxation: Remarks on an Empirical Result

It is now time to return to the result by Fullerton et al. (1981), cited in Section 9.1, according to which a full or partial integration of corporate and personal taxation in the United States would have created welfare gains of hundreds of billions of dollars. The empirical model the authors use is a sequenced general equilibrium model with myopic expectations that was built on previous static general equilibrium models developed by Shoven, Whalley and various co-workers. These models combine brilliant techniques with large and carefully chosen data sets to create impressive products of economic research. Nevertheless, on the basis of this book's analysis, the reported results cannot be accepted.

The fundamental problem is that firms are not allowed to optimize their financial decisions.[27] Although the exclusively verbal description of the model leaves a number of ambiguities, it seems fairly clear that, in the tradition of the Harberger literature (see Chapter 6.2), the results are derived on the basis of suboptimal financial reactions to the tax reform. It is true that the authors mention the problem of financial decisions and in their calculations they also consider an abritrary change in the financial behavior of firms. However, the assumptions they make are not compatible with the

[26a] Cf. Footnote 7.29.

[27] In fact, it is not clear whether and in what sense there are firms at all.

outcome of market value maximization in the absence of tax loopholes as discussed in Chapter 4. In particular, it seems incorrect to assume that a double taxation of dividends favors retentions and its removal profit distributions.

If firms are allowed to react to taxation in a sensible manner, it seems that not even the sign of the welfare gains calculated can be maintained. There are two reasons why it seems likely that, contrary to the results of Fullerton et al., an integration of corporate and personal taxation brings about a dynamic welfare loss.

The first relates to the fundamental neutrality of dividend taxation. Removing double taxation can stimulate economic growth only to the extent that (i) firms will prefer new share issues instead of profit retentions as the marginal source of equity finance and (ii) equity capital is required at the margin. The first of these conditions, in particular, cannot be expected to have much empirical relevance and, as argued above, it is impossible in a Miller equilibrium. The reform in itself will therefore be fairly neutral. It will, however, reduce the tax revenue. A revenue-neutral integration of corporate and personal taxation will require a rise in the personal and corporate tax rates to compensate for the reduced dividend taxation. This will be unambiguously growth-retarding.

The second reason refers to the phenomenon of accelerated depreciation. This is not addressed in the paper by Fullerton et al., but it is definitely of great importance for the U.S. economy. As shown in Section 9.5.2.4, the presence of accelerated depreciation will not affect the qualitative implications of a simultaneous change in both the corporate and personal tax rates; so far this does not add a new element to the first reason. However, it is important to realize that Fullerton et al. consider a version of a perfectly integrated Schanz–Haig–Simons system where the corporate tax rate is abolished and the personal tax rate applies to distributed profits and capital gains.[28] As a capital gains tax is implicitly a tax on retained profits with true economic depreciation, introducing the fully integrated tax system has the side effect of abolishing accelerated depreciation. This is an advantage for old assets where tax depreciation is less than true economic depreciation, but it is a disadvantage for new assets. As only the latter count for the allocative effects of the reform, there is a clear disincentive for investment that becomes operative even without an increase in tax rates.

Formally, these effects can be seen most easily in Equation (9.21) which gives the wedge parameter for the case of a Miller equilibrium ($\theta_p = \theta_r^*$).

[28]How the capital gains tax is formally modelled is not apparent from the paper.

The first reason is implicit in the fact that $\tilde{P}_K$ rises with a fall in θ_r^* and is independent of θ_d^*. The second reason is represented by the fact that $\tilde{P}_K$ rises with a fall in τ_r, given θ_r^*. According to Table 9.1, the rise in $\tilde{P}_K$ results in a short-run rise in consumption at the expense of comparatively lower values of consumption, output, and capital in the long run. Figure 9.3 illustrates the change in the growth path assuming that, because of a distortionary tax system, the economy is initially in a steady state to the left of the point that characterizes the Modified Golden Rule and that would be maintained in the laissez-faire case.

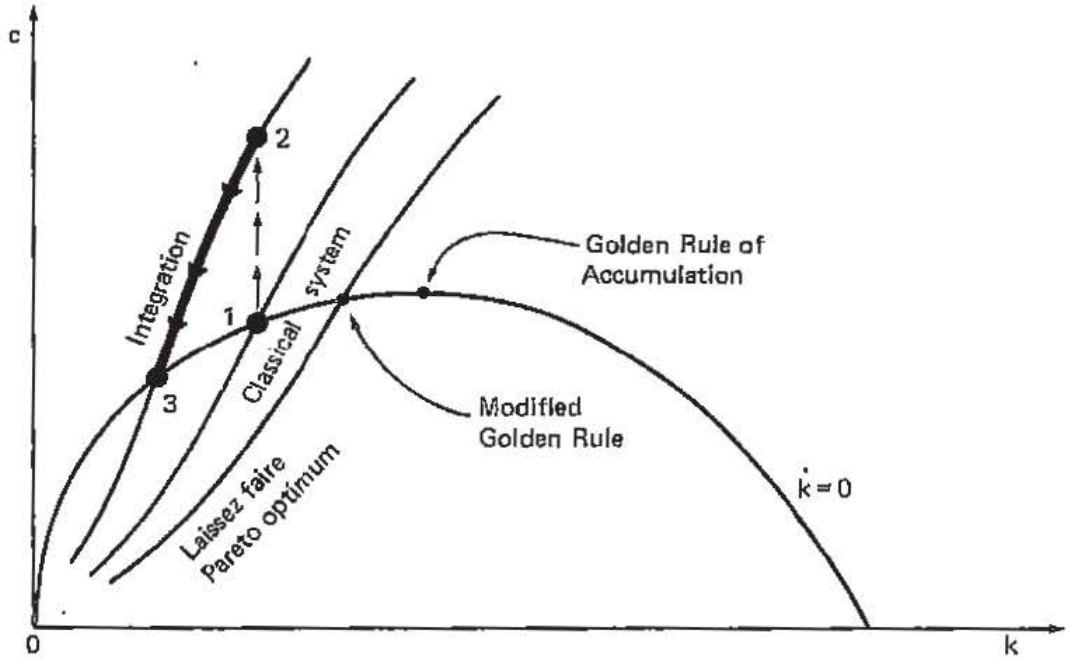

Figure 9.3. Growth losses from the integration of corporate and personal taxation.

As the tax reform moves the economy further away from the laissez-faire path, an increase in the direct excess burden of capital income taxation seems unavoidable. Not a welfare *gain* of up to $500 billion, but a substantial welfare *loss* might have been the consequence of a tax reform that moved the U.S. capital income tax system towards a fully integrated Schanz–Haig–Simons system.

9.6. Consumption Tax versus Capital Income Tax

As a final step in the analysis, this section returns to a tax that provided the starting point for the discussion of intertemporal taxation effects: the

consumption tax or – to use more recent names for more or less the same thing – the "expenditure tax" or the "value-added tax".[29]

In Chapter 5.3.7 it was stated that the value-added tax does not affect the investment decision of the firm if the time paths of the market rate of interest and of the employment of labor are given. Moreover, it was shown in Chapter 8.1 that the tax does not distort the household's intertemporal consumption planning either. Taken together, the two aspects imply that the consumption tax does not affect the growth path of the economy.[30] This result holds independently of whether the tax is the only tax in the economy or is levied in conjunction with other taxes.

Formally, the neutrality of the consumption tax follows from the fact that the tax rate τ_v does not show up in Equations (9.1)–(9.7). Intuitively, the neutrality can best be understood if one assumes a full shifting of the tax and notes that an increase in the consumption good price, which occurs at all points in time, is the same as a tax on all components of wealth, including human capital, that is levied just once. Clearly such a tax will not be able to induce intertemporal substitution effects. The assumption of a full shifting simplifies understanding, but is, in fact, not necessary. The model used is a real model where only relative prices of commodities and factors matter, and not money prices. Monetary shifting processes play no role whatsoever.

Because of its growth neutrality, the consumption tax is an attractive element of a tax system that may help overcome the present sclerosis of Western economies. It should be noted, however, that the goal of economic growth is not the only criterion for an allocative evaluation of taxes. Feldstein (1978a), Atkinson and Sandmo (1980), and others have stressed that the influence of the tax on the supply of labor must also be taken into account. This is indeed a valid point. As shown in Chapter 5.3.7, the consumption tax is equivalent to a Brown tax plus a tax on wage incomes. As the Brown tax is allocatively neutral, it is only the wage component that can bring about potential distortions.[31] This component introduces a new element into our analysis that goes beyond an investigation of the structural components of capital income taxation itself.

[29]A very early discussion of the tax involved Mill (1865, pp. 488–492), Elster (1913, 1916), and Mombert (1916), but it was not before the contributions of I. and H.W. Fisher (1942) and Kaldor (1955) that it received broad attention in the economic literature.

[30]This confirms the view expressed by Fisher and Kaldor (see preceeding footnote). In the context of an intertemporal general equilibrium model the growth neutrality of the consumption tax was shown in Sinn (1980b).

[31]For a formal proof that this and other cash flow taxes neither distort the labor–leisure nor the consumption–savings trade-off in an intertemporal general equilibrium model with elastic labor supply see Sinn (1984a).

Because an inelastic labor supply is assumed, the growth model used here does not capture the distortions in the labor–leisure choice that come with the consumption tax, and it is therefore not well suited for a comparison between this tax and a capital income tax. With an inelastic labor supply, reforms which move the tax burden entirely from capital incomes to consumption unambiguously appear as advantageous. When labor is elastically supplied, however, this result is no longer assured. In principle, it may well turn out that weighing the distortions in the consumption–savings decisions against those in the labor–leisure choice results in the recommendation to supplement the consumption tax with a capital income tax.

Feldstein (1978a) demonstrated this possibility in a two-period life cycle model where households consume in both periods, but work only in the first. He also showed, however, that the need for a supplementary capital income tax is by no means a necessary result. With suitable preferences it may even be true that the consumption tax should be supplemented with a subsidy on capital incomes, and, in the special case where the ratio of the consumption levels of both periods is not affected by a compensated variation in the wage rate, it is optimal to have a consumption tax alone. Thus, elastic labor supply is not in itself an argument in favor of plain capital income taxation.

In fact, it seems that incorporating the labor supply decision could even strengthen the case against capital income taxation. It is a central result of the static theory of optimal taxation that comparatively high marginal tax burdens should be imposed on those commodities that are complementary to that part of leisure time that competes with employment. Under the realistic assumption that consuming market commodities is a significant part of leisure activities, it seems likely that consumption and leisure are complements within any period, but substitutes across periods. Given that second-period leisure is a fixed retirement period and that only first-period leisure can be traded against consumption in both periods, this implies that first-period consumption should be taxed more heavily than second-period consumption. Contrary to existing tax laws, it would therefore be necessary to supplement the consumption tax with a subsidy, rather than a tax, on capital incomes.

This is a theoretical argument that merely rests on plausibility considerations. It is, however, confirmed in a slightly different context by empirical results that were reported by King (1980). Using data of Boskin and Lau, King specified the relevant parameters of the utility function numerically and found that, given that there is a choice between wage and capital income taxation, it would be optimal to supplement a wage tax with a negative capital income tax. In the model he used, decision makers do not

have an initial inherited endowment and so the wage tax is similar to the consumption tax. His result is therefore directly applicable to the case considered here.[32]

Unfortunately, however, neither the theoretical argument nor the empirical result is likely to carry over from the two-period life cycle model to a multi-period model with an operative bequest motive. With the latter, there is a fundamental difference between wage and consumption taxes and, most importantly, there is a labor–leisure trade-off in each period. In each period, one generation of the infinitely lived family is of working age! Thus, the argument that a high tax burden should be imposed on that consumption quantity which is complementary to the part of leisure time which competes with employment fits all periods equally well. It is therefore no longer obvious that present consumption should be taxed more heavily than future consumption, and of course the reverse does not follow either. It remains to be seen whether future research will be able to provide more definite conclusions on this matter.

Perhaps there is really no point in worrying too much about this problem. After all, the optimal mix between a consumption tax and an ordinary capital income tax is a purely academic problem. There is no uniform capital income tax with true economic depreciation in reality, and this tax cannot even claim to serve as a good approximation. Instead of replacing the existing capital income taxes with a consumption tax it might be better to reform capital income taxation itself by increasing the relative weight of dividend taxation or introducing more pronounced accelerated depreciation allowances. This way, it would be possible to stimulate economic growth without at the same time imposing an additional burden on wage incomes and distorting the labor–leisure trade-off. The last chapter of this book will study some of the alternatives.

9.7. Comparison with the Overlapping-generations Model

Apart from its emphasis on the diverging roles of the various components of capital income taxation, this chapter brought about two basic results. First, ordinary capital income taxation slows down economic growth.

[32]King discussed the life cycle model in the context of an overlapping-generations framework and showed that there are significant distributional differences between the two taxes. [Cf. also Summers (1981, pp. 538 n.) for a discussion of this matter.] However, for his empirical result (p. 28), these differences are irrelevant as he assumes that the economy is at the Golden–Rule level. At the Golden–Rule level, the recommendations resulting from the overlapping-generations model become indistinguishable from those of the two-period life cycle model.

Secondly, as the laissez-faire allocation is Pareto efficient, this slowdown is a welfare loss. None of these results is confirmed by existing overlapping-generations models. This section tries to point out the reasons for the divergences.

The problem of optimality of the laissez-faire allocation has already been discussed in Chapter 2.7. Because of a quite peculiar mixture of dictatorial preferences and the assumption of a corner solution with regard to the private bequest motive, this optimality is not assured with the overlapping-generations model.

The suboptimality of the private market solution in the overlapping-generations model becomes particularly obvious with the possibility of a dynamically inefficient steady-state solution where the economy is at a point to the right of the maximum of the $(\dot{k} = 0)$ curve. In this case, the model recommends government measures that slow down the speed of economic growth. However, if Barro (1974), Carmichael (1982), and Burbidge (1983) are right, then this possibility can be excluded. If each generation is interested in the well-being of its heirs and transfers resources to them then no solution of the overlapping-generations model exists that is characterized by an inefficient steady-state point.

When the steady-state point is dynamically efficient, that is, when it is to the left of the maximum of the $(\dot{k} = 0)$ curve, the suboptimality of the market solution in the overlapping-generations model is less obvious. However, even in this case, an optimal solution cannot in general be expected since the social welfare function that is used for an evaluation of the intertemporal allocation is exogenously imposed upon the model and is not identical with the preferences that govern the behavior of the agents in the model.

In the infinitely-lived-consumer model used here there are no similar problems. Social and private preferences coincide, and there is no dictator who knows better than the agents how much of their resources they should transfer to their children. In the absence of taxation, the allocation is Pareto efficient, and there is no need for corrective government measures, let alone measures that retard the growth process.

Consider now the purely positive question about the growth effects of capital income taxation. Assume, for whatever reason, we want to stimulate economic growth. Suppose, the policy parameters available are variations in a uniform capital income tax rate and in a uniform wage tax rate, where the two tax rates must be varied in opposite directions in order to keep the government budget balanced. Which policies are recommended by the rival models?

In the present model, a wage tax is growth neutral and in fact, as labor is

inelastically supplied, it is indistinguishable from a lump sum tax. The capital income tax, on the other hand, induces a substitution of present for future consumption. It is clear therefore that shifting the tax revenue from capital incomes to wages is the appropriate measure for speeding up the growth process.

The overlapping-generations model yields precisely the opposite conclusion. In order to stimulate economic growth it is necessary in this model to substitute capital income taxation for wage taxation.[33] Even an ordinary capital income tax that applies to all kinds of capital incomes and does not allow for accelerated depreciation is not an obstacle, but a stimulus to the process of capital formation!

It is true that most overlapping-generations models do allow for elastic labor supply and are more attractive in this respect than the model used here. However, this is not the reason for the strange result. It occurs even with a fixed labor supply.

The true reason can most easily be understood if one recalls the role of government distribution policy in the Keynesian model with two classes of households that was studied with regard to the process of capital formation, for example by Krzyzaniak (1966) and Sato (1967). In order to stimulate savings, the Keynesian model recommends a tax cut for the class with the high savings rate and a tax increase for the class with the low savings rate. The overlapping-generations model does not recommend anything different, it only differs from the Keynesian literature in that it is based on another hypothesis on the relative sizes of the marginal savings rates. While the Keynesian literature assumes that the (rich) receivers of capital income have a higher marginal savings rate than the (poor) receivers of wage income, the overlapping-generations model *implicitly* assumes the opposite.

In the overlapping-generations model, the class of receivers of capital income has a marginal savings rate of zero. Since this class consists of people who are in the second stage of their life and since a bequest to the following generation is excluded by assumption, an income change experienced by this class is fully translated into a change in consumption. With regard to the redistribution policy in question, the class of receivers of wage income has instead a marginal savings rate of about one. The reason is that wage earners, who form the younger generation, know that the redistribution policy is permanent and that a tax reduction in the first stage of life

[33]As shown by King [1980, Eqs. (35) and (36)], this result holds under extremely weak assumptions about the shape of the utility function. The casual reader might interpret a remark of Atkinson and Sandmo (1980, p. 343) as if the result were to arise only in the very special case of a Cobb–Douglas utility function. This interpretation is wrong.

is compensated with a tax increase in the second, and vice versa. For example, the marginal savings rate of the younger generation is precisely one if the net-of-tax market rate of interest equals the growth rate of the restribution volume for, in this case, the policy will not affect this generation's intertemporal budget constraint.

Given this information on the marginal savings rates, it is clear how a substitution of a capital income tax for the wage tax operates. Via the redistribution effect there is a *drastic* increase in aggregate savings of about the size of the redistribution volume. It is true that, in addition to income effects, there is a substitution effect: the increase in aggregate savings is dampened as the reduction in the net-of-tax market rate of interest induces the younger generation to substitute present for future consumption. Moreover, most, if not all, of the redistribution effect on aggregate savings occurs in the first period. However, these are only mitigating effects that cannot alter the basic result that a substitution of a capital income tax for a wage tax pushes the economy towards a steady-state growth level with a higher capital intensity.[34]

The economic mechanism offered by the overlapping-generations model, albeit not stressed by its creators, is not very convincing. It is not plausible to assume that the receivers of capital income have a lower marginal savings rate than the receivers of wage income. It is even less plausible – and for the dominance of the redistribution effect over the substitution effect this is of great importance – if a difference between the marginal savings rates of about *one* is contended.

The dominant role of the income redistribution effect seems to be an implication of an apparently simplifying assumption that, quite unexpectedly, has severe consequences rather than the result of a particular

[34]This can easily be seen from King's (1980) Equation (20). In the case considered of an inelastic labor supply it holds that $\sigma_{L2} = \sigma_{LL} = \sigma_{2L}$. Thus the optimal capital income tax rate that represents the best possible compromise between the goal of distorting the individual life cycle planning as little as possible and the goal of pushing the economy as far as possible towards the Golden–Rule point, which is assumed to be optimal, is: $\tau = -(r-n)/(r\sigma_{22})$. Here, σ_{22} is the, always negative, compensated price elasticity of old-age consumption and the other variables have the usual meaning. The fact that the optimum is characterized by a capital income tax in the case where the growth path is too low ($r > n$) and is characterized by a capital income subsidy if the growth path is too high ($r < n$) shows that an increase of the capital income tax rate will always stimulate economic growth. If this were not true and an increase of the capital income tax rate (or a reduction of the capital income subsidy rate) slowed down economic growth, then an optimum with $r > n$ and $\tau > 0$ ($r < n$ and $\tau < 0$) would not be possible, since a reduction of the capital income tax rate (capital income subsidy rate) would, with such a constellation, bring about the double advantage of reducing the distortions in life-cycle planning *and* moving the economy closer to the Golden–Rule path.

theoretical foundation. If the model is generalized in the sense of Barro by incorporating a bequest motive, then all income effects vanish immediately. For if the older generation deliberately transfers part of its wealth to the younger generation, then the government redistribution between the young and the old will induce the older generation to compensate for this redistribution with a countervailing change in the size of the bequest. For example the older generation will, if it loses from a redistribution policy, reduce its private bequest to the younger generation to the extent that it is already forced by the government to transfer part of its wealth to the younger generation.[35] Obviously, what remains after taking into account the bequest motive, is merely the substitution effect resulting from capital income taxation. It is precisely this effect that is responsible for the allocative results derived here, and, to reiterate a point that has frequently been made in this book, only *it* is relevant for a welfare theoretic evaluation of tax distortions.

[35] It goes without saying that, in this theoretical context, "bequest" should not be understood in the purely legal sense. What is meant here is the total resource transfer from parents to children, including the cost of education. Educational expenses are a good example for countervailing variations in the "bequest" volume. In West Germany, even rich people do not spend a penny for school or university fees; they pay for the education system nearly exclusively through taxes. (Some private schools and universities exist, but they do not attract many students.) In the United States, on the other hand, where less educational expenditure is publicly enforced, parents typically spend large sums of money for school and education fees. Sometimes these amount to the cost of a family home or more.