

Capital Income Taxation and Resource Allocation

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North Holland: Amsterdam, New York, Oxford and Tokio 1987

Chapter 10: Dynamic Incidence

DYNAMIC INCIDENCE

The problem of material incidence, that is, the question of who bears the tax burden, has always been at the center of microeconomic tax analysis. The reason may be that the incidence problem is one of the rare topics in our discipline that really interests the public. The concept of welfare losses is difficult for laymen to understand. However, everyone understands that the influence of taxation on factor incomes is a problem, and those, at least, whose incomes are affected are usually very interested in what economists have to say about the incidence problem. Here, therefore, this problem will not be left out.

Traditionally, incidence analyses are static: time does not explicitly appear in the models used.¹ The neglect of time is a useful simplification if incidence mechanisms that operate with given aggregate factor endowments are considered. Thus, the incidence of a change in the structure of indirect taxation or a change in wage taxation can be studied in static models with a certain degree of justification. However, the incidence of taxes that induce changes in factor endowments is a very different matter. Since such changes will often occur through a gradual process of accumulation or decumulation, a dynamic analysis seems necessary. The incidence of capital taxation in the context of changes in the time path of capital formation is the example considered here.

The intertemporal general equilibrium model developed in Chapters 2, 8, and 9 appears appropriate for this task. As it describes the time paths of factor prices from the introduction of the reform up to the new steady state of the economy, it can be used for both static and dynamic analyses of incidence.

The existing studies of dynamic incidence problems can be separated

¹ Cf. Harberger (1962) or Mieszkowski (1967). Exceptions among the older literature are studies on the burden of the public debt. See, for example, Bowen et al. (1960) or Vickrey (1961).

into two groups. The first includes the papers of Krzyzaniak (1966), Sato (1967), Grieson (1975), or Boadway (1979b), to mention only four examples. In these papers, different classes of income receivers with different, but constant, savings rates are assumed. Government levies various taxes and buys commodities that are used in a way that does not affect private behavior. Incidence is exclusively determined by income effects; there are no substitution effects. The second group includes studies by Diamond (1970), Feldstein (1974a and b), Friedlaender and Vandendorpe (1978), Ballentine (1978), and Bernheim (1981).² In these contributions, the volume of savings depends on the market rate of interest and thus substitution effects are of crucial importance.

The studies in the first group are not comparable to the present approach since this addresses the problem of differential tax incidence and thus concentrates on substitution rather than income effects. The contributions in the second group are modified and supplemented in various ways. First, the analysis will be carried out in the framework of an intertemporal general equilibrium model instead of, as in the cited literature, within models whose dynamics result from interest-dependent savings rates or consist of sequences of static equilibria where individual expectations, even if they are important, prove to be wrong outside the steady state.³ Secondly, not only the incidence of a uniform capital income tax rate but also that of complete *systems* of capital income taxation, as described in Chapter 3.1, will be discussed. Among other topics, the analysis includes the dynamic incidence effects of corporate income taxation that the literature treats in passing but does not really investigate in detail. Thirdly, the problem of incidence will not only be discussed with regard to capital incomes and wages, but capital incomes will be segregated into the incomes of "old" and "new" shareholders and the income of bond owners. Fourthly, the incidence analysis includes the case of accelerated depreciation.

The discussion is organized in seven sections. Section 10.1 offers basic methodological considerations that are indispensable for understanding the results to be derived. Section 10.2 has also a preparatory character. It sets up the formal model and provides preliminary remarks on the way it functions. The analysis itself is carried out in Sections 10.3–10.7. Sections 10.3 and 10.4 treat a uniform Schanz–Haig–Simons tax and a tax on the factor capital. Section 10.5 is the heart of this chapter. It contains an extensive discussion of various aspects of corporate taxation and provides

² Cf. also Sinn (1981). Except for the first of the four points mentioned in the next paragraph the present approach differs from this study, too.

³ Compare the discussion of alternative dynamic taxation models in Chapter 2.7.

incidence results, some of which contrast sharply with established opinions. The chapter concludes with an investigation of the incidence of capital gains and personal income taxation (Sections 10.6 and 10.7).

10.1. The Method of Incidence Analysis

Before the analysis proper, two conceptual problems have to be mentioned, whose understanding is necessary for using the model of Chapter 8.

The first relates to the representative household. Is it not problematic or even absurd, in the light of the fact that there is only one household in the model, to investigate the redistributive effects of taxation? Does it make any sense to speak about shifting processes if shifting only means that funds are transferred from the right to the lefthand pocket of the representative household? It would be possible to respond to the reproach implied by these questions by alluding to the fact that the analysis is exclusively concerned with the functional, and not with the personal, distribution of incomes. However, this response would not be satisfactory since, behind the interest in functional distribution, there is ultimately always the wish to know more about personal income distribution. Another aspect is therefore more important.

In various places in this book it was mentioned that the representative household represents a large number of households each of which believes it is too small to affect market variables by its own actions. The simplest idea here is that all households are identical with regard to their factor endowments and preferences. In fact, however, the assumption of identical factor endowments was not necessary. Provided – as was assumed – the utility functions of all households are characterized by the same constant elasticity of marginal utility, a differential equation like (8.19), which describes the relative time profile of consumption, will hold for each household. At each point in time, the ratio of the consumption levels chosen by any two households is therefore the same as the ratio of their respective wealth levels, and this holds independently of how these wealth levels are made up from among human capital (A), claims on government transfers (F^*), company shares (M), and interest bearing bonds (D). Both the distribution of wealth among the households and differences in the structures of individual wealth portfolios are therefore irrelevant for the behavior of the aggregate of all households. It is true that taxation results in different tax burdens being imposed on different income categories so that households will not be affected equally. However, the growth path of the economy and the way factor prices change will be the same as in the case where there is

just one representative household. The reason for the irrelevance of endowment differences is that the assumption of a constant elasticity of marginal utility implies homothetic preferences. That such preferences avoid the aggregation problem is well known.

These considerations should not be taken to mean that the assumption of a constant elasticity of marginal utility is necessarily realistic. Their purpose is simply to show that the present model can be used for incidence analysis in a meaningful way despite the assumption of a representative household. The assumed constancy of the elasticity of marginal utility is an idealization that makes it possible to concentrate on the shifting processes brought about by substitution effects. Future extensions of this research may add income effects by allowing for different preference structures. Here we bypass the difficulties such a generalization would cause.

The second problem that has to be mentioned concerns the measurement of incidence. Sometimes incidence analyses concentrate on the change in net incomes induced through taxation. This procedure may seem plausible at first sight, but it has the disadvantage that the change in net income is not necessarily a good indicator for the change in utility which the taxation causes. If, as in this book, proportional taxes are assumed, then a net income after tax can be seen as a product of a net factor price and a factor supply. Only that part of the change in net income that results from a change in the net factor price is a clear indicator of a change in utility. The quantity-induced part of the income change, however, is only of subordinate importance for the utility level since, in general, it is balanced by a change in opportunity costs. If, for example, the stock of bonds held by the household diminishes as a reaction to a tax reform, then the reduction in interest income resulting *therefrom* cannot be interpreted as an indicator of a loss in utility because the reduction in the stock of bonds means an increase in the stocks of other assets and the returns they generate or an increase in consumption, at any rate it means an increase in utility from other sources. For this reason, the analysis will concentrate on tax-induced changes in the time paths of factor prices; that is, those changes in net incomes that would occur if the factor prices changed but the time paths of factor supply nevertheless stayed unaffected by taxation.

10.2. Taxation and the Structure of Interest Rates: Basic Considerations

The analysis will be exclusively concerned with the taxation of capital and capital incomes. This section sets up the model on which the discussion will

be based and offers some preliminary insights into the incidence process.

In addition to the real gross wage rate w , four rates of return will be considered. These rates of return are the marginal product of capital (or internal rate of return) $\varphi' - \delta$,⁴ the (gross) market rate of interest r , the net-of-personal-tax market rate of interest r_n [which according to (8.17) equals the rate of time preference], and the equivalent rate of return on shares $\bar{r}_n$. The last mentioned is a measure of the incidence on shareholders that will be defined below.

Since the investigation is confined to real types of tax system, it is assumed that only actual interest costs are deductible ($\alpha_2 = \alpha_3 = 0$). Except for this, none of the features of the tax systems that appear in the basic model will be excluded. From (8.39), (8.40), (5.12), and the definition $r_n \equiv \theta_p r$, it follows that the net and gross market rates of interest are given by

$$r_n = [\varphi'(k) - \delta - \tau_k] / \tilde{P}_K \quad (10.1)$$

and

$$r = [\varphi'(k) - \delta - \tau_k] / P_K, \quad (10.2)$$

where $\tilde{P}_K$ and P_K are the wedge parameter and the effective price of capital, respectively. Both of these played important roles in the analyses of intertemporal and intersectoral tax distortions. By definition it holds that

$$P_K = \tilde{P}_K \theta_p \quad (10.3)$$

and

$$\tilde{P}_K = \frac{\varepsilon^*}{\max(\theta_d^*, \theta_r^*)} + \frac{\sigma^*}{\theta_p}. \quad (10.4)$$

According to (8.41) and (8.42), alternative degrees of financial flexibility are modelled through the following, by now familiar, expressions:

$$\sigma^* + \varepsilon^* = 1 - \alpha_1 \tau_r, \quad (10.5)$$

$$\varepsilon^* \geq \alpha_1 W \max(\theta_d^*, \theta_r^*). \quad (10.6)$$

The net market rate of interest r_n is an important variable for the growth process since it determines the households' savings behavior. It is also a variable that has a central role in incidence analysis. It explains the income

⁴The derivative $\varphi' - \delta$ is the marginal physical product (net of depreciation) of a physical unit of capital and, independently of the numeraire, also the marginal value product of a value unit of capital. Cf. Chapter 5.3.7.

position of private creditors and debtors and, in addition, it is an indicator of the incidence on two other sectors. One is the government. As private interest income on government bonds is taxed, the government's actual interest burden is not determined by the gross, but by the net, market rate of interest. The other sector consists of shareholders. At each point in time, shareholders receive a net-of-tax rate of return comprising the effects of capital gains, dividends, and, potentially, purchasing options for new shares that equals the net market rate of interest. This follows from the fundamental arbitrage condition (3.21) from which the market value formula (3.24) was derived.

The net market rate of interest is not necessarily a perfect indicator of shareholder incidence though. It reveals all the information necessary to assess the incidence on shareholders who invest their money after a tax reform – let us call them “new” shareholders. However, at the time of the tax reform there will be in general a sudden revaluation of the existing stock of shares, and this will create windfall profits or losses for “old” shareholders.⁵ The magnitude of this effect follows from the market value function (6.4). Using the definition of the average debt–asset ratio [$\sigma \equiv D_t/K$, from (5.10)], this function can be written as

$$M(0) = \theta_d K(0) [P_K - \sigma(0)]. \quad (10.7)$$

A crucial variable in this formula is the effective price of capital P_K that, according to (10.2), explains the wedge between the marginal product of capital and the market rate of interest. The effective price of capital can be interpreted as the cost of a unit of real capital relative to a unit of financial capital. A tax reform that increases P_K discriminates against real investment and requires a decline in the market rate of interest to compensate for this. This decline then revalues the existing stock of capital that had previously been invested under more favorable conditions.

To capture the overall effect of both the windfall gains or losses and the tax-induced change in the actual net rate of return on shares, the above-mentioned *equivalent rate of return on shares* is introduced. This variable will be used as a measure of the incidence on old shareholders, and it is defined as

$$\bar{r}_n(t) \equiv \frac{M(0)}{M(0^-)} r_n(t), \quad (10.8)$$

⁵ It goes without saying that new and old shareholders should be interpreted as economic functions rather than individuals. Of course, both functions can simultaneously be combined within a single individual.

where $M(0)$ is the market value immediately after, and $M(0-)$ the market value immediately before, the tax reform:⁶

$$M(0-) = \theta_d(0-)K(0)[P_K(0-) - \sigma(0)]. \quad (10.9)$$

The equivalent rate of return on shares measures the *current* net return from shareholding relative to the share value *before* the reform. It indicates which percentage of the pre-reform value of shares could be withdrawn per period without eroding the post-reform value. Using (10.2), (10.3), and (10.7), and noting that $\theta_d^* \equiv \theta_d \theta_p$, the equivalent rate of return on shares can be written as

$$\bar{r}_n = \frac{K(0)}{M(0-)}(\varphi' - \delta - \tau_k)\theta_d^* \left[1 - \frac{\sigma(0)}{P_K} \right]. \quad (10.10)$$

This equation will turn out to be a useful tool of incidence analysis.

Expressions (10.1)–(10.10) reveal how a tax reform affects the *structure* of the four rates of return. In order to get information on the *levels* of these rates, it is useful to note that, in the long and in the short run respectively, one of the rates of return is anchored. In the short run, the capital intensity is a constant,

$$k(0) = \text{constant}, \quad (10.11)$$

and so the marginal product of capital, $\varphi'(k) - \delta$, is given. However, in the long run, when a new steady state is reached, it follows from (8.37) and (8.38) that the subjective rate of time preference, and hence the net market rate of interest, is a constant:⁷

$$\lim_{t \rightarrow \infty} r_n(t) = \rho + \eta g = \text{constant}. \quad (10.12)$$

Given the tax-induced change in the structure of the rates of return, the levels of these rates must react to the tax reform in such a way that both these requirements can be met.

If, as we want to assume for the normal case, the economy was in a steady state before the reform, then the net market rate of interest had the

⁶Note that K and σ must have the same values immediately before and after the reform as K and D_f are state variables and cannot jump.

⁷Admittedly this is a special case that hinges on the particular specification of the household's intertemporal utility function. But it is a useful simplification that should not be overly misleading. Of course, it cannot be expected that the steady-state value of r_n is *completely* independent of the tax law. But what might turn out to be a robust result is that tax reforms will have larger effects on r_n in the short run than in the long run and that there is a tendency for r_n to return to the neighborhood of some stable value after an initial disturbance.

value indicated in (10.12) during this time. The typical pattern of development of the four rates of return can therefore be described as follows. Immediately after the tax reform there is a sudden, discontinuous change in the rate structure as shown by (10.1), (10.2), (10.10) and (10.11). As $\varphi' - \delta$ is anchored in the short run, this structural change will, in general, require abrupt adjustments in the gross and net interest rates and in the equivalent rate of return on shares. Over time, the capital intensity k will then monotonically change, and the economy will drift towards a new steady state. During this process, the levels of all four rates of return will shift, but their relative magnitude structure remains stable. In the long run, the net market rate of interest will be on the same level as before the reform, and the structural change will exclusively translate into variations in the marginal product of capital, the market rate of interest, and the equivalent rate of return on shares.

Given this general reaction pattern, much information on the incidence of the various taxes is already revealed by the results on the growth effects of taxation that were derived in the previous chapter. Whether the growth process was retarded or accelerated through a tax reform depended exclusively on the way this reform affected the overall wedge between the marginal product of capital and the net market rate of interest. The latter is the variable to which households equate their rates of time preference through a revision of their intertemporal consumption plans. The lower the net market rate of interest, the higher is present consumption and the slower is economic growth. Thus, all measures that were shown to be growth retarding reduce the net market rate of interest in the short run and raise the marginal product of capital in the long run. And all measures stimulating economic growth increase the net market rate of interest in the short run and reduce the marginal product of capital in the long run.

It is also obvious how the wage rate will be affected through the reforms. According to (3.38) the wage rate equals the marginal product of labor:

$$w = f_L \quad (10.13)$$

Using the standardized production function $\varphi(k) = f(k, 1)$, $k \equiv K/L$, the marginal product of labor can be written as a function of the capital intensity k :

$$f_L = \varphi(k) - \varphi'(k)k. \quad (10.14)$$

Equations (10.13) and (10.14) imply that $dw = d\varphi - d\varphi'k - dk\varphi' = \varphi'dk - d\varphi'k - dk\varphi' = -d\varphi'k$ or, as $\delta = \text{constant}$, that

$$dw = -k d(\varphi' - \delta). \quad (10.15)$$

This is a familiar expression for the factor price frontier of a competitive economy with constant returns to scale. It shows that, whatever the cause of a distortion in the growth path, the wage rate must vary inversely with the marginal product of capital.

What is still unclear at this stage, however, is the effect of tax reforms on the market rate of interest and the equivalent rate of return on shares. The following discussion will pay particular attention to these variables.

10.3. The Incidence of a Schanz-Haig-Simons Tax on Capital Incomes

A uniform taxation of all kinds of capital income is the natural starting point for the analysis. It is assumed that $\theta \equiv \theta_d^* = \theta_r^* = \theta_p$ where arbitrary blends of capital gains, personal income, and corporate taxation are admissible that satisfy this condition. True economic depreciation is also required ($\alpha_1 = 0$).

Table 10.1 describes the incidence pattern that follows straightforwardly from the previous equations. The results show that the marginal product of capital and the market rate of interest change in the same way. The reason

Table 10.1
The incidence of a uniform tax on all kinds of capital income with true economic depreciation.^a

	$d(\varphi' - \delta)/d\tau$	$dr/d\tau$	$dr_n/d\tau$	$d\bar{r}_n/d\tau$	$dw/d\tau$
Short run	0	0	$-r < 0$	$-r < 0$	0
Long run	$r/\theta > 0$	$r/\theta > 0$	0	0	$-rk/\theta < 0$

^aHere and in the following tables "short run" means $t = 0$ and "long run" $t \rightarrow \infty$.

is that (10.3)–(10.5) imply $P_K = 1$ and that capital income taxation is therefore unable to drive a wedge between these quantities. Moreover, the net market rate of interest and the equivalent rate of return on shares are also equally affected. This follows from the fact that $\bar{P}_K = 1$ and $\theta_d = 1$ (from $\theta_d^* = \theta_p$), together with (10.7), imply a constancy of the initial market value of shares:

$$\partial M(0)/\partial \tau = 0, \quad \tau = 1 - \theta, \quad \theta \equiv \theta_d^* = \theta_r^* = \theta_p, \quad \alpha_1 = 0. \quad (10.16)$$

There are, however, differences in the developments of these two groups of rates of return. They confirm the general incidence pattern of growth retarding tax reforms that was described above. In the short run, the marginal product of capital is given and thus the reform reduces the net

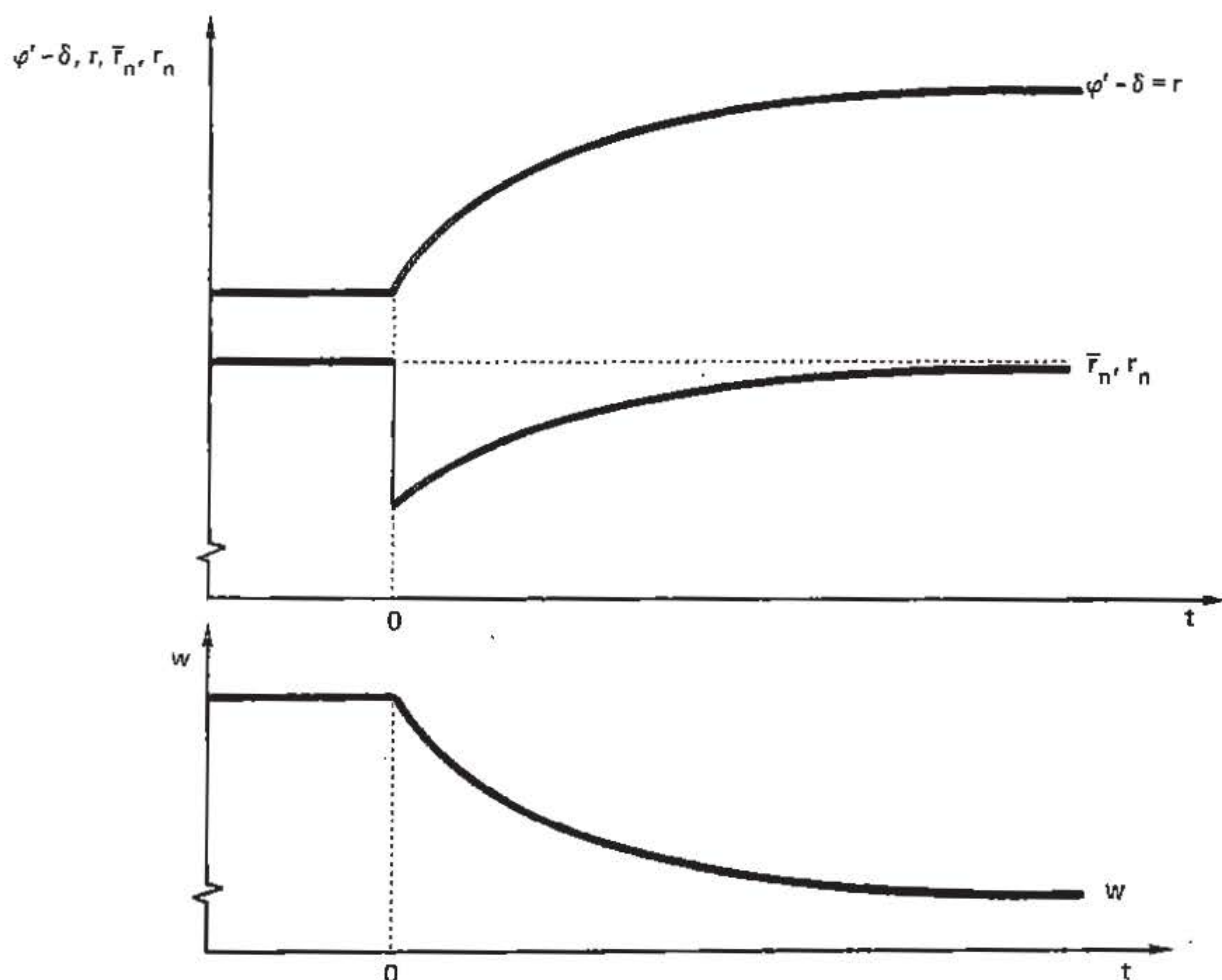


Figure 10.1. A uniform Schanz-Haig-Simons tax on capital incomes ($\tau_k = 0, \alpha_1 = 0$).

market rate of interest. This induces households to save less and thereby slows down the growth process. Over time, the capital intensity of production declines, the wage rate declines, and the marginal product of capital rises. The process comes to a halt when the rising marginal product of capital has pulled the net market rate of interest back to its original level. Strictly speaking, this will only happen as time goes to infinity, but a situation close to the new steady state might be reached in a foreseeable period of time. Figure 10.1 illustrates the incidence result in a schematic way.

10.4. A Tax on the Factor Capital

Assume now that, perhaps in addition to a given Schanz-Haig-Simons tax, a tax on the stock of capital is levied: $\tau_k > 0$. As shown in the last chapter,

this tax shares with the Schanz-Haig-Simons tax the property of slowing down the process of economic growth. The question is whether it also shares the incidence effects of the Schanz-Haig-Simons tax.

Clearly the marginal product of capital $\varphi' - \delta$, the net rate of interest r_n , and the wage rate w will all exhibit the same kinds of adjustment as those depicted in Figure 10.1. There are differences, however, with regard to the gross market rate of interest.

While both the Schanz-Haig-Simons tax and the tax on the stock of capital create wedges between the marginal product of capital and the consumer rate of time preference, they place these wedges at different points. The former drives a wedge between the market rate of interest and the rate of time preference, but the latter drives one between the marginal product of capital and the (gross) market rate of interest. Thus the gross market rate of interest no longer follows the marginal product of capital but exhibits a time path similar to that of the net market rate of interest: it falls in the short run and returns gradually to its initial level in the long run.

Table 10.2 reports the corresponding differential quotients for these and the other variables considered. They follow from (10.1), (10.2), (10.7), (10.8), (10.11), (10.12), and (10.15).

Table 10.2
The incidence of a tax on the factor capital.

	$d(\varphi' - \delta)/d\tau_k$	$dr/d\tau_k$	$dr_n/d\tau_k$	$d\bar{r}_n/d\tau_k$	$dw/d\tau_k$
Short run	0	$-1/P_K < 0$	$-\theta_p/P_K < 0$	$-\theta_p/P_K < 0$	0
Long run	1	0	0	0	$-k < 0$

The differences in the development of the gross market rate of interest illuminate the channels through which the Schanz-Haig-Simons and the capital taxes affect the economy, but they are irrelevant under the aspect of incidence. Not only are creditors, new shareholders, and wage earners affected in the same way; even for old shareholders there is no relevant difference between the two taxes. This follows from the fact that the tax rate τ_k does not show up in (10.3)–(10.7) and that the market value of shares will hence, as with the Schanz-Haig-Simons tax, not be affected by the tax on the capital stock:

$$dM(0)/d\tau_k = 0. \quad (10.17)$$

Because of (10.8), this in turn implies that the equivalent rate of return $\bar{r}_n$ again equals the net market rate of interest r_n at all points in time.

The reason that there is no meaningful difference between the Schanz-Haig-Simons tax and the tax on the capital stock lies in the general equilibrium repercussions that the model incorporates. It is true that the formal incidence of the capital tax falls exclusively on shareholders (or their firms), but the resulting change in investment behavior reduces the market rate of interest to a point where the firms' creditors and new shareholders bear their fair share of the burden. This reduction compensates for the firms' additional tax payments and saves their shareholders from capital losses. There is the same incidence pattern despite, and not because of, the differences in the time paths of the market rate of interest under the two taxes.

A basic aspect of this incidence pattern is the gradual shifting of the tax burden on to the shoulders of wage earners. In the short run, old shareholders, new shareholders, and bond owners incur losses from the fall in the common net rate of return on their respective assets. But, because of the retardation of economic growth, over time all rates of return will gradually rise at the expense of the wage rate. In the long run, they will be back to their common initial level. The wage rate, however, will permanently be lower than it otherwise would have been.

The process of shifting the burden of capital taxation to wage earners not only results from the present model, and for two alternative variants of capital taxes. It also was shown to be an implication of other types of model that were studied by Diamond (1970), Feldstein (1974a and b), Friedlaender and Vandendorpe (1978), and Ballentine (1978). Does this mean that this shifting process is a robust result? Can we expect that all kinds of taxes on capital or its returns will bring about similar incidence effects? The next few sections try to find answers to these questions.

10.5. Corporate Income Taxation

Widely diverging views on the incidence of corporate income taxation exist in the literature. Some authors believe this tax operates like a tax on pure profits that cannot be shifted and others stress that it is a tax on the returns to equity that increases the cost of finance and induces shifting processes. Another important reason for the different views seems to be the time horizons the authors have in mind. Short run analyses where a given stock of capital is assumed, for example those of Harberger (1962), Mieszkowski (1967), or Ballentine and Eris (1975), typically show that the burden of the

tax will exclusively be born by capital owners.⁸ Older, partial analytic and long-run oriented studies often come to the opposite conclusion.⁹ The same is true for the dynamic investigations of Feldstein, Friedlaender, Vandendorpe, and Ballentine that were cited at the end of the previous section.

Contrary to the present approach, none of these last three investigations distinguishes between retained profits, distributed profits, and interest income. That such a simplification is justified in the case of uniform taxation was seen above. However, Feldstein, Ballentine, Friedlaender, and Vandendorpe claim more than this. They argue that their approaches can also be used for an incidence analysis of corporate taxation, as if it were only the total tax burden on capital incomes that mattered and as if the corporate and personal taxes brought about identical distortions. In the light of the substantial differences in the growth effects of these taxes that were found in Chapter 9, this view cannot be shared. Differences with the incidence effects can be expected just as with the growth effects.

10.5.1. The Incidence of Dividend Taxation

The fallacy of the established view on the incidence of corporate taxation can most clearly be demonstrated with the corporate tax on dividends (τ_d). The corporate tax on dividends undoubtedly is a burden for shareholders, but, because of the fundamental neutrality aspects of dividend taxation, it may be impossible to shift this tax either to wage earners or to the firms' creditors. The conditions of non-shiftability are precisely those of growth neutrality that were discussed in Chapter 9.5.2.1. Thus, at least in the classical and closely related partial imputation systems where profit retentions dominate new issues of shares as the marginal source of equity finance ($\theta_r^* > \theta_d^*$), a marginal change in the corporate tax rate on dividends will exclusively affect the tax burden that shareholders themselves have to bear.

Equations (10.1)–(10.10) show this. Obviously, the net market rate of interest r_n is unaffected by a marginal variation in θ_d^* , but the initial market

⁸ Cf., however, Shoven and Whalley (1972, p. 306). These authors find that, with an elastic labor supply and sector-specific taxation, a partial shifting of the tax on to the factor labor is possible.

⁹ For an overview see Cosciani (1958/59).

value of shares declines with a tax increase:¹⁰

$$\frac{dM(0)}{d\tau_d} = -\frac{M(0)}{\theta_d} < 0 \quad (\text{for } \theta_r^* > \theta_d^* \text{ and/or } \varepsilon^* = 0). \quad (10.18)$$

As the net rate of interest is not affected by the tax, (10.8) reveals that this decline in the market value results in a once-and-for-all decline in the equivalent rate of return. The incidence pattern is formally summarized in the first and third rows of Table 10.3 and, with the broken lines, it is illustrated in Figure 10.2.

This once again demonstrates that a dividend tax is the dynamic analog of the textbook profit tax. The only way to escape the burden of the profit tax is not to maximize profits, and the only way to escape a dividend tax is not to maximize the market value of shares. Reacting to the dividend tax through a change in real or financial decisions therefore means cutting off your nose to spite your face. No rational shareholder will vote for such a policy. He will accept his fate or bribe a politician to "cut off" the dividend tax rate instead.

Consider now, however, the case where new issues dominate retentions ($\theta_d^* > \theta_r^*$). This case may, but does not have to, prevail in full imputation or closely related partial imputation systems and cannot occur in classical or closely related systems. It is particularly relevant for an evaluation of radical tax reforms that aim at abolishing the double taxation of dividends.

It is known from the analysis of the last chapter that an increase in the corporate tax rate on dividends will remain growth neutral even in the case $\theta_d^* > \theta_r^*$ if firms enjoy perfect financial flexibility in the sense that they can dispense with equity financing at the margin ($\varepsilon^* = 0$). With perfect financial flexibility, a change in τ_d is unable to affect the wedge parameter $\tilde{P}_K$ regardless of the firm's choice between new issues of shares and retentions. Equation (10.18) therefore continues to hold and the incidence pattern illustrated with the broken lines in Figure 10.2 still applies.

However, when new issues are preferred to retentions ($\theta_d^* > \theta_r^*$) and the firm must choose equity at the margin ($\varepsilon^* > 0$), another situation arises. As was shown, an increase in the dividend tax rate will now raise the wedge parameter [see (9.16)] and retard the growth process. According to (10.1)–(10.3) and (10.11), the increase in the wedge parameter reduces both the net and gross market rates of interest in the short run. With the passage of time, according to the general reaction pattern described in Section 10.2, all

¹⁰ Recall that $P_K - \sigma(0) > 0$ was assumed in (3.33) to ensure a strictly positive market value: $M(0) > 0$.

Table 10.3
The incidence of dividend taxation.^a

	$d(\phi' - \delta)/d\tau_d$	$dr/d\tau_d$	$d\bar{r}_n/d\tau_d$	$d\bar{r}_n/d\tau_d$	$dw/d\tau_d$
Short run	$\theta_t^* > \theta_d^*$ and/or $\varepsilon^* = 0$	0	0	$-\frac{\theta_p}{\theta_d} < 0$	0
	$\theta_d^* > \theta_t^*$ and $\varepsilon^* > 0$	$-\frac{r}{P_K} \frac{dP_K}{d\tau_d} < 0$	$\frac{dr(0)}{d\tau_d} \theta_p < 0$	$-\frac{\theta_p}{\theta_d} - \frac{D_r(0)}{M(0)} \frac{dr(0)}{d\tau_d} \theta_d^* \geq 0$	0
Long run	$\theta_t^* > \theta_d^*$ and/or $\varepsilon^* = 0$	0	0	$-\frac{\theta_p}{\theta_d} < 0$	0
	$\theta_d^* > \theta_t^*$ and $\varepsilon^* > 0$	$-\frac{dr(0)}{d\tau_d} P_K > 0$	0	$\frac{dM(0)}{d\tau_d} - \frac{r_n}{M(0)} \geq 0$	$\frac{dr(0)}{d\tau_d} P_K < 0$

^aThe term $dr(0)/d\tau_d$ refers to the field in the second row and second column, and it follows from (10.6) and (9.16) that $dP_K/d\tau_d = \theta_p d\bar{P}_K/d\tau_d \geq \varepsilon^*/\theta_d^2$ for $\theta_d^* > \theta_t^*$.

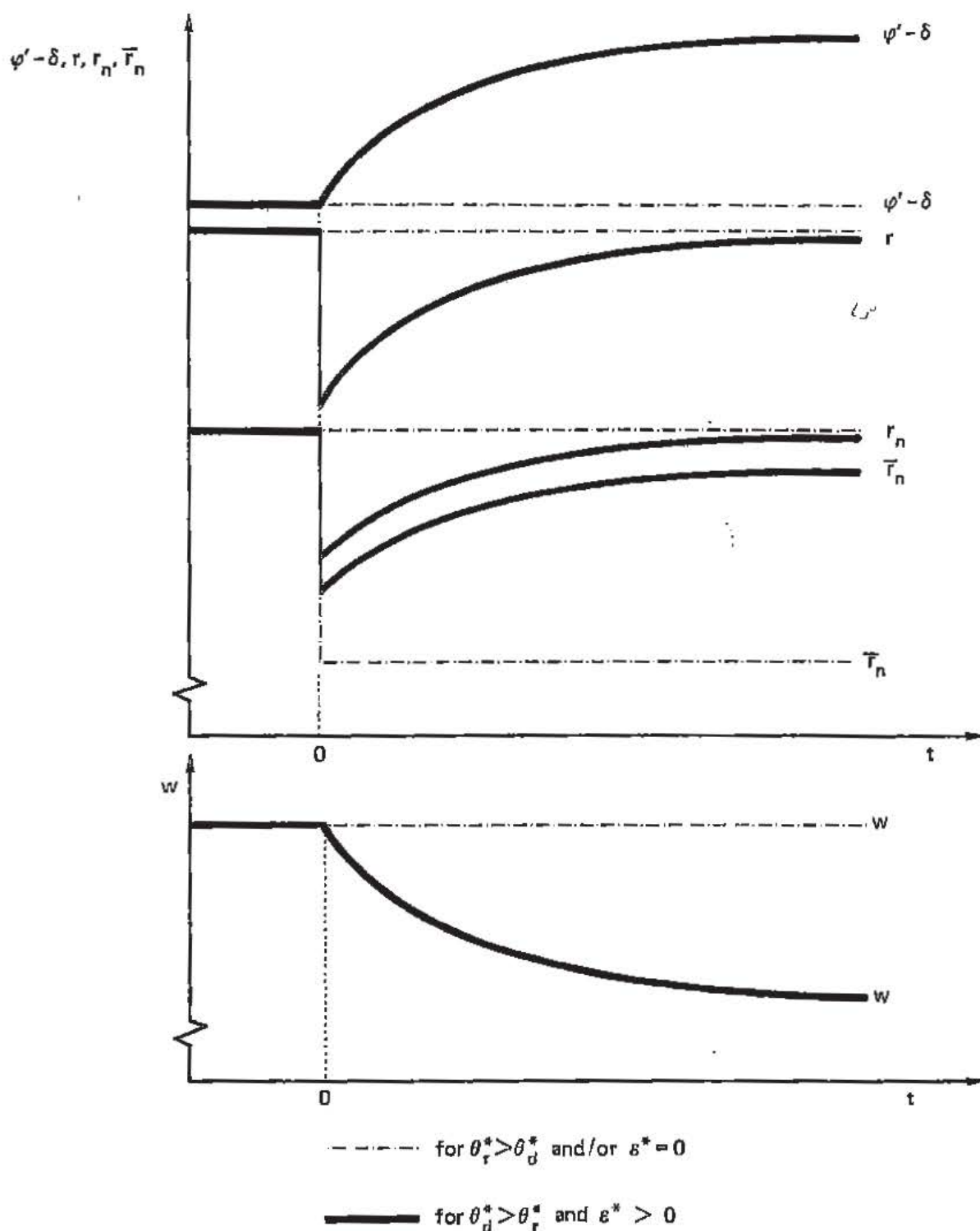


Figure 10.2. The incidence of dividend taxation [$D_r(0) > 0$, $\sigma^* - \sigma(0) + y > 0$]. (The figure arbitrarily assumes that $\varphi' - \delta > r$. The incidence pattern illustrated with heavy lines also applies to an increase in the corporate tax rate given the degree of integration between corporate and personal taxation when new issues dominate retentions; i.e., when $\theta_d^* > \theta_r^*$ (cf. next section).)

rates of return will gradually rise again, with the two market rates of interest returning to their original levels and the marginal product of capital taking on a higher value than before. The wage rate will gradually fall to a lower steady-state value. Table 10.3 and Figure 10.2 provide more exact and more graphic information on these results. The differential quotients reported in the table follow by straightforward transformations from (10.1)–(10.15) in connection with (9.16).

Obviously, “old” shareholders succeed in shifting a tax burden on to other shoulders. In the short run, they shift it to their creditors and to new shareholders, but not to wage earners. Over time, the creditors and new shareholders, in turn, “manage” to raise the rate of interest and to pass their burden entirely over to wage earners.

But what is the incidence on old shareholders themselves? What part of the burden remains with them? To answer these questions differentiate (10.7) for τ_d :

$$\frac{dM(0)}{d\tau_d} = -K(P_K - \sigma) + K\theta_d \frac{dP_K}{d\tau_d}. \quad (10.19)$$

Because of (10.8), the sign of this derivative indicates whether the equivalent rate of return on shares $\bar{r}_n$ will fall more or less than the net market rate of interest, and as the latter approaches a constant in the long run, the sign also indicates whether the long-run value of the equivalent rate of return on shares will be greater or less than the value before the reform. (Compare the bottom field in the fourth column of Table 10.3).

For the two alternative cases where the minimum marginal equity–asset ratio is exogenously determined and where it is endogenously determined through the interaction of accelerated depreciation and the limited loss–offset,

$$\frac{dP_K}{d\tau_d} = \frac{\varepsilon^*}{\theta_d^x} \quad \text{where } x = \begin{cases} 2 & \text{for } \varepsilon^* = \text{constant} \\ 1 & \text{for } \varepsilon^* = \alpha_1 W\theta_d^* \end{cases} \quad (10.20)$$

can be calculated from (10.3)–(10.6). Using (10.20) and again (10.3)–(10.6), (10.19) can be transformed to¹¹

¹¹ If $\varepsilon^* = 0$, then, from (10.3)–(10.5), $\sigma^* = P_K = 1 - \alpha_1 \tau_r$, and (10.21) reduces to (10.18). Because of (10.7), it is necessary in this case for $M(0) > 0$ that $\sigma^* > \sigma(0)$. However, if $\varepsilon^* > 0$, then $P_K > \sigma^*$, and the case $\sigma^* < \sigma(0)$ is compatible with $P_K > \sigma(0)$ or, equivalently, $M(0) > 0$. In fact, as will be shown in Footnote 14, the assumption $M(0) > 0$ is compatible even with $\sigma^* < \sigma(0) - y$ where $y = \varepsilon^* \tau_d / \theta_d > 0$.

$$dM(0)/d\tau_d = -K(0)[\sigma^* - \sigma(0) + y] \quad (\text{for } \theta_d^* > \theta_r^*) \quad \text{where}$$

$$y = \begin{cases} 0 & \text{for } \varepsilon^* = \text{constant} \\ \varepsilon^* \tau_d / \theta_d & \text{for } \varepsilon^* = \alpha_1 W \theta_d^* \end{cases} \quad (10.21)$$

When $\varepsilon^* = \text{constant}$ and thus $y = 0$, this expression shows that the sought sign of $dM(0)/d\tau_d$ is ambiguous and depends only on the relative magnitudes of σ^* and σ . In the special case where the maximum *marginal* debt-asset ratio (σ^*) equals the actual *average* debt-asset ratio (σ), the initial market value of shares does not depend on the corporate tax rate on dividends when new issues of shares are the preferred marginal source of finance. However, when the marginal and average debt-asset ratios are different, the market value may rise or fall after an increase in the dividend tax rate.

The reason for this ambiguity is that there are two opposing effects represented by the two items on the right-hand side of (10.19). There is a negative direct effect through the increased tax burden itself. Given the stock of capital, this effect is lower the higher the average debt-asset ratio σ . However, there is also a positive indirect effect that results from the general equilibrium repercussions of the model. This effect comes from the decline in the market rate of interest or, equivalently, the rise in the effective price of capital, and it is lower the higher the maximum marginal debt-asset ratio. When the average and marginal ratios are equal, the two effects just balance, and the market value stays constant. When the average exceeds the marginal ratio, a rise in the share value after an increase in dividend taxation is possible, and, when the marginal exceeds the average ratio, the more familiar decline in the market value results.

The ambiguity in the change in the market value carries over to the equivalent rate of returns on shares, $\bar{r}_n$. This follows from inspecting the differential quotients for $\bar{r}_n$ that are reported in the fourth column of Table 10.3. It is true that a comparison of the first and second fields in this column shows that the equivalent rate of return on shares falls less in the case of shifting ($\theta_d^* > \theta_r^*$) than in the case of no shifting ($\theta_r^* > \theta_d^*$) if the firm sector is in a net debtor position [$D_f(0) > 0$].¹² However, it is unclear whether $\bar{r}_n$ falls by more or less than r_n , and it is not even clear whether it will fall at all. Since the first item of the expression in the second field dominates the second item when $D_f(0) \rightarrow 0$ and the second item dominates the first item

¹²Figure 10.2 demonstrates this in that the heavy line $\bar{r}_n$ is above the broken line with the same label.

when $M(0) \rightarrow 0$ [and hence $D_r(0)$ sufficiently large], the sign of the differential quotient $d\bar{r}_n(0)/d\tau_d$ is ambiguous when $\theta_d^* > \theta_r^*$.¹³

Fortunately there are two arguments that reinforce one another and help remove the ambiguity.

The first is empirical. Table 4.1 showed that the average debt–asset ratios in major industrial countries had risen during the sixties and seventies. This clearly suggests that $\sigma^* > \sigma$ was the normal case and that $dM(0)/d\tau_d < 0$ so that, according to (10.8), $d\bar{r}_n(0)/d\tau_d < dr_n(0)/d\tau_d < 0$. But, of course, there is no presumption that this will also be so in the future.

The second argument is theoretical. Suppose the firm's marginal debt–asset ratio is not an exogenous parameter, but is endogenously explained through the interaction between accelerated depreciation, growth, and limited loss-offset that is implicit in the hypothesis $\varepsilon^* = \alpha_1 W \max(\theta_d^*, \theta_r^*)$ (where $\sigma^* = 1 - \alpha_1 \tau_r - \varepsilon^*$). In this case the indirect effect that operates through a rise in the effective price of capital gets weaker. It is still true that the rise in τ_d increases the effective price of capital P_K , but as this increase is associated with an increase in the wedge between the marginal product of capital and the market rate of interest, it enlarges the firms' scope for debt financing. This in itself works against the wedge and hence against the rise in P_K . As a result, the direct effect dominates the indirect effect even when $\sigma^* = \sigma$. This is shown by the item $\varepsilon^* \tau_d / \theta_d$ that according to (10.21) must be added to $\sigma^* - \sigma(0)$ when $\varepsilon^* = \alpha_1 W \theta_d^*$. It is still possible that an increase in dividend taxation increases the market value of shares,¹⁴ but it is even less likely.

All of this implies that even in the case where new issues of shares are the marginal source of equity finance, old shareholders are likely to suffer from an increase in the dividend tax rate. It is true that they are better off than in the case where retentions are the marginal source of equity finance and where no shifting is possible. However, despite a successful shifting of part of the tax burden on to other shoulders, they will typically bear a higher tax

¹³ Note that $dr(0)/d\tau_d = (rP_K)(dP_K/d\tau_d)$ (from the second field in the second column) is negative and independent of $\sigma(0)$.

¹⁴ Comparing (10.7) and (10.21) and noting that $y > 0$, it could be suspected that this possibility now requires such a high value of $\sigma(0)$ that $M(0) \leq 0$. It can easily be shown, however, that this suspicion is wrong. On the one hand it follows from (10.3) and (10.4) for the case $\varepsilon^* = \alpha_1 W \theta_d^*$ that the requirement $P_K > \sigma(0)$ which ensures $M(0) > 0$ is equivalent to $\sigma(0) - \sigma^* < \varepsilon^* / \theta_d$. On the other hand, (10.21) shows that, in the case $\varepsilon^* = \alpha_1 W \theta_d^*$, there is an abnormal reaction of the market value [$dM(0)/d\tau_d < 0$] if, and only if, $\sigma(0) - \sigma^* > \varepsilon^* \tau_d / \theta_d$. Obviously, the general assumption of non-confiscatory taxation, $\tau_d < 1$, implies that the case $\varepsilon^* \tau_d / \theta_d < \sigma(0) - \sigma^* < \varepsilon^* / \theta_d$ is possible and that the assumption $M(0) > 0$ does not contradict the possibility $dM(0)/d\tau_d > 0$ when $\varepsilon^* = \alpha_1 W \theta_d^*$.

burden than bond owners and new shareholders. This is the result the casual reader will expect, but it is not a trivial result and is quite sensitive with regard to the underlying financial assumptions. It is illustrated in Figure 10.2 in that the time path of the equivalent rate of return on shares $\bar{r}_n$ is below that of the net market rate of interest r_n .

The findings of this section complete the evaluation of tax reforms that remove or reduce the double taxation of dividends. A marginal reform which replaces the classical system with a partial imputation system can be expected to benefit only existing shareholders. It provides them with windfall profits, but does not induce economic reactions that could benefit other parties. In order to induce such reactions the reform must be radical enough to reduce the corporate and personal tax burdens on dividends below the overall tax burden on retained profits and to make firms choose new issues in lieu of retentions as their marginal source of equity finance. Only under these circumstances will the reform benefit other parties. Bond owners and new shareholders will then gain in the short and medium run, and wage earners will gain in the medium and long run. Existing shareholders will still enjoy windfall profits.

The party that definitely loses from the tax cut is the government or, more correctly, those who benefit from its expenditures or pay the taxes that must be raised to balance the budget. The government loss results not only from the reduction in the tax revenue though. It also results from its debtor position. The rise in the rate of interest that a successful, radical reform might bring about increases the burden of the public debt and produces an even greater gap in the budget.

10.5.2. *The Incidence of a Change in the Corporate Tax Rate: The Case of True Economic Depreciation*

Consider now a change in the corporate tax rate given the degree of integration between corporate and personal taxation. Provided dividends are subject to corporate tax at all, this change will simultaneously affect the corporate tax rates on retained (τ_r) and distributed (τ_d) profits.

In the case where true economic depreciation is required and new issues of shares are the marginal source of finance, the firm does not retain profits, and the incidence effects of a change in the corporate tax rate are identical, in qualitative terms, to those derived in the preceding section (for $\varepsilon^* > 0$ and $\theta_d^* > \theta_r^*$). The same is true when true economic depreciation is required for tax purposes and the firm enjoys full financial flexibility ($\varepsilon^* = 0$) so that

the corporate tax rate cannot interfere with the firm's marginal investment condition. This and the following sections therefore concentrate on different cases.

Assume true economic depreciation ($\alpha_1 = 0$), an exogenously given, strictly positive, minimum marginal equity-asset ratio ($\varepsilon^* > 0$), and a dominance of retained profits over share issues as the marginal source of finance ($\theta_r^* > \theta_d^*$) as characteristic of the classical and closely related partial imputation systems. As shown in Chapter 9, a rise in the corporate tax rate is growth retarding under these circumstances. Thus, we have the familiar incidence pattern as illustrated in Figure 10.1 or (for the case $\theta_d^* > \theta_r^*$) in Figure 10.2, characterized by a short-run fall in the net market rate of interest, a long-run fall in the wage rate, and a long-run rise in the marginal product of capital.

Exact formal results are reported in Table 10.4. They follow from (10.1)–(10.4), (10.8), (10.11), (10.12), and (10.15) by straightforward algebraic transformations. The signs of the reported derivatives are the same as those reported in Table 10.3 for the case $\theta_d^* > \theta_r^*$, $\varepsilon^* > 0$, and in some cases the algebraic expressions are even identical. Note, however, that the differential quotient for $r(0)$ has a different value (as, in general, $\tau_r \neq \tau_d$) and that the first item in the expression for the differential quotient for $\bar{r}_n(0)$ is augmented by the additional factor τ_d/τ_r which can be interpreted as a measure of the degree of double taxation of dividends. Again the two differential quotients for $\bar{r}_n$ are ambiguous, and again this ambiguity can be traced back to an ambiguity in the way the market value of shares is affected.

To see this, differentiate (10.7) for τ_r noting that τ_d may vary with τ_r . Using (10.3)–(10.5), the expression

$$\frac{dM(0)}{d\tau_r} = K(0) \left[\varepsilon^* \frac{\theta_p}{\theta_r^*} \left(\frac{\theta_d}{\theta_r} - \frac{d\tau_d}{d\tau_r} \right) - \frac{d\tau_d}{d\tau_r} [\sigma^* - \sigma(0)] \right] \quad (10.22)$$

(for $\alpha_1 = 0, \varepsilon^* = \text{constant} > 0, \theta_r^* > \theta_d^*$),

is obtained.

In the case of the classical system of capital income taxation, it holds that $\theta_d/\theta_r = d\tau_d/d\tau_r = 1$ and thus the righthand side of (10.22) reduces to $-K(0)[\sigma^* - \sigma(0)]$ which is the same as (10.21) for the case $\varepsilon^* = \text{constant}$. Again the direction of change in the market value depends exclusively on the relationship between the firm's maximum marginal and actual average debt-asset ratios.

For a country like the United States that employs the classical system, this reveals an interesting contrast between a marginal reform that reduces the corporate tax rate, given the degree of double taxation of dividends, and

Table 10.4
The incidence of the corporate income tax under true economic depreciation^a
(classical and closely related systems with $\theta_r^* > \theta_d^*$; $\alpha_1 = 0$, $\varepsilon^* = \text{constant} > 0$, $\tau_d/\tau_r = \text{constant}$).

	$d(\varphi' - \delta)/d\tau_r$	$dr/d\tau_r$	$dr_n/d\tau_r$	$d\bar{r}_n/d\tau_r$	$dw/d\tau_r$
Short run	0	$-\frac{r}{P_K} \frac{dP_K}{d\tau_r} < 0$	$\frac{dr(0)}{d\tau_r} \theta_p < 0$	$-\frac{\theta_p}{\theta_d} \frac{\tau_d}{\tau_r} - \frac{D_r(0)}{M(0)} \frac{dr(0)}{d\tau_r} \theta_d^* \geq 0$	0
Long run	$-\frac{dr(0)}{d\tau_r} P_K < 0$	0	0	$\frac{dM(0)}{d\tau_r} \frac{r_n}{M(0)} \geq 0$	$\frac{dr(0)}{d\tau_r} P_K < 0$

^aThe table uses the result $dP_K/d\tau_r = \theta_p d\bar{P}_K/d\tau_r = \theta_p \varepsilon^*/(\theta_r \theta_r^*) > 0$ from (10.6) and (9.17).

a marginal reform that reduces the degree of double taxation, given the corporate tax rate. The latter will be allocatively neutral, but revalue existing shares. The former will stimulate the growth process, but, when the marginal and average debt–asset ratios are equal, it will not induce a revaluation of existing shares.

Equation (10.22) does not only refer to the classical system though. In partial imputation systems it holds that $\theta_d/\theta_r > 1 > d\tau_d/d\tau_r$, and so the first item in the squared bracket of (10.22) begins to play a role. As this item is strictly positive, it becomes more likely that $dM(0)/d\tau_r > 0$. In fact, if the maximum marginal debt–asset ratio is below, equal to, or not too far above the average debt–asset ratio, a rise in the corporate tax rate will increase the market value of shares!

To understand this result and the forces that determine the tax influence on the market value of shares in general, it is useful to consider the two counteracting effects that were mentioned in the context of Equations (10.19) and (10.20) in more detail. There was a direct effect and an indirect effect. The direct effect measured the tax-induced change in market value that appears even with given time paths of factor prices. It can also be seen as an effect that results from the taxation of existing equity. The indirect effect, on the other hand, reflected the general equilibrium repercussions, in particular the tax-induced change in the time path of the market rate of interest. This effect results exclusively from the taxation of new assets. Only the tax treatment of new assets matters for the allocative distortions and the factor price changes taxation brings about. An increased tax burden on existing equity capital is allocatively neutral, but reduces the market value of shares. An increased tax burden on newly acquired assets reduces the market rate of interest, increases the effective price of capital, and raises the market value of shares.

The corporate tax is a tax on retained *and* distributed profits. The tax on retained profits is a tax on new assets that are fully or partially financed with equity. Existing equity capital is not affected by the tax on retained profits simply because, when there is no real net investment, its returns could be distributed without imposing any disadvantages on existing shareholders.¹⁵ Only the decision to increase the stock of real capital and to use retained profits as a source of finance makes it necessary to pay the tax. Thus, an isolated rise in the corporate tax rate on retained profits¹⁶ will

¹⁵ Because of $\theta_p \geq \theta_r^*$ shareholders do not mind reinvesting their profits in the capital market personally rather than through their firms. Cf. Chapters 3.1.2 and 4.3.1.

¹⁶ In practice, this would mean a simultaneous increase in the degree of integration between corporate and personal taxation and in the corporate tax rate.

impose an additional tax burden exclusively on new assets and will hence increase the market value of shares! Formally, this is immediately obvious from (10.22) as the righthand side of this expression reduces to $K\varepsilon^*(\theta_p/\theta_r^*)$ (θ_d/θ_r) > 0 when $d\tau_d/d\tau_r = 0$.

When retentions dominate new issues, the tax on distributed profits, on the other hand, is exclusively a tax on existing equity capital. An increase in its rate will therefore only produce the direct effect and decrease the market value of shares. The direct effect comes in with full strength in the classical system where the two tax rates are equal. In the partial imputation systems, however, an increase in the corporate tax rate will produce a comparatively weak direct effect as the tax rate on dividends rises less than that on retentions. This is the reason that the market value of shares can increase even in the case where the maximum marginal is above the actual average debt–asset ratio.

It is worth mentioning in this context that the case for a rising market value of shares is not necessarily stronger the lower the degree of double taxation of dividends. It is true that it will be stronger as long as the preference for retentions ($\theta_r^* > \theta_d^*$) persists despite the fact that $\tau_d < \tau_r$. However, a low double taxation of dividends may create a dominance of new issues over retentions ($\theta_d^* > \theta_r^*$). If this is the case, the indirect effect is weakened, too. The corporate tax then operates in the way analyzed with (10.21) for the case of a dividend tax, and again a rise in the market value is impossible when the marginal debt–asset ratio is constant and equal to, or above, the average debt–asset ratio. It is only in the intermediate case with some, but neither a high nor a low, degree of double taxation of dividends that an increase in the corporate tax rate will raise the market value of shares under comparatively weak conditions.

10.5.3. Corporate Taxation and Accelerated Depreciation: The Phenomenon of Negative Incidence

The incidence effects of dividend taxation turned out to be quite insensitive to assumptions about tax depreciation rules. Only an indirect effect of accelerated depreciation that operates via the firms' financial decisions was seen to affect the market value of shares in the case where new issues dominate retentions. The other results were robust in qualitative terms.

This is not so with the incidence of the corporate income tax as such. As accelerated depreciation implies a subsidy on marginal investment that depends on the tax rate on retained profits, the incidence effects that result

from a change in the corporate tax rate are sensitive to assumptions about tax depreciation rules. It is true that a rise in the corporate tax rate will continue to slow down economic growth despite accelerated depreciation when the minimum marginal equity-asset ratio is high enough. Basic aspects of the incidence pattern will therefore remain unchanged when the firm's financial flexibility is sufficiently limited. However, when the minimum marginal equity-asset ratio is endogenously determined through the interaction between economic growth, accelerated depreciation, and legal loss-offset constraints, there is a different situation as now the conditions for the taxation paradox apply. In the following, only this case will be considered.

As shown in the last chapter, the taxation paradox implies that an increase in the corporate tax rate will accelerate the growth process. According to the general reaction pattern of factor prices described in Section 10.2, and as the personal tax on interest income is given, this implies a short-run rise in both the gross and net market rates of interest, a long-run decline in the marginal product of capital, and a long-run rise in the wage rate.

Formally, the stimulation of economic growth results from the fact that, as shown in Chapter 5.4.3.4, the rise in the corporate tax rate reduces the effective price of capital P_K and hence the wedge parameter $\tilde{P}_K \equiv P_K/\theta_p$. This has obvious consequences for the change in the market value of shares if (10.7) is differentiated for τ_r :

$$\left. \frac{dM(0)}{d\tau_r} \right|_{\tau_d/\tau_r = \text{constant}} = -\frac{\tau_d}{\tau_r} \frac{M(0)}{\theta_d} + \theta_d K(0) \left. \frac{dP_K}{d\tau_r} \right|_{\tau_d/\tau_r = \text{constant}} < 0$$

(for $\varepsilon^* = \alpha_1 W \max(\theta_d^*, \theta_r^*) > 0$). (10.23)

Clearly, $M(0) > 0$ and $dP_K/d\tau_r|_{\tau_d/\tau_r = \text{constant}} < 0$ [from (5.63)] imply that the sign of this expression is negative. Unlike the case of true economic depreciation and an exogenously given, strictly positive value of ε^* , the result unambiguously confirms the "naive" expectation that an increase in the corporate tax rate reduces the market value of shares.

The reason for the disappearance of the ambiguity is that the direct effect from a taxation of existing equity and the indirect effect that results from the general equilibrium repercussions of a taxation of new assets work in the same direction. As before, the rise in the corporate tax rate is a rise in the tax burden on dividends and hence on the returns to existing equity, provided, of course, dividends are subject to corporate tax at all. However, because of accelerated depreciation and sufficient financial flexibility, the rise in the corporate tax rate implies an additional relief, rather than an

additional burden, on new assets. Existing assets that were acquired under less favorable conditions will therefore be subject to a devaluation which reinforces the negative direct effect on the market value.

Given that the equivalent rate of return on shares captures the joint effect of the change in the initial market value and the opposite change in the net market rate of interest, the direction of the short-run change of the equivalent rate of return on shares is a priori ambiguous. An inspection of (10.10), however, quickly removes this ambiguity. Provided the firm is not a net creditor [$\sigma(0) \geq 0$], $\bar{r}_n$ will unambiguously fall. Obviously the decline in the market value is strong enough to overcompensate the rise in r_n .

A formal description of the full incidence pattern that follows from (5.63), (10.1)–(10.6), (10.10)–(10.12), and (10.15) is given in Table 10.5, and Figure 10.3 provides an illustration. Algebraically, the derivatives reported in the table are the same as those in Table 10.5. However, the derivatives of $\varphi' - \delta$, r , r_n , and w have opposite signs and the two derivatives of $\bar{r}_n$ are no longer ambiguous.

The peculiar aspect of the incidence pattern is that a rise in the corporate tax rate induces a negative shifting process. Rather than shifting some of their burden on to other shoulders, firms react in a way that creates advantages for other parties and imposes a burden on existing shareholders. In the short run, the firms, creditors, and new shareholders gain from the rising net market rate of interest (which equals the actual rate of return on shares). It is true that this gain disappears with the passage of time as the net market rate of interest returns to its given steady-state level. But old shareholders cannot benefit from this fact. As there is only one actual rate of return for all shares, the equivalent rate of return on shares must gradually decline together with the actual one. Old shareholders have no chance of recouping. Only wage earners will permanently gain from the negative shifting process as the wage rate will approach a higher steady-state level.

Objections to this result may be raised on the grounds that existing shareholders will be alert enough to tell their managers not to react to the tax increase with a change in investment. This would then preclude the negative shifting process from taking place, and the shareholders would be better off than with a reaction. With competitive markets and with collective rationality absent, such objections are not valid though. While it would be better for all shareholders if no firm reacted, each one of them will prefer the firm (or firms) he controls to respond to the tax increase by changing the investment policy. The reason is simply that he cannot expect that his firm's investment decision will affect the time paths of factor prices,

Table 10.5
The incidence of the corporate income tax and the taxation paradox^a
[$\varepsilon^* = \alpha_1 W \max(\theta_d^*, \theta_r^*) > 0$, $\tau_d/\tau_r = \text{constant}$].

	$d(\varphi' - \delta)/d\tau_r$	$dP_K/d\tau_r$	$dr_a/d\tau_r$	$d\bar{r}_a/d\tau_r$	$dw/d\tau_r$
Short run	0	$-\frac{r}{P_K} \frac{dP_K}{d\tau_r} > 0$	$\frac{dr(0)}{d\tau_r} \theta_p > 0$	$-\frac{\theta_p}{r} \frac{\tau_d}{\theta_d} \frac{D_r(0)}{M(0)} \frac{dr(0)}{d\tau_r} \theta_d^* < 0$	0
Long run	$-\frac{dr(0)}{d\tau_r} P_K < 0$	0	0	$\frac{dM(0)}{d\tau_r} \frac{r_a}{M(0)} < 0$	$\frac{dr(0)}{d\tau_r} P_K k > 0$

^aThe table uses the result $dP_K/dr|_{\tau_d/\tau_r = \text{constant}} < 0$ from (5.63).

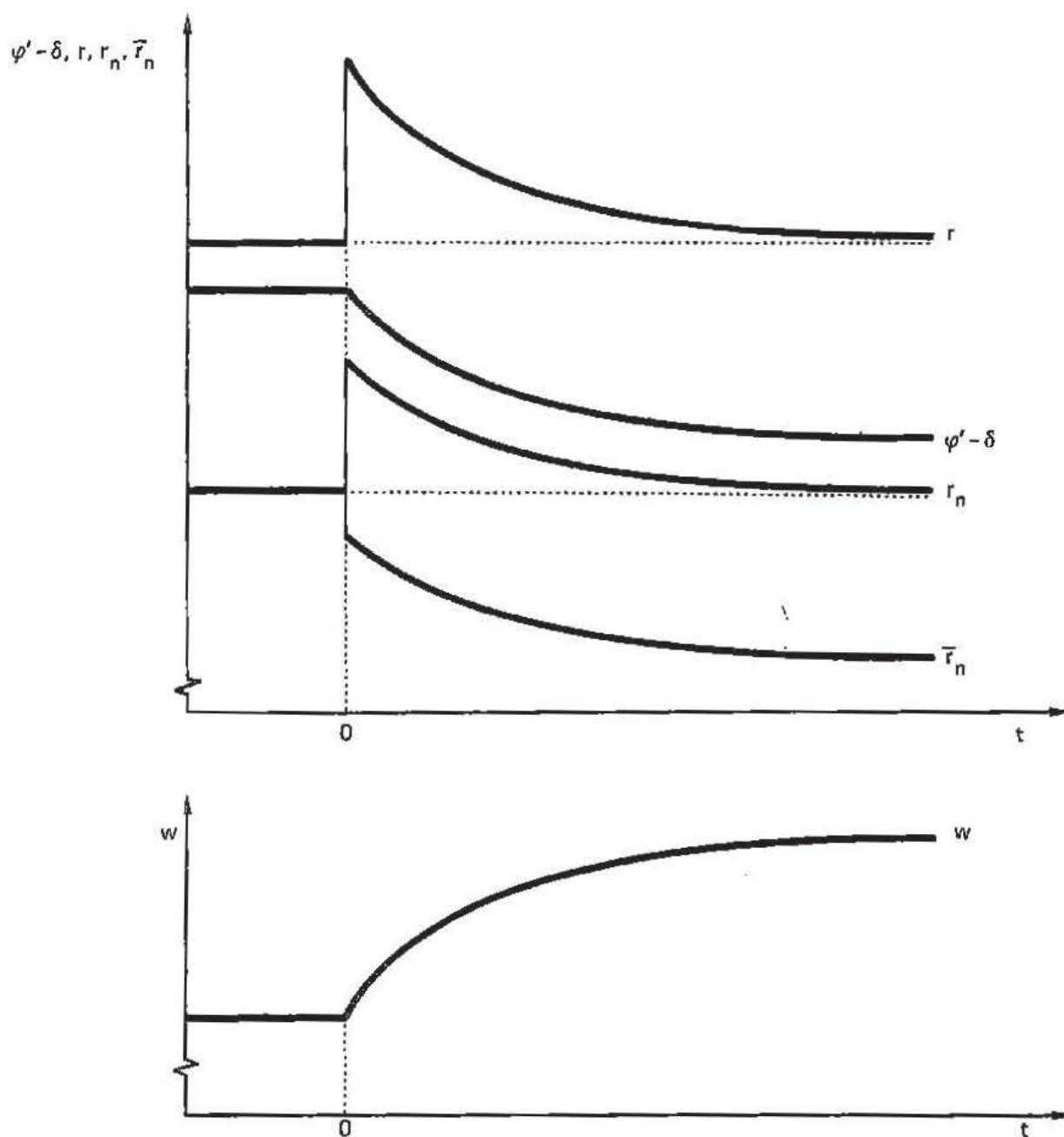


Figure 10.3. The incidence of corporate income taxation and the taxation paradox [$\varepsilon^* = \alpha_1 W \max(\theta_d^*, \theta_r^*) > 0, \tau_d/\tau_r = \text{constant}$].

in particular the path of the market rate of interest. Under competitive conditions, the single selfish and rational shareholder votes for an investment policy that maximizes the share value *given* the factor price paths. This is the best he can do, notwithstanding the fact that, when all firms behave this way, they will change the factor price paths in a way that increases the burden of the tax beyond what they pay to the tax authorities.

10.6. The Capital Gains Tax: A Gift to Shareholders

The personal tax on capital gains from company shares is an indirect tax on retained profits with true economic depreciation. It is allocatively neutral if firms exclusively use debt or new share issues as marginal sources of finance. But when, as in the classical system, retained profits are preferred to new issues and equity financing is used at the margin, the tax slows down the process of economic growth. Only this case will be considered here.

As with other growth-retarding taxes, the burden of the capital gains tax can be shifted to creditors and new shareholders in the short run and to wage earners in the long run. Table 10.6 reports the signs of the respective derivatives that again follow from the equations set up in Section 10.2. All qualitative results hold independently of whether ε^* is exogenously or endogenously determined.

A peculiarity in comparison with the corporate tax and the dividend tax is that the capital gains tax affects the market value of shares exclusively through the effective price of capital and not through the dividend tax factor. It follows from (10.3) and (9.23) that $dP_K/d\tau_c \geq \varepsilon^*/\theta_c > 0$ for $\varepsilon^* = \text{constant} > 0$ or $\varepsilon^* = \alpha_1 W\theta_r^* > 0$. Thus (10.7) implies that an increase in the capital gains tax rate raises the initial market value of shares:

$$\frac{dM(0)}{d\tau_c} = \theta_d K(0) \frac{dP_K}{d\tau_c} \geq K(0) \varepsilon^* \frac{\theta_d}{\theta_c} > 0 \quad (\text{for } \varepsilon^* > 0). \quad (10.24)$$

This result resembles the inverse reaction of the market value to an isolated rise in the corporate tax rate on retained profits ($d\tau_d/d\tau_r = 0$) that was shown to be an implication of (10.22) for the case $\theta_r^* > \theta_d^*$, $\varepsilon^* = \text{constant} > 0$, $\alpha_1 = 0$, and it has basically the same explanation. As the capital gains tax applies only to the extent firms invest and finance their investment with retentions, it is exclusively a tax on new assets. A rise in its rate revalues existing assets relative to debt, and there is no direct negative effect from dividend taxation that is able to offset this revaluation.

Given the previous discussion, the result does not come as a surprise. However, it is in striking contrast to a familiar contention. Typically, it is argued that the market value of an asset reflects the discounted tax burden on its returns and that an increase in the capital gains tax rate will thus reduce this value. There is certainly some truth in this view. The problem, however, is that it implicitly refers to a partial model where the time paths of the market rate of interest and the cash flow generated by the asset remain unaffected by the tax. If, as in the present case, the tax incidence is analyzed from a general equilibrium perspective where the tax-induced

Table 10.6
The incidence of capital gains taxation^a
[$\theta_r^* > \theta_d^*$, $D_r(0) > 0$, $\varepsilon^* > 0$].

	$d(\varphi' - \delta)/d\tau_c$	$dr/d\tau_c$	$dr_n/d\tau_c$	$d\bar{r}_n/d\tau_c$	$dw/d\tau_c$
Short run	0	$-\frac{r}{P_K} \frac{dP_K}{d\tau_c} < 0$	$\frac{dr(0)}{d\tau_c} \theta_p < 0$	$-\frac{dr(0)}{d\tau_c} \frac{D_r(0)}{M(0)} \theta_d^* > 0$	0
Long run	$-\frac{dr(0)}{d\tau_c} P_K > 0$	0	0	$\frac{dM(0)}{d\tau_c} \frac{r_n}{M(0)} > 0$	$\frac{dr(0)}{d\tau_c} P_K k < 0$

^aThe table uses the result $dP_K/d\tau_c = \theta_p d\bar{P}_K/d\tau_c \geq \varepsilon^*/\theta_c > 0$ from (10.3) and (9.23).

changes in the two time paths are taken into account, then the rise in the market value is the unambiguous implication of a tax increase.

The revaluation of the existing stock of capital without doubt makes existing shareholders richer. But it is not self-evident that it raises their current returns as measured by the equivalent rate of return on shares. In view of the fact that the net market rate of interest and hence the *actual* rate of return on shares declines after the tax increase, such a result seems even less likely a priori than an increase in the market value. Nevertheless, an

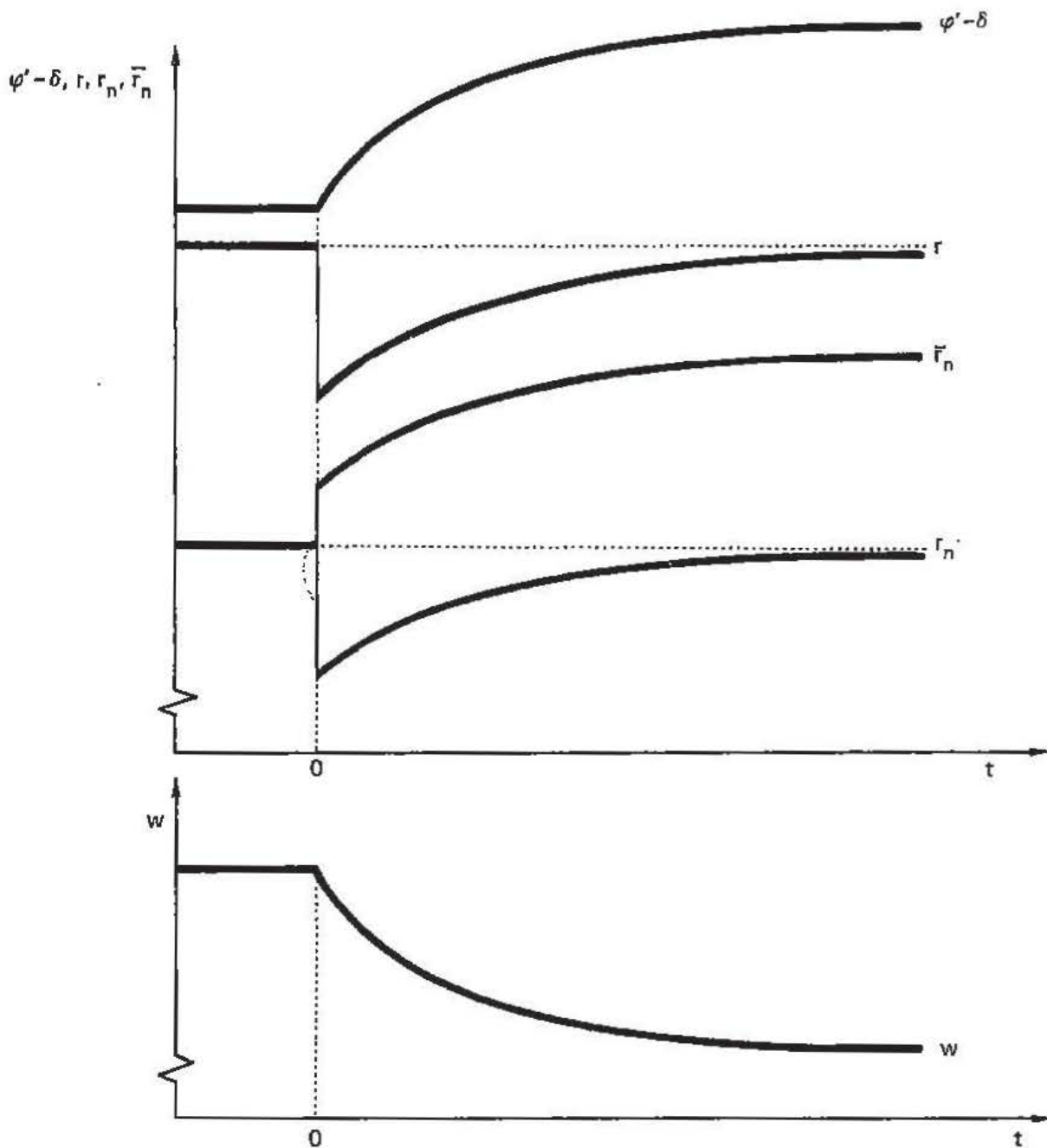


Figure 10.4. Capital gains taxation: the advantage to "old" shareholders
 $[\theta_r^* > \theta_d^*, D_r(0) > 0, c^* > 0]$.

inspection of (10.10) reveals that it will occur under the realistic assumption that the sector of firms is in a net debtor position. The fourth column of Table 10.6 contains the corresponding differential quotient and shows that its value is proportional to the decline in the market rate of interest and the size of the stock of debt. Thus, despite the fact that they, too, pay the capital gains tax, old shareholders enjoy a clear net income advantage from a tax increase. This advantage is not limited to the short run. It will even get stronger with the passage of time as old shareholders, like new shareholders, benefit from the recovering actual rate of return on shares. (See Figure 10.4.)

The capital gains tax is a marvellous instrument for shareholders to collectively exploit the market. They should approach parliament, demand a modest tax cut on dividends (to stimulate economic growth), and offer (be generous!) a substantial increase in the capital gains tax rate in exchange. Perhaps they will be lucky and the politicians will walk into their trap.

10.7. The Incidence of the Personal Tax on Capital Incomes

All capital income taxes considered so far have in common that they are exclusively taxes on equity. The personal income tax, on the other hand, is a tax on equity and debt: both personal interest income and dividends are included in the tax base. For this reason, the incidence effects of the personal income tax are slightly more subtle than those analyzed above.

It is clear from the analysis in the last chapter that an increase in the personal tax rate is growth retarding (provided firms enjoy at least some degree of financial flexibility). Thus the marginal product of capital, the net market rate of interest, and the wage rate follow the familiar time paths. (See Figure 10.5 and Table 10.7.) However, unlike the other cases considered, the gross market rate of interest does not move parallel with the net market rate of interest.

The reason is that the retardation of economic growth and the corresponding increase in the overall wedge between the marginal product of capital and the consumer rate of time preference does not result from an increased wedge between the marginal product of capital and the gross market rate of interest but from one between the latter and the net market rate of interest. In fact, the wedge between the marginal product and the gross market rate of interest can even become smaller. This will definitely occur when retentions are preferred to new issues of shares and equity is required for marginal investment projects. To see this, inspect (10.2) and differentiate the expression for the effective price of capital, (10.3), using

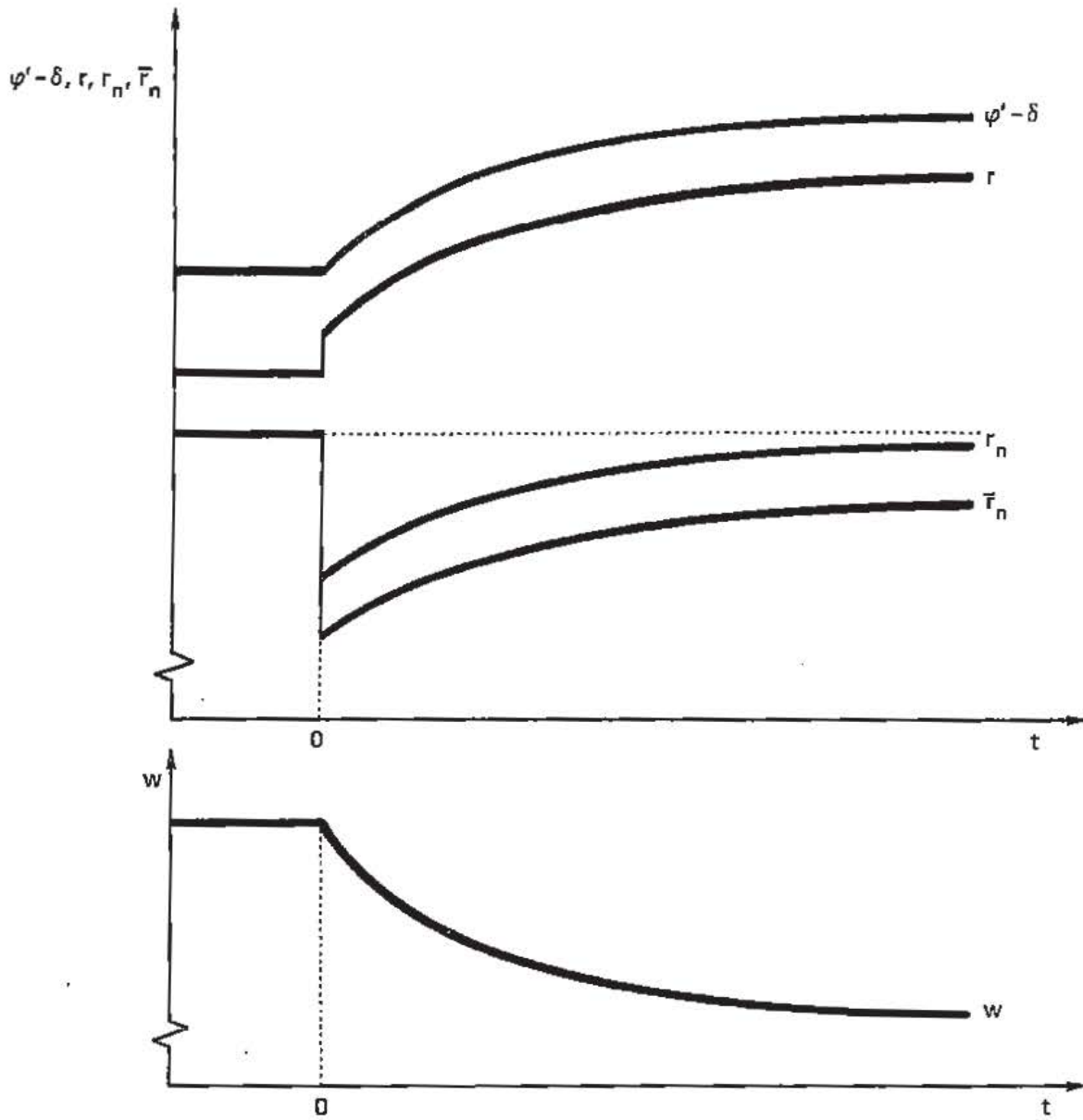


Figure 10.5. The personal tax on interest income and dividends ($\sigma^* > 0$, $\varepsilon^* > 0$, $\theta_r^* > \theta_d^*$).

(10.4)–(10.6). Regardless of whether ε^* is exogenously or endogenously determined,

$$dP_K/d\tau_p = -\varepsilon^*/\theta_r^* < 0 \quad (\text{for } \varepsilon^* > 0 \text{ and } \theta_r^* > \theta_d^*) \quad (10.25)$$

is obtained. In other cases, a negative sign of the differential quotient $dP_K/d\tau_p$ is not assured, but, given that ε^* cannot become negative, (10.3)–(10.6) show that it is clearly impossible for P_K to rise. In general it therefore holds that

$$\frac{dP_K}{d\tau_p} \leq 0. \quad (10.26)$$

Table 10.7
The incidence of personal capital income taxation^a ($\sigma^* > 0$).

	$d(\varphi' - \delta)/d\tau_p$	$dr/d\tau_p$	$dr_n/d\tau_p$	$d\bar{r}_n/d\tau_p$	$dw/d\tau_p$
Short run	0	$-\frac{r}{P_K} \frac{dP_K}{d\tau_p} \geq 0$	$-\frac{r_n}{\bar{P}_K} \frac{d\bar{P}_K}{d\tau_p} < 0$	$\frac{dM(0)}{d\tau_p} \frac{r_n}{M(0)} + \frac{dr_n(0)}{d\tau_p} < 0$	0
Long run	$-\frac{dr_n(0)}{d\tau_p} \bar{P}_K > 0$	$\frac{r}{\theta_p} > 0$	0	$\frac{dM(0)}{d\tau_p} \frac{r_n}{M(0)} \leq 0$	$\frac{dr_n(0)}{d\tau_p} \bar{P}_K k < 0$

^aThe table uses the result $d\bar{P}_K/d\tau_p \geq \sigma^*/\theta_p^2 > 0$ from (9.15).

The second column of Table 10.7 summarizes these considerations. In the short run, when $\varphi' - \delta$ is constant, the gross market rate of interest stays constant or rises, and in the long run r rises in order to bring r_n back to its pre-reform level. Figure 10.5 illustrates the path of the gross market rate of interest for the empirically most relevant case where retentions dominate new issues and equity is required at the margin.

The change in the effective price of capital also has immediate consequences for the incidence on existing shareholders. Clearly (10.7), (10.25), and (10.26) imply that

$$\frac{dM(0)}{d\tau_p} = \theta_p K(0) \frac{dP_K}{d\tau_p} \begin{cases} < 0 & \text{if } \varepsilon^* > 0, \theta_r^* > \theta_d^* \\ \leq 0 & \text{otherwise} \end{cases}. \quad (10.27)$$

Thus, an increase in the personal tax rate cannot increase the market value of shares, and when retentions contribute to financing marginal investment projects the market value will definitely decline.

As the net rate of interest r_n (or the actual rate of return on shares) was shown to fall immediately after the rise in τ_p (see Table 10.7, third column), (10.27) unambiguously implies that the equivalent rate of return on shares, defined in (10.8), must also fall in the short run, and perhaps by even more than the net rate of interest. Under the classical and closely related systems shareholders will therefore suffer more from an increase in the personal tax rate than bond owners do, provided only that firms cannot completely dispense with equity financing.

As the structure of interest rates stays constant after the initial tax reform, this result is not limited to the short run. In the long run, the net rate of interest returns to its constant steady-state level, but the equivalent rate of return on shares will be lower than or equal to its original value, depending on whether $M(0)$ falls or stays constant respectively. The fourth column of Table 10.7 shows the corresponding differential quotients and Figure 10.5 illustrates the path of $\bar{r}_n$ for the case $dM(0)/d\tau_p < 0$.

An explanation for the decline in the market value of shares under the classical and closely related systems can be given by again distinguishing between the taxation of old and new equity. As a rule, the taxation of old equity was seen to reduce, and that of new equity to increase, the market value of existing shares. This rule still applies in the present case, but it must be considered now that the market value of shares is a present value that, as the market rate of interest is used for discounting, is defined relative to the value of bonds.¹⁷ What matters for the rule is therefore the taxation of old

¹⁷ Cf. Chapter 3.2.1.

and new equity not in absolute terms, but *relative* to the taxation of bonds.

As it applies to dividends *and* interest incomes, an increase in the personal tax rate clearly does not affect the relative tax burden on existing equity capital. However, it does affect that on new equity capital. The personal tax on interest income is a tax on new as well as on existing bonds. But the personal tax on dividends is not a tax on new equity; it reduces both the cost of equity finance in terms of net dividends foregone in the present and the returns from equity in terms of net dividends available in the future. Thus, an increase in the personal tax rate lightens the relative tax burden on new assets, and this is the only way through which it affects the market value: analogously to the other cases considered in the previous sections, the declining tax burden on new assets increases the market rate of interest and devalues the existing stock of shares.

The logic of this interpretation of (10.27) implies that an isolated increase in the personal tax on interest income, given the overall tax burden on dividends, will reduce the relative tax burdens on both new and old equity and will therefore have an ambiguous effect on the share value. To see that this is indeed the case, differentiate (10.7) using (10.3)–(10.6) under the constraint $\theta_d^* \equiv \theta_p \theta_d = \text{constant}$ which requires the increase in the personal tax to be compensated by an appropriate reduction in the degree of double taxation. For all systems of capital income taxation, and regardless of whether σ^* (or ε^*) is exogenously or endogenously determined, this gives

$$\left. \frac{dM(0)}{d\tau_p} \right|_{\theta_d^* = \text{constant}} = \frac{\theta_d}{\theta_p} K(0) [\sigma^* - \sigma(0)]. \quad (10.28)$$

Equation (10.28) confirms that there is an ambiguity. As above with the corporate income tax [cf. (10.21) and (10.22)], the direction of change in the market value depends on the relationship between σ^* and σ and, not surprisingly, the sign is opposite. With much equity finance at the margin and, nevertheless, much existing debt [$\sigma^* - \sigma(0) < 0$], a rise in the personal tax on interest income reduces the market value. But in the reverse case $\sigma^* > \sigma(0)$, which seemed realistic on empirical grounds since it fits with the observation of declining equity–asset ratios, the share value will rise with an increased tax burden on interest incomes.

An isolated rise in the personal tax on interest incomes is a somewhat artificial case. The more relevant case is the previous one where the increase in the personal tax rate applies to both dividends *and* interest. If this case occurs in a classical system of capital income taxation, shareholders will experience capital losses on the existing stock of shares and a fall in the actual net rate of return on shares. Because the increase in the personal

tax rate applies in full to the returns on bonds and exempts only retained part of equity returns, shareholders will suffer more than bond owners!

If combined with the results on the corporate and capital gains tax rates, this has straightforward implications for the incidence on shareholders of the U.S. 1986 policy of cutting the corporate and personal taxes and raising the capital gains tax rate. As argued in the last chapter, the probable net effect of this policy in a closed economy is to stimulate economic growth. Old shareholders, new shareholders, and bond owners will therefore benefit in the short and medium run via a rise in the actual net rates of return on their respective assets, and wage earners will enjoy higher wages in the medium and long run. In addition, the cut in the corporate tax rate, the cut in the personal tax rate, and the rise in the capital gains tax rate will all result in a revaluation of existing shares under very mild conditions. Existing shareholders therefore appear to be the unambiguous winners of the 1986 U.S. tax reform.¹⁸

¹⁸ This statement holds a fortiori if the additional discrimination against new assets resulting from the decline in the depreciation parameter α_1 from 0.5 to 0.3 is taken into account (cf. Chapter 3.1.3). This discrimination operates like the increase in capital gains taxation and increases the market value of shares via a reduction in the interest rate. The discussion does not elaborate on this problem since the market value function (10.9) does not lend itself well to a study of this effect as it does not allow for different depreciation rules applying to old and new assets, a limitation that is irrelevant for all other problems discussed in this book.