

A Dynamic Analysis of Differential
Incidence in a Two-Class Economy with
Public Capital*

by

Masaaki Homma**
Osaka University

No. 163

WARWICK ECONOMIC RESEARCH PAPERS

DEPARTMENT OF ECONOMICS

UNIVERSITY OF WARWICK
COVENTRY

A Dynamic Analysis of Differential
Incidence in a Two-Class Economy with
Public Capital*

by

Masaaki Homma**
Osaka University

No. 163

* The author would like to thank Professors Avinash Dixit, Kiyoshi Kuga and Takashi Negishi for their helpful comments and suggestions.

** Visiting Fellow at the University of Warwick during 1979.

This paper is circulated for discussion purposes only and its contents should be considered preliminary.

ABSTRACT

Within a two-class growing economy with public capital, a comparative dynamic analysis of differential shift from a wage income to a corporation profit tax is carried out to appreciate the distributional effects of tax substitution on capitalists and workers, and to set out the conditions which determine the magnitude of the tax shifting. It is also shown that the differential tax substitution induces decreased saving and capital shallowing lowering, the private capital/labour ratio, and that a higher rate of a corporation profit tax increases the tax shifting and vice versa in the steady state equilibrium with both classes existing.

1. Introduction

The central argument for supporting capital tax is that of achieving a more equitable distribution of wealth and income. The conventional comparative static analysis of tax incidence, originally developed by Harberger (1962), seems to provide a rationale for the argument by asserting that owners of capital would bear the entire burden of a general tax on profits.^{1/} However, recent developments by Feldstein (1974), Grieson (1975), and Stiglitz (1978) in the theory of tax incidence suggested that this argument is not so straightforward as may appear at first sight and in particular neglecting effects of taxation on capital accumulation is likely to yield misleading conclusions.

Feldstein re-examined the incidence effects of a capital income tax in a growing economy which distinguishes saving properties out of capital and labour incomes. His analysis showed the possibility that the burden of a capital income tax is shifted to labour by a significant portion under quite plausible assumptions. Grieson investigated the rate of a capital income tax which maximizes the wage in a neo-classical growth model. His estimate indicated that labour might not desire the increase in a capital income tax necessary to maximize net wages in the steady state. Stiglitz considered the balanced growth path incidence of an estate tax in a growth model of distribution. His study reached a conclusion that an estate tax may lead to the increase in inequality of distribution unless the government takes action to offset the capital accumulation effects.

Although their contributions provided very instructive insights in the theory of tax incidence, there has been no explicit analysis which investigates more precisely what conditions determine how to share the burden of differential change in the tax system among consumers. The purpose of this

paper is to present a dynamic analysis of differential incidence in the two-class economy with public capital, and to obtain the economic meaningful conditions under which capitalists or workers bear a larger share of the burden.^{2/} The differential incidence is introduced by supposing that a corporation profit tax is substituted for a wage income tax keeping a per-capita level of public capital constant.

The main results in this paper are summarized as follows:

(i) The differential tax substitution results in the burden in the private sector in the sense that it reduces the private sector capital (wealth) accumulation. (ii) It depends on the relative magnitudes of marginal productivity of private capital (f_k) and savings rates (s^c, s^w, s^a), where s^c and s^w are the propensities to save of capitalists and workers respectively, and s^a is the overall savings rate. That is, the burden is more than 100 per cent borne by capitalists in the Case I ($f_k < n/s^c$) and more than 50 per cent in the Case II ($n/s^c < f_k < n/s^a$), while the burden is more than 50 per cent shifted to workers in the Case III ($n/s^a < f_k < n/s^w$) and more than 100 percent in the Case IV ($n/s^w < f_k$). n is the growth rate of population. (iii) The higher a corporation profit tax becomes, the more shifted the burden is from capitalists to workers.

The plan of the paper is as follows. In the next section, we describe the basic model, paying particular attention to the differential treatment of taxation. In Section 3, we investigate the steady state properties of the model, deriving the critical condition for both classes to exist and examining causality of the dynamic system. In Section 4, we carry out a comparative dynamic analysis for evaluating the differential incidence on the distribution of private wealth and consumption between the two classes. In Section 5, we mention briefly the limitations of the present analysis and give concluding remarks for further research.

2. Description of the model

We assume that the government provides public capital which may be thought of as social overhead capital or public intermediate goods. In the presence of public capital, the economy produces a single output Y according to the following production function :

$$Y = F(K,G,L), \quad (1)$$

where K and G are quantities of private and public capital and L is the labour supply assumed to grow at the constant rate n . The production function is assumed to satisfy the neoclassical postulates such as constant returns, positive marginal products and a diminishing rate of substitution. We may then show the production function in an intensive form as

$$y = f(k,g), \quad (2)$$

where $Y = Y/L$, $k = K/L$ and $g \equiv G/L$, and $f_k = \partial f / \partial k > 0$, $f_g = \partial f / \partial g > 0$, $f_{kk} = \partial^2 f / \partial k^2 < 0$, $f_{gg} = \partial^2 f / \partial g^2 < 0$ and $f_{kk} f_{gg} - (f_{kg})^2 > 0$.

Since public capital is the so-called unpaid factor type termed by Meade (1952), it is assumed to be supplied free of charge to the private firm who captures its marginal product as part of the output. On the other hand, public investment \dot{G} is financed by taxing the private firm through a corporation profit tax at the rate t and workers through a wage income tax at the rate τ , where the dot over variables denotes its time-derivative. Under such a regime, the after-tax corporation profit Π is represented by

$$\Pi = (1-t)\{y-w\}L \quad (3)$$

where W is the wage rate.^{3/} The private firm plans to choose its labour demand L so as to maximise Π subject to (2). Since the necessary condition for this maximization problem is

$$y - kf_k - gf_g = W, \quad (4)$$

the after-tax corporation profit becomes, with the aid of (3) and (4),

$$\Pi = (1-t)(kf_k + gf_g)L \quad (5)$$

The after-tax corporation profit is distributed to all the shareholders according to their own share of private capital (wealth) K , which is divided categorically into two parts, private capital of capitalists K^c and private capital of workers K^w . Introducing a new variable z to denote the capitalists' wealth share K^c/K , we may write capitalists' dividend received from the private firm as $z\Pi$. Workers not only receive their dividend $(1-z)\Pi$ but also earn the after-tax wage income $(1-\tau)WL$.

We assume that capitalists save $100 s^c$ per cent and workers $100 s^w$ per cent of their own disposable income D^i ($i = c, w$). Then, we have

$$\dot{K}^c = s^c D^c = s^c z\Pi \quad (6)$$

$$\dot{K}^w = s^w D^w = s^w \{(1-z)\Pi + (1-\tau)WL\}.$$

The dynamic system may be then reduced by making use of (4) and (5)

to

$$\dot{k}^c = s^c(1-t)z(kf_k + gf_g) - nk^c, \quad (7)$$

$$\dot{k}^w = s^w\{(1-t)(1-z)(kf_k + gf_g) + (1-\tau)(f - kf_k - gf_g)\} - nk^w,$$

where $k^c = K^c/L$ and $k^w = K^w/L$.

Under the assumption that public investment is financed by a corporation profit tax and a wage income tax, the government budget equation may be expressed as

$$\frac{\dot{G}}{L} = t(kf_k + gf_g) + \tau(f - kf_k - gf_g). \quad (8)$$

The traditional approach in differential taxation is concerned with a situation in which a constant amount of public expenditures is financed independently of the method of financing chosen. It is, however, inappropriate to follow the traditional one. The trouble with the approach is that the relative size of government budget becomes smaller and approaches zero as time tends to infinity.

To avoid such a difficulty, we will extend the concept of balanced growth incidence developed by Stiglitz to our growing economy with public capital. We assume in this context that the government raises the tax revenue so as to keep the per capita government budget constant. This is tantamount to assuming that the government increases its budget at the rate n , i.e. $\dot{g} = 0$. This restriction on the budget may be represented with the use of

(8) by

$$ng^* = t(kf_k + gf_g) + \tau(f - kf_k + gf_g) \quad (9)$$

The combinations of t and τ satisfying (9) are the differential changes in which a corporation profit tax is substituted for a wage income tax leaving a constant per capita level of public capital g^* unchanged.

3. Properties of the steady state equilibrium

All the time profile of the economy can be fully described by the dynamic system (7) starting from given initial values ($k^c = k^c(0)$, $k^w = k^w(0)$) subject to the government constraint (9). For the analysis that follows, we choose the overall private capital/labour ratio k and the capitalists' wealth share z as unknown variables. Substituting (9) into (7) to cancel out τ and using the relations $\dot{k} = \dot{k}^c + \dot{k}^w$ and $\dot{z}/z = \dot{k}^c/k^c - \dot{k}/k$, we obtain the following differential equations in k and z :

$$\begin{aligned} \dot{k} &= (s^c - s^w)(1-t)z(kf_k + gf_g) + s^w(f - ng) - nk, \\ \dot{z} &= \left[\frac{s^c(1-t)(kf_k + gf_g)}{k} - \frac{\dot{k}}{k} - n \right] z, \end{aligned} \quad (10)$$

which is expressed in a general form by

$$\begin{aligned} \dot{k} &= \phi(k, z; t, g^*) \\ \dot{z} &= \psi(k, z; t, g^*), \end{aligned}$$

where ϕ and ψ are non-linear functions of k and z , and t and g^* are policy variables.

The steady state equilibrium relative to t and g^* may be defined as the pair $\langle k^*, z^* \rangle$ that satisfies $\dot{k} = \dot{z} = 0$ in (10) under the constraints $0 < k < \infty$ and $0 \leq z \leq 1$. We can solve from $\dot{k} = \dot{z} = 0$ explicitly for z^* , the capitalists wealth share, and for $1 - z^*$, the workers' wealth share. The resulting equations may be written as

$$z^* = \frac{nk^* - s^w(f - ng^*)}{(1-t)(s^c - s^w)(k^* f_k + g^* f_g)}, \quad (11)$$

and

$$1 - z^* = \frac{s^w \{s^c(f - ng^*) - nk^*\}}{(1-t)s^c(s^c - s^w)(k^* f_k + g^* f_g)}.$$

Since the present analysis centers upon the distributional effects of differential tax substitution on capitalists and workers, it becomes necessary to confine our attention to a steady state equilibrium with both classes existing. Assuming throughout the rest of the paper that $s^c > s^w$, we can verify that the existence of the steady state equilibrium is guaranteed if and only if ^{5/}

$$\frac{n}{s^c} < \frac{f - ng^*}{k^*} = \frac{n}{s^a} < \frac{n}{s^w} \quad (12)$$

This result may be interpreted by analogy with the standard one based on usual aggregative growth models. ^{6/} The steady state equilibrium in those models requires $n/s^a = 1/v$ to hold where v is the capital/output ratio. In the present model, the natural analogic of v is the ratio of private capital to the private sector disposable income, which becomes $k^*/f - ng^*$ in the steady state. Thus, for existence of the steady state with both classes existing

we need s^a , the overall saving rate, to be a positive weighted average of s^w and s^c , which corresponds to the coexistence condition (12).

We are now ready to evaluate the Jacobian determinant of the dynamic system (10). Unless the Jacobian determinant has the same sign, i.e. $|J| \neq 0$, the steady state values of k and z cannot be uniquely determined by given parameters and hence the comparative dynamic analysis cannot be conducted. We will show that the Jacobian determinant has a positive sign around the steady state equilibrium with both classes existing under the quite plausible assumption that private capital and labour interact in the production process so as to complement each other, i.e., $F_{KL} > 0$. The Jacobian determinant will be derived directly from (10) with some manipulation as

$$|J| = \begin{vmatrix} \phi_k & \phi_z \\ \psi_k & \psi_z \end{vmatrix} \quad (13)$$

where $\phi_k \equiv \partial\phi/\partial k = (s^c - s^w)(1-t)z(kf_{ff} + kf_{gk} + f_k) + s^w f_k^{-n}$,

$$\phi_z = \partial\phi/\partial z = (s^c - s^w)(1-t)(kf_k + gf_g)$$

$$\psi_k = \partial\psi/\partial k = \left\{ \frac{s^c(1-t)\{(kf_{kk} + gf_{gk})k - gf_g\}}{k} - \phi_k \right\} \frac{z}{k} \quad (14)$$

and $\psi_z \equiv \partial\psi/\partial z = -(s^c - s^w)(1-t)(kf_k + gf_g)z/k$,

which are all evaluated at the steady state (k^*, z^*) .

A direct calculation of $|J|$ verifies that

$$J = \frac{s^c(s^c - s^w)(1-t)^2 z(kf_{kk} + gf_g) [gf_g - (kf_{kk} + gf_{gk})]}{k^2} \quad (15)$$

A close observation of (17) indicates that the sign of $|J|$ depends on that of the expression within the square bracket in the numerator. It is a well-known fact that the marginal productivity of private capital, i.e. F_K , is homogeneous of degree zero because the production function is homogeneous of degree one. Applying Euler's theorem on homogeneous functions to F_K and using $F_{KK} = f_{kk}/L$ and $F_{KG} = f_{kg}/L$ we obtain

$$F_{KL} = - (fk_{kk} + gf_{kk}) > 0 \quad (16)$$

It follows from (15) and (16) that the Jacobian determinant is positive around the steady state equilibrium values. ^{7/}

4. Evaluations of differential incidence

We will now examine the effects on the steady state values k^* , z^* , k^{c*} and k^{w*} when the government changes the combination of a corporation income tax rate and a wage income tax rate keeping a per capital level of public capital constant. Since we have shown that the Jacobian determinant has a positive sign, we can assert the existence of such functions that $k^* = k^*(t;g^*)$, $z^* = z^*(t;g^*)$, $k^{c*} = k^{c*}(t;g^*)$ and $k^{w*} = k^{w*}(t;g^*)$, and carry out the comparative dynamic analysis for determining the differential incidence of tax substitution.

We first show that private capital (wealth) accumulation is depressed by the differential shift from a wage income tax to a corporation

profit tax. Putting $\dot{k} = \dot{z} = 0$ in (10) and totally differentiating it, we have

$$\begin{bmatrix} \phi_k & \phi_z \\ \psi_k & \psi_z \end{bmatrix} \begin{bmatrix} dk^* \\ dz^* \end{bmatrix} = - \begin{bmatrix} \phi_t \\ \psi_t \end{bmatrix} dt \quad (17)$$

where $\phi_t = -(s^c - s^w)z(kf_k + gf_g)$

and $\psi_t = -\{s^c(kf_k + gf_g) + \phi_t\}z/k$.

Solving for dk^*/dt by using Cramer's rule leads to

$$\frac{dk^*}{dt} = - |J|^{-1} (1-t)(s^c - s^w)(kf_k + gf_g)^2 z/k. \quad (18)$$

A quick inspection of (18) reveals that dk^*/dt is always negative under the assumptions made.

The remaining question we will have to answer is how the resulting burden is shared with capitalists and workers. It may be safely presumed that the change in capitalists' wealth share is suitable for the measure to determine which class bears a larger or smaller share of the burden.

Solving (17) for dz^*/dt , we obtain

$$\begin{aligned} \frac{dz^*}{dt} &= \frac{s^c z (kf_k + gf_g)}{k^2 |J|} \{ (s^c - s^w) (1-t) z (kf_k + gf_g) - nk + s^w kf_k \} \\ &= \frac{s^w s^c z (kf_k + gf_g)}{k^2 |J|} \{ kf_k - (f - ng) \}^8. \end{aligned} \quad (19)$$

It is observed from (19) that

$$\frac{dz^*}{dt} > 0 \quad \text{as} \quad f_k \geq \frac{f - ng^*}{k} = \frac{n}{s^a} \quad (20)$$

which implies that capitalists bear a larger or smaller share of the burden according as marginal productivity of private capital is less or greater than n over the overall saving rate.

Needless to say, it depends on the change in k^c or k^w whether capitalists or workers bear the burden in an absolute sense. Noting that $k^c = zk$ and $k^w = k - k^c$, we have

$$\frac{dk^c}{dt} = z \frac{dk}{dt} + k \frac{dz}{dt}, \quad (21)$$

and

$$\frac{dk^w}{dt} = \frac{dk}{dt} - \frac{dk^c}{dt}. \quad (22)$$

Substitution of (18) and (19) into (21) and rearrangement yields

$$\frac{dk^c}{dt} = |J|^{-1} s^c s^w z (kf_k + gf_g) \left(f_k - \frac{n}{s^w} \right). \quad (23)$$

We can also obtain, with the use of (18), (22) and (23), that

$$\frac{dk^w}{dt} = |J|^{-1} s^w z (k f_k + g f_g) \left(\frac{n}{s^c} - f_k \right). \quad (24)$$

From (23) and (24),

$$\frac{dk^c}{dt} \begin{matrix} \geq \\ < \end{matrix} 0 \text{ as } f_k \begin{matrix} > \\ < \end{matrix} \frac{n}{s^w} \quad (25)$$

and

$$\frac{dk^w}{dt} \begin{matrix} \geq \\ < \end{matrix} 0 \text{ as } \frac{n}{s^c} \begin{matrix} \geq \\ < \end{matrix} f_k \quad (26)$$

It can be concluded from (25) and (26) that capitalists (workers) bear the resulting burden from the tax substitution if and only if marginal productivity of private capital is less (more) than n over workers' savings rate (n over capitalists' savings rate).

It is very convenient and instructive to illustrate the results obtained thus far by the Table 1. Since we concentrate our focus on the steady state with both classes existing, we have four cases to consider depending on values of marginal productivity of private capital and savings rates : Case I ($f_k < n/s^c$), Case II ($n/s^c < f_k < n/s^a$), Case III ($n/s^a < f_k < n/s^w$) and Case IV ($n/s^w < f_k$). This classification enables us to sum up in a following manner:

TABLE I

	Case I	$f_k = n/s^c$	Case II	$f_k = n/s^a$	Case III	$f_k = n/s^w$	Case IV
dk^*/dt	-	-	-	-	-	-	-
dz^*/dt	-	-	-	0	+	+	+
dk^{c^*}/dt	-	-	-	-	-	0	+
dk^{w^*}/dt	+	0	-	-	-	-	-

Table I may be read : In Case I, the differential tax change from a wage income tax to a corporate profit tax leads to the reduction in capitalists' private wealth, but to the increase in workers' private wealth. This implies that the burden in terms of private wealth is more than 100 per cent borne by capitalists. In Case II, it reduces both classes' private wealth, and entails the decrease in capitalists' wealth share. From this fact follow that the burden is more than 50 per cent borne by capitalists. In Case III, conversely, it results in the increase in capitalists' wealth share, while it is associated with the decrease in both classes' private wealth. This reflects the fact that the burden is more than 50 per cent shifted to workers. In Case IV, it brings in the increase in capitalists' private wealth, but in the decrease in workers' private wealth. This means that the burden is more than 100 per cent shifted to workers. In addition, the burden is divided equally between both classes when $f_k = n/s^a$ and is entirely or just 100 per cent borne by capitalists (workers) when $f_k = n/s^c$ ($f_k = n/s^w$).

The above summary indicates that it becomes easier for capitalists to shift the burden to workers as the economy advances consequently from the Case I to the Case IV, that is, the more scarce private capital is relative

to labour in the steady state the more shifted the burden is. The essential conclusion drawn from the summary is that a higher rate of a corporation profit tax increases the shifting and a lower rate decreases it. This is due to the fact that marginal productivity of private capital is a decreasing function of private capital intensity of production and the capital intensity is a decreasing function of a corporation profit tax, and therefore marginal productivity of private capital increases as a corporation profit tax increases and vice versa.

It is very suggestive to seek for the tax rates which correspond to Case I, Case II, Case III and Case IV for a special class of production functions. We obtain, from $\dot{z} = 0$ ($\dot{k} = 0$) for $z^* > 0$ in (10),

$$s^c(1-t)(k^* f_k^* + g^* f_g^*) = nk^* \quad (27)$$

For a Cobb-Douglas function, $y = k^\alpha g^\beta$ ($0 < \alpha$, $0 < \beta$, $\alpha + \beta < 1$), the equation (27) can be rewritten as

$$\frac{y^*}{k^*} = \frac{n}{s^c(1-t)(\alpha + \beta)}, \quad (28)$$

since $k^* f_k^* + g^* f_g^* = (\alpha + \beta)y^*$. Marginal productivity of private capital is simply $f_k^* = \alpha y^*/k^*$, so is expressed by using (28) as:

$$f_k^* = \frac{\alpha y^*}{k^*} = \frac{\alpha n}{s^c(1-t)(\alpha + \beta)}. \quad (29)$$

Combining (29) with (12) yield the following:

$$t_1 \text{ (Case I) ; } 0 < t < 1 - \frac{\alpha}{\alpha + \beta}$$

$$t_2 \text{ (Case II) ; } 1 - \frac{\alpha}{\alpha + \beta} < t < 1 - \frac{\alpha}{\alpha + \beta} \cdot \frac{s^a}{s^c}$$

$$t_3 \text{ (Case III) ; } 1 - \frac{\alpha}{\alpha + \beta} \cdot \frac{s^a}{s^c} < t < 1 - \frac{\alpha}{\alpha + \beta} \cdot \frac{s^w}{s^c}$$

$$t_4 \text{ (Case IV) ; } 1 - \frac{\alpha}{\alpha + \beta} \cdot \frac{s^w}{s^c} < t < 1.$$

In order to appreciate the critical tax rates, we put, for example, $s^c = \frac{1}{2}$, $s^w = \frac{1}{4}$, $\delta^c = 1/3$ ($\delta^w = 2/3$), $\alpha = 1/3$ and $\beta = 1/6$. The assumption on numerical values implies that $s^a = \delta^c s^c + \delta^w s^w = 1/3$. Then we easily calculate that $0 < t_1 < 1/3$, $1/3 < t_2 < 5/9$, $5/9 < t_3 < 2/3$ and $2/3 < t_4 < 1$. The numerical example given here shows that we need to observe carefully the economic circumstances which determine the magnitude of the tax shifting when we judge the distributional effects of taxation.

The difficulty with the present analysis stems from the fact that there is no single well defined measure for evaluating the differential incidence. The distribution of disposable income or private consumption between the two classes may be considered as more appropriate measure. However the alteration in measure raises no substantial changes within the present framework of analysis. Under the assumption of a fixed savings ratio, it is possible to treat private consumption as a fixed fraction of disposable income. Therefore we only consider the distribution of private consumption as an alternative measure. Noting that capitalists' disposable

income $d^C = (1-t)z(kf_k + gf_g)$ and using $\dot{k} = 0$ in (10), we have

$$C^C = (1-s^C)d^C = \frac{(1-s^C)\{nk^* - s^W(f-ng^*)\}}{s^C - s^W} \quad (30)$$

Since $d = d^C + d^W = f - ng^*$ in the steady state, workers' private consumption C^W becomes with the use of (30)

$$C^W = (1-s^W)d^W = \frac{(1-s^W)\{s^C(f-ng^*) - nk^*\}}{(s^C - s^W)} \quad (31)$$

Differentiating (30) and (31) with respect to t , we obtain

$$\frac{dC^C}{dt} = \frac{(1-s^C)(n-s^Wfk)}{(s^C - s^W)} \frac{dk}{dt} \quad (32)$$

and
$$\frac{dC^W}{dt} = \frac{(1-s^W)(s^Cfk - n)}{(s^C - s^W)} \frac{dk}{dt}.$$

It follows from $dk/dt < 0$ that

$$\frac{dC^C}{dt} \begin{matrix} > \\ < \end{matrix} 0 \text{ as } f_k \begin{matrix} > \\ < \end{matrix} \frac{n}{s^W}, \quad (33)$$

and
$$\frac{dC^W}{dt} \begin{matrix} > \\ < \end{matrix} 0 \text{ as } \frac{n}{s^C} \begin{matrix} > \\ < \end{matrix} f_k.$$

A direct comparison of (33) with (25) and (26) reveals that the change in private consumption of each class is quite parallel to that in private wealth.

We can also show that the private consumption rate of both classes, $m = C^C/C^W$, changes in the same direction as the capitalists' wealth share moves. Logarithmically differentiating m with respect to t leads to

$$\frac{1}{m} \frac{dm}{dt} = \frac{1}{C^C} \frac{dC^C}{dt} - \frac{1}{C^W} \frac{dC^W}{dt} \quad (34)$$

Substituting (30) - (32) into (34), we obtain

$$\frac{1}{m} \frac{dm}{dt} = \left[\frac{n-s^W f_k}{nk-s^W(f-ng)} - \frac{s^C f_k - n}{s^C(f-ng)-nk} \right] \frac{dk}{dt}$$

This is simplified, with the use of $d^C = \{nk-s^W(f-ng)\}/s^C-s^W$ and $d^W = \{s^C(f-ng)-nk\}/s^C-s^W$, as

$$\frac{1}{m} \frac{dm}{dt} = \left\{ \frac{n - [\delta^C s^C + (1-\delta^C) s^W] f_k}{d(s^C-s^W) \delta^C (1-\delta^C)} \right\} \frac{dk}{dt}, \quad (35)$$

where δ^C is the proportion capitalists' disposable income to the whole private sector disposable income. Since $\delta^C s^C + (1-\delta^C) s^W$ within the square bracket is the aggregative savings rate, we can confirm from (35) the desired result that

$$\frac{1}{m} \frac{dm}{dt} > < 0 \quad \text{as} \quad f_k > < \frac{n}{s^a}$$

5. Concluding Remarks

Although the level and structure in the tax system determine the distribution of wealth and consumption among different groups in the long run as well as in the short run, their implications have been explored only in terms of the short run situation except recent contributions made by Feldstein, Grieson and Stiglitz. Their analyses have taught us the importance of considering capital accumulation effects in the theory of tax incidence.

In this paper, the attempt has been made to present a two-class growing model with public capital and to examine how a differential change in which a corporate profit tax is substituted for a wage income tax has influence on the distribution of wealth and consumption between capitalists and workers. It has been shown that how to bear the burden between both classes depends on the relative magnitudes of marginal productivity of private capital and savings rates and that a higher rate of a corporation profit tax tends to increase the tax shifting.

All of the results in this paper must for several reasons be treated with caution. First, the present paper has been limited to the local one in which the results are valid only around the steady state equilibrium. The global analysis is required to establish more robust conclusions. Second, the present analysis has been based on a simple one-sector two-class growing model. To extend the present analysis to more general models is to represent a significant step forward from the present stage of discussions. Third, the present analysis has retained the physical similarity of public and private goods. To relax the assumption seems to introduce fairly interesting results into the theory of tax incidence.

Footnotes

1. See, for instance, Mieszkowski (1969). The recent contributions in the static incidence theory include Homma (1977) and Vandendorpe and Friedlaender (1976).
2. The present model is an extension of the standard two-class growing economy to encompass a situation where the government finances public capital by a corporation profit tax and a wage income tax. See, in particular, Pasinetti (1962) and Samuelson and Modigliani (1966).
3. It is very important, as emphasised by King (1975), to deal carefully with the deduction of interest payments and investment expenditure in the theory of tax incidence. However, this aspect was not discussed because it would obscure the points we wished to make.
4. The similar distribution rule may be found in Negishi (1973).
5. The equality in (12) will be obtained as follows: The dynamic system (6) implies that $\dot{K} = s^C D^C + s^W D^W$. Then we obtain $\dot{k} = s^C d^C + s^W d^W - nk$, where $d^i = D^i/L$ ($i=C,W$). The steady state requires $k^* = s^C d^C + s^W d^W/n$ to hold. Substituting this into $f - ng^*/k^*$ in (12) and then dividing by $d = f - ng^*$ leads to:

$$\frac{f - ng^*}{k^*} = \frac{n}{\delta^C s^C + \delta^W s^W},$$
 where d is the overall disposable income in the private sector and $\delta^i = d^i/d$ ($i = C,W$; $\delta^C + \delta^W = 1$). We therefore obtain the desired result because the denominator in R.H.S. corresponds to the overall savings rate s^a .
6. Thanks are due to Professor Dixit for suggesting this interpretation.
7. The positiveness of the Jacobian determinant not only ensures local uniqueness of the steady state solution, but also constitutes a necessary condition for local stability of the dynamic system (10). In order to accomplish the stability analysis, we must show that the trace of J has a negative sign.
8. It should be noticed here that the relation, $(1-t)(s^C - s^W)z(kf_k + gf_g) - nk = -s^W(f - nk)$, is used for deriving the last expression.

References:

- Feldstein, M., 1974, Incidence of a capital income tax in a growing economy with variable savings rates, Review of Economic Studies, 41, 505-513.
- Grieson, R.E., 1975, The incidence of profits taxes in a neo-classical growth model, Journal of Public Economics 4, 75-85.
- Harberger, A.C., 1962, Incidence of the corporation income tax, Journal of Political Economy, 70, 215-240.
- Homma, M., 1977, A comparative static analysis of tax incidence, Journal of Public Economics 8, 53-65.
- King, M.A., 1975, Taxation, corporate financial policy, and the cost of capital : A comment, Journal of Public Economics 4, 271-279.
- Meade, J.E., 1952, External economies and diseconomies in a competitive situation, Economic Journal 62.
- Mieszkowski, P., 1969, Tax incidence theory : the effects of Taxes on the distribution of income, Journal of Economic Literature 7, 1103-1124.
- Negishi, T., 1973, The excess of public expenditures on industries, Journal of Public Economics 2.
- Pasinetti, L.L., 1962, Rate of profit and income distribution in relation to the rate of economic growth, Review of Economic Studies 29, 267-279.
- Samuelson, P.A. and F.Modigliani, 1966, The Pasinetti paradox in neo-classical and more general models, Review of Economic Studies, 33, 269-302.
- Stiglitz, J.E., 1978, Notes on estate taxes, redistribution, and the concept of balanced growth path incidence, Journal of Political Economy 86.
- Vandendorpe, A.L. and A.F.Friedlaender, 1976, Differential incidence in the presence of initial distorting taxes, Journal of Public Economics 6, 205-229.