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Tax Structure and Government Expenditures under Fairness Norms

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Abstract: We augment a standard tax model by concerns about tax equity: people get upset when labour is taxed more heavily than capital. Even the slightest concern for tax equity invalidates the common recommendation for small open economies that capital should remain tax-exempt. This holds for exogenous as well as for endogeous government expenditures and irrespective of whether concerns with tax equity only cause discomfort or impact on work incentives. If concerns with tax equity grow stronger, the economy may choose higher taxes on labour and move to the downward sloped part of its Laffer curve. For endogenous government spending, stronger concerns with tax equity may call for a larger size of the public sector.

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1 Introduction

A fundamental theorem on taxation states that small open economies should not rely on capital taxation. This result, originally derived in Gordon (1986), emerges from the assumption of an infinitely elastic capital supply which small countries face. Under this assumption, the burden of a tax on capital will be entirely shifted onto workers or other immobile domestic factors. But if those factors bear the tax burden anyway, it is less costly to tax them directly and, by this, to avoid the excess burden associated with capital flight.

Zero capital taxation, thus, is optimal in this class of models – it maximizes the representative household's utility and, thus, is also the policy outcome that people actually want and would vote for. However, in reality the prospect of zero taxes on capital hardly looks popular. It flies in the face of all sorts of concerns with equity, fairness, and equal treatment in taxation – which remain unmodelled in the standard framework of optimal (international) taxation. Over the past decades a large body of evidence has been compiled suggesting that people are not solely driven by material self-interest but also by values, norms and equity concerns. While social preferences of various types have been embedded into many economic contexts, only little is known about the optimal tax structure in the presence of tax norms.

In this paper, we discuss optimal taxation when tax rates on capital and labour incomes (or their difference) directly enter into individual utility functions. Such an approach can be motivated along several lines:

- First, tax systems that exclusively or disproportionately rely on taxes on labour incomes appear unacceptable on grounds of common norms for equity and justice.[1] The most general and fundamental of such norms is reflected in the principle of horizontal tax equity, to which most tax systems pay at least lip service. Stating that equal incomes should be taxed at equal rates (Musgrave, 1959; Kaplow, 1995), the principle forms part of the rationale underlying the comprehensive income tax (of the Schanz-Haig-Simons type), a normative ideal to which many countries (used to) adhere.[2] Discrimination between similarly situated tax payers – such as zero or low taxes on capital in the presence of positive and high tax rates on labour – clearly violates this principle. It also violates its relative, the ability-to-pay principle, stating that all members of society have a duty to pay taxes in accordance with their economic capabilities; tax legislation warps this principle when tax privileges are not based on ability to pay.[3] Equity does not only matter from an

[1] For a survey on tax equity norms and their implications for actual tax policy see, e.g., Barker (2006).

[2] These aspects also matter in the debate on dual income taxes: by applying different tax treatments to incomes from different sources, dual income tax generate problems of horizontal inequity. See, e.g., Sørensen (1994).

[3] Moreover, burdening only one subgroup of the population (i.e., workers) could also be in conflict with the benefit principle of taxation, stating that the taxes an agent pays should somehow reflect the benefits that (s)he receives from the goods and services supplied by the state (for a discussion of the benefit and sacrifice principles of

abstract, philosophical perspective; the experimental literature provides ample evidence that perceptions of "fairness" and its violation impact on subjective well-being as well as on individual behaviours (for a survey, see, e.g., Fehr and Schmidt, 2006). From a citizen's perspective, the tax systems equity constitutes an important criterion for the legitimacy of a tax; it shapes work incentives, tax complicance, and political support (Taylor, 2003, p. 84).

- Second, zero or low tax rates on capital income in the presence of high tax rates on labour income cause discontent and envy. The rich, capital income earners or profitable businesses getting away without being taxed adequately makes wage earners with (perceived) high tax burdens angry (The Economist, 2009). The "common man", paying a substantial share of his moderate income in taxes, is upset when – as it happens in many countries – capital incomes are subject to rather symbolic income or capital gains taxes, exempt from contributing to social insurance, or given various preferences and privileges. Likewise, the (perception of a) growing imbalance in the taxation of labour and capital incomes (allegedly induced by globalisation) nourishes political discomfort. Generally, policies that discriminate across comparable circumstances or individuals appear to create resentment, possibly also endangering social stability. This view finds strong support in the socio-psychological literature which shows that *relative deprivation* – via unequal treatment, exclusion, or discrimination – negatively impacts both on individual well-being and on social cohesion and welfare (Runciman, 1966; Podder, 1996).[4] As argued by Elster (1991, p. 66) in general and by Boskin and Sheshinski (1978, p. 590) for taxation, a society that tries to assuage its envy may well adopt policies that damage its material interests.

- Third, large discrepancies between taxes on capital and labour may indicate a growing degree of inequality which might be detrimental for utility: Reducing inequality is a major rationale for taxation in modern societies; exemption from taxation or low tax rates for capital incomes and fortunes let the social compact for redistribution appear shaky – which many people in developoed economies find undesirable (Brooks and Manza, 2006). Moreover, happiness research shows that, in addition to one's absolute level of income, well-being also depends on one's income position relative to others (e.g. Clark and Oswald, 1996; Luttmer, 2005; Layard 2006). Taxation can change relative positions. Earners of labour income may, thus, dislike tax privileges for earners of capital income since that would worsen their relative income position.

taxation see, e.g., Neill, 2000). Since everybody benefits from the provision of public goods, the benefit principle calls (as a minimum) for a positive share in taxes for everyone.

[4] While economists tend to reduce relative deprivation to shortfalls of income or consumption, Runciman's original concept is far wider and applicable to abstract or intangible social objects, including policy measures such as tax rates.

To summarize, people seem to care about the tax structure in itself (and beyond the extent by which it affects their own net incomes). They find it important that tax rates on different factors or types of income do not differ too much. Tax rate differentials affect individual well-being via concerns for equity, equality, and sentiments of relative deprivation or envy. In this paper we analyze the implications of such concerns for the tax structures in small open economies. To keep terminology simple, we shall henceforth and invariably refer to the tax-related sentiments as "tax equity concerns". This term is an imperfect container for a wide range of different concepts that partially overlap and are difficult to disentangle (norms for horizontal tax equity, envy, fairness perceptions, feelings of relative deprivation or discrimination, status concerns etc.). Their common denominator is, however, that large discrepancies between tax rates on different types of income are undesirable.

Concerns for tax equity may matter in at least two different ways: Perceiving a situation as more inequitable may cause discomfort and reduce the level of well-being (level effect), but it may also trigger adjustments in labour supply (incentive effects). The motivation for the inclusion of incentive effetcs comes from empirical and experimental evidence suggesting that unfairness felt in the context of taxation indeed affects work incentives. Dissatisfied individuals spend less effort on work, show higher rates of absenteeism etc. (see, e.g., Lévy-Garboua et al., 2009; Cornelissen et al., 2010). In social psychology, adverse behavioural reactions of similar type have since long been discussed under the label "equity theory" (Adams, 1963). In our model, level effects of tax equity concerns formally show up in preferences as (separable) reductions in total utility while incentive effects affect marginal rates of substitution between consumption and leisure.

We embed these tax equity concerns into a model of a small open economy whose remaining components are fairly standard: A single output is produced with labour and capital. Capital is perfectly mobile internationally. Workers are immobile but their supply of labour is endogenous (and may be affected by equity concerns). Higher levels of capital imply higher equilibrium wages. The government provides a consumption good and finances its expenditures with source taxes on capital and labour income. The level of government expenditure can be exogenously given or might be chosen optimally.

In the absence of concerns for tax equity, government finance should rely only on labour income taxes. Capital taxation invariably causes a higher excess burden, irrespectively of whether government expenditures are exogenous or endogenous. An optimum without concerns for tax equity, thus, involves a large differential tax treatment of capital and labour.

In the presence of equity concerns, however, the tax designer faces a trade-off. On the one hand, taxes on capital drive capital out of the country and, by this, also depress gross wages. On the other hand, at given (and relatively high) labour tax rates, they reduce the tax gap and thereby placate equity concerns. This trade-off has a number of implications for optimal tax policies, some expected, others perhaps less so.

First, exempting capital income from taxation is never optimal. With the slightest concern for tax equity already a zero tax rate on capital income ceases to be optimal, irrespectively of whether equity concerns impact on work incentives or "only" on well-being. Second, and more surprising, the effect that stronger concerns for tax equity may call for a higher level of labour taxation. One reason is that equity concerns may drive the economy onto the decreasing part of the partial Laffer curve for the capital tax – a situation that would never occur within a standard framework of taxation. Another reason is that government finance via capital taxes may eventually carry so large an excess burden that a further increase of capital taxes, induced by stronger equity concerns, needs to be accomodated by a (smaller) increase in labour taxes. Third, also the comparative statics for government expenditures reveal some interesting non-monotonicities. One might expect that a stronger concern for tax equity calls for higher capital tax rates and, by this, for a smaller public sector (capital taxation being plagued by a larger excess burden). However, even when the former is true, the size of the public sector need not necessarily decline. Tax equity effects erode the size of the public sector only when they are relatively weak. With strong concerns for equal taxation of labour and capital, further increases in the degreee of tax equity are associated with higher government expenditure.

Our paper contributes to the theory of taxation in two areas. First, it complements a small literature that incorporates values and equity norms into optimal tax frameworks.[5] Most of this literature is concerned with the impact of equity perceptions on tax compliance, but some recent theoretical and experimental research also deals with the interaction between inequity aversion (in the Fehr-Schmidt sense) and tax structures (see, e.g., Lévy-Garboua et al., 2009). Second, we add to recent research on the optimal mix of capital and labour taxation in open economies which is puzzled by the failure of empirical studies to confirm the theoretical prediction that increased capital mobility leads to a lower relative tax burden on capital (see Haufler, 1997, or Haufler et al., 2008). Our paper suggests that concerns with tax equity may have prevented such a race to the bottom for capital taxes; the social value of balanced taxation may outweigh the economic benefits from low capital taxes.

This paper proceeds as follows: Section 2 sets out a basic model with tax equity concerns. In Section 3, we analyze tax policies and their comparative statics for the case that government spending is exogenous. In Section 4, we extend the model to endogenous government spending. Section 5 concludes.

[5] The literature on social preferences often assumes that individuals compare their own income position to that of others. If such comparisons entail negative externalities (via envy, say), Pigou-type taxes may be helpful remedies (see, e.g., Alvarez-Cuadrado 2007; Alonsa-Carrera and Caballé 2006). By contrast, in our framework unequal taxation is a *source* of disutility – and not a remedy against it.

2 The model

We consider a small open one-good-economy which is inhabited by a large number of identical individuals. For simplicity, we normalize the number of individuals to unity. Production in the economy takes place in one single-output firm that is owned by absent foreigners. Production uses labour and capital as its inputs. Capital is an internationally mobile factor of production that can be purchased on world capital markets at an exogenous rental rate of $r > 0$ per unit. Capital and labour can be taxed with tax rates t_ℓ on labour and t_k on capital.

The individual has convex and increasing preferences over consumption c, leisure – which will be negatively represented by working hours ℓ – and a publicly provided good g. We assume that these preferences can be represented by an additively separable utility function

$$u(c, \ell) = c - E(\ell, \psi) + h(g) - \Omega, \tag{1}$$

where $E(\cdot)$ with $E_\ell > 0$ and $E_{\ell\ell} > 0$ represents the disutility from labour ℓ and $h(g)$ with $h'(g) > 0 > h''(g)$ measures the utility from the publicly provided good.

The special features of preferences in our model are functions ψ and Ω, both of which are assumed to depend on the tax rates on labour and capital:

$$\psi = \psi(t_\ell, t_k) \quad \text{and} \quad \Omega = \Omega(t_\ell, t_k).$$

Thus, preferences depend on the policy choices made in the society. In particular, ψ captures that the disutility from work not only increases with working hours ℓ but also on the individual's perception ψ of tax policies. We assume that both the absolute and the marginal disutility from labour increase whenever the the tax policy becomes less fair ($E_\psi > 0$, $E_{\ell\psi} > 0$). Moreover, we assume that

$$\psi = \psi(t_\ell, t_k), \tag{2}$$

with $\psi_\ell := \partial\psi/\partial t_\ell \geq 0$ and $\psi_k := \partial\psi/\partial t_k \leq 0$. Higher taxes on labour (weakly) depress work morale while higher taxes on capital boost it. Experimental evidence for the validity of (2) can be found in Lévy-Garboua et al. (2009) where it is shown that workers who consider equity norms to be violated by taxation refuse to work.

In addition to this incentive effect of tax equity, there may also be a mere level effect, represented by Ω, of discrepancies between labour and capital tax rates. Similar as with ψ, we assume that $\Omega_\ell := \partial\Omega/\partial t_\ell \geq 0$ and $\Omega_k := \partial\Omega/\partial t_k \leq 0$.

The distinction between ψ and Ω reflects two channels of tax equity: a work morale effect (ψ alters the marginal rate of substitution between leisure and consumption) and a "feel-good" effect (Ω affecting well-being but leaving incentives unaltered). As discussed in the introduction, the labelling of ψ and Ω as equity concerns covers a wide array of affects, ranging from abstract horizontal equity norms to envy to feelings of relative deprivation.

One might question the asymmetric treatment of t_k and t_ℓ in both ψ and Ω. With ψ and Ω representing equity norms, any widening of the statutory tax gap $(t_\ell - t_k)$ should be welfare reducing. However, in our framework we will only encounter situations where capital is tax less severly than labour $(t_k \leq t_\ell)$. For such scenarions, the modelling of ψ and Ω covers the case where they just negatively depends on the tax differential.[6]

The legal incidence of labour taxes is assumed to lie with workers. Thus, the disposable income of a worker just equals the hourly net wage $(w - t_\ell)$ times hours worked: $c = (w - t_\ell) \cdot \ell$. The (gross) wage rate w will be endogenously determined (see below).

Individuals take the wage and tax rate as parametrically given. Substituting for c in (1) and maximizing over ℓ requires that:

$$E_\ell(\ell, \psi(t_\ell, t_k)) = w - t_\ell. \tag{3}$$

Equation (3) implicitly defines a labour supply function $\ell^S(w, t_\ell, t_k)$ with properties

$$\frac{\partial \ell^S}{\partial w} = \frac{1}{E_{\ell\ell}} > 0, \tag{4}$$

$$\frac{\partial \ell^S}{\partial t_\ell} = -\frac{1}{E_{\ell\ell}} \cdot (1 + E_{\ell\psi} \cdot \psi_\ell) < 0, \tag{5}$$

$$\frac{\partial \ell^S}{\partial t_k} = -\frac{E_{\ell\psi}}{E_{\ell\ell}} \cdot \psi_k > 0. \tag{6}$$

Firms maximize their profits. Denoting by K and L, respectively, the amounts of capital and labour employed in the firm, output of the firm equals $F(K, L)$, where F is a strictly increasing, constant-returns-to-scale and strictly quasi-concave production function. Firms pay a tax t_k on each unit of capital they hire. Since the cost of hiring an additional hour of labour are w while an additional unit of capital costs $r + t_k$, the firm's net profits amount to

$$\pi = F(K, L) - w \cdot L - (r + t_k) \cdot K = L \cdot (f(k) - w - (r + t_k) \cdot k). \tag{7}$$

Here, $k := K/L$ denotes capital per labour unit and $f(k)$ is the per-unit-of-labour production function; f is strictly increasing and strictly concave. The firm takes input prices and taxes as given. Profit maximization requires

$$f'(k) = r + t_k, \tag{8}$$

which implicitly defines the capital intensity $k = k(r + t_k)$ as a function of the cost of capital, with

$$k'(r + t_k) = \frac{1}{f''(k)} < 0. \tag{9}$$

[6]Moreover, in (1) we assume the perspective of a worker without capital income. Hence, feelings of envy or deprivation of earners of capital income relative to earners of work income are not relevant here.

Since we assume constant returns to scale, the gross wage rate is determined via the factor price frontier and is given by

$$w(r + t_k) = f(k) - (r + t) \cdot k \tag{10}$$

with

$$w'(r + t_k) = -k. \tag{11}$$

In equilibrium, labour supply must equal labour demand. The equilibrium level L^* of employment is, thus, given by

$$L^*(t_\ell, t_k) = \ell^S(w(r + t_k), t_\ell, t_k); \tag{12}$$

it decreases in the tax rate on labour but has an ambiguous response to higher capital taxation:

$$\begin{aligned} \frac{\partial L^*}{\partial t_\ell} &= \frac{\partial \ell^S}{\partial t_\ell} < 0, \\ \frac{\partial L^*}{\partial t_k} &= w'(r + t_k) \cdot \frac{\partial \ell^S}{\partial w} + \frac{\partial \ell^S}{\partial t_k} = -k \cdot \frac{\partial \ell^S}{\partial w} + \frac{\partial \ell^S}{\partial t_k} \lesseqgtr 0. \end{aligned}$$

Note that when equity concerns are sufficiently high, they may offset the usual disincentive from higher capital taxation on labour supply. In this case, equilibrium employment would increase in the tax rate on labour.

The government provides a (public) good g (measured in units of output) which has to be financed out of the revenues from labour and capital taxes. Hence, its budget constraint reads:

$$g = t_\ell \cdot L^* + t_k \cdot K = L^*(t_\ell, t_k) \cdot (t_\ell + t_k \cdot k(r + t_k)) =: G(t_\ell, t_k). \tag{13}$$

In what follows, we shall refer to $G(t_\ell, t_k)$ as the Laffer curve of the economy. For later use, we note that from (13) the partial derivatives of the Laffer curve with respect to the two tax rates are given by

$$\frac{\partial G}{\partial t_k} = \frac{\partial L^*}{\partial t_k}(t_\ell + t_k k) + L^*(k + t_k k') =: G_k, \tag{14}$$

$$\frac{\partial G}{\partial t_\ell} = \frac{\partial L^*}{\partial t_\ell}(t_\ell + t_k k) + L^* =: G_\ell. \tag{15}$$

3 Optimal tax policy with exogenous government spending

In this section, we assume that a given and fixed level of government revenues $\bar{g}$ has to be raised; the case of endogenous government expenditures will be dealt with in Section 4.

3.1 Some taxation of capital is optimal

The government chooses t_ℓ and t_k such as to maximize individual welfare (recall that firm owners are absentee capitalists). Plugging the equilibrium level of employment L^* and (13) into (1) and taking into account that $w = w(r + t_k)$ via (10), we obtain indirect utility (= social welfare) in equilibrium as follows:

$$V(t_\ell, t_k) := (w(r + t_k) - t_\ell) \cdot L^*(t_\ell, t_k) - E(L^*(t_\ell, t_k), \psi(t_\ell, t_k)) - \Omega(t_\ell, t_k). \tag{16}$$

As government expenditures g are exogenously fixed, the utility $h(g)$ derived from them does not matter here; it is omitted from (16). The government chooses tax rates t_ℓ and t_k such as to maximize V subject to the revenue constraint. The Lagrangian W for this problem reads:

$$\max_{t_\ell, t_k} \quad W(t_\ell, t_k) = V(t_\ell, t_k) + \lambda \cdot [G(t_\ell, t_k) - \bar{g}], \tag{17}$$

where λ denotes the Lagrange multiplier and $\bar{g}$ the exogenous level of the public good to be financed. Differentiating (17), with respect to tax rates (t_k, t_ℓ) and using the Envelope Theorem gives:

$$\begin{aligned}
\frac{\partial W}{\partial t_\ell} &= -L^* + \lambda \cdot G_\ell - E_\psi \cdot \psi_\ell - \Omega_\ell \\
&= L^* \cdot [\lambda - 1] + \lambda \cdot (t_\ell + t_k k) \cdot \frac{\partial L^*}{\partial t_\ell} - E_\psi \cdot \psi_\ell - \Omega_\ell && (18) \\
\frac{\partial W}{\partial t_k} &= w'(r + t_k) L^* + \lambda \cdot G_k - E_\psi \cdot \psi_k - \Omega_k \\
&= kL^* \cdot [\lambda - 1] + \lambda \cdot \left((t_\ell + t_k k) \cdot \frac{\partial L^*}{\partial t_k} + t_k k' L^* \right) - E_\psi \cdot \psi_k - \Omega_k. && (19)
\end{aligned}$$

No concerns for tax equity. As a benchmark, we consider the case without tax equity concerns (i.e., $\psi_k = \psi_\ell = \Omega_k = \Omega_\ell \equiv 0$). Here,

$$\frac{\partial L^*}{\partial t_\ell} = -\frac{\partial \ell^S}{\partial w} \quad \text{and} \quad \frac{\partial L^*}{\partial t_k} = -k \cdot \frac{\partial \ell^S}{\partial w}. \tag{20}$$

From (18) and (19) we, thus, get

$$\frac{\partial W}{\partial t_\ell} = \frac{1}{k} \cdot \frac{\partial W}{\partial t_k} - \lambda L^* \frac{t_k k'}{k} > \frac{1}{k} \cdot \frac{\partial W}{\partial t_k} \tag{21}$$

for all (t_ℓ, t_k) with $t_k > 0$. Hence, without equity concerns it can never be optimal to tax capital at source: $t_k = 0$.[7] The intuition for this standard result is that a small country faces a fixed rate of return on capital and, thereby, an infinitely elastic capital supply. Capital taxes would then be entirely shifted over to the immobile factor, which makes it less costly to tax this factor directly (Razin and Sadka, 1990; Bucovetsky and Wilson, 1991).

[7]Formally, if $\frac{\partial V}{\partial t_\ell} = 0$, one gets $\frac{\partial V}{\partial t_k} < 0$ for all $t_k > 0$ such that a reduction of t_k is worthwhile.

Disutility from unequal tax rates. First, consider the case where concerns for tax equity only affect utility levels ($\Omega_k \leq 0, \Omega_\ell \geq 0$ with at least one strict inequality) but do not have any incentives effects (i.e., $\psi_k = \psi_\ell \equiv 0$). Then (20) continues to hold and we get from (18) and (19) that

$$\frac{\partial W}{\partial t_\ell} = \frac{1}{k} \cdot \frac{\partial W}{\partial t_k} - \lambda \frac{t_k k' L^*}{k} - \Omega_\ell + \frac{1}{k}\Omega_k. \tag{22}$$

This equation differs from (21) only by the term $-\Omega_\ell + \Omega_k/k < 0$, implying that zero taxation of capital is no longer desirable: at $t_k = 0$ and $\frac{\partial W}{\partial t_\ell} = 0$, we get $\frac{\partial W}{\partial t_k} > 0$ instead of $\frac{\partial W}{\partial t_k} = 0$ such that a positive t_k is warranted. Intuitively, with preferences for equal taxation, capital taxation not only has economics costs (distortion of the capital intensity), but also reduces the psychological costs from tax differences. For later use, note that

$$L^* t_k k'/k = \frac{1}{\lambda}(\frac{1}{k}\Omega_k - \Omega_\ell) \tag{23}$$

must hold in a welfare maximum.

Incentive effects. Suppose now that deviation from the tax equity norm does not cause a deterioration in utility *per se*, but distorts the incentives to provide labour. I.e., we shall assume that $\psi_k(t_\ell, t_k) \leq 0 \leq \psi_\ell(t_\ell, t_k)$ (with at least one strict inequality), while we reset $\Omega_k = \Omega_\ell \equiv 0$. Then the partial derivatives of equilibrium employment with respect to the tax rates are given by

$$\frac{\partial L^*}{\partial t_\ell} = -\frac{1}{E_{\ell\ell}} \cdot (1 + E_{\ell\psi} \cdot \psi_\ell) \quad \text{and} \quad \frac{\partial L^*}{\partial t_k} = -\frac{1}{E_{\ell\ell}} \cdot (k + E_{\ell\psi} \cdot \psi_k). \tag{24}$$

Using (24), it follows from (18) and (19) that

$$\frac{\partial W}{\partial t_\ell} = \frac{1}{k} \cdot \frac{\partial W}{\partial t_k} - \lambda L^* \frac{t_k k'}{k} + \underbrace{(\frac{1}{k}\psi_k - \psi_\ell)[E_\psi + \lambda(t_\ell + t_k k)\frac{E_{\ell\psi}}{E_{\ell\ell}}]}_{<0}. \tag{25}$$

This again implies that no taxation of capital can never be optimal: For any $(t_\ell, t_k) = (t_\ell, 0)$, we get $\frac{\partial V}{\partial t_k} > k \cdot \frac{\partial V}{\partial t_\ell}$ such that an increase in t_k is warranted. In an interior optimum $\frac{\partial W}{\partial t_k} = \frac{\partial W}{\partial t_\ell} = 0$ and, from (25),

$$L^* \frac{t_k k'}{k} = \frac{1}{\lambda}(\frac{1}{k}\psi_k - \psi_\ell)[E_\psi + \lambda(t_\ell + t_k k)\frac{E_{\ell\psi}}{E_{\ell\ell}}]. \tag{26}$$

To sum up:

Result 1 *In the absence of tax equity concerns, capital should remain untaxed. In the presence of equity concerns, whether they shape incentives or just affect utility levels, a zero tax rate on capital is never optimal.*

Result 1 shows that the standard recommendation that small open economies should leave capital untaxed balances on a knife's edge. Any effect providing capital taxation with some extra marginal benefit induces the government to rely on at least some capital taxation. Here, concerns for tax equity do the job.

3.2 Comparative statics with level effects

The inclusion of tax equity considerations provides governments with incentives to levy positive capital tax rates. But precisely how do different strenghts of equity concerns affect tax policy? To answer this, we first consider the case where tax equity concerns do not impact on work incentives. In addition, we suppose that equity concerns are assuaged as soon as the difference between capital and labour tax rates narrows down, i.e.,

$$\Omega = \tilde{\Omega}(\beta \cdot (t_\ell - t_k)) \tag{27}$$

with $\tilde{\Omega}' > 0$ and $\tilde{\Omega}'' \geq 0$. Parameter $\beta > 0$ serves as a parametric measure for the intensity of the equity concern. The comparative statics of (t_ℓ, t_k) with respect to β are given through:

$$\begin{pmatrix} W_{\ell\ell} & W_{\ell k} & G_\ell \\ W_{\ell k} & W_{kk} & G_k \\ G_\ell & G_k & 0 \end{pmatrix} \cdot \begin{pmatrix} \mathrm{d}t_\ell \\ \mathrm{d}t_k \\ \mathrm{d}\lambda \end{pmatrix} = \begin{pmatrix} -W_{\ell\beta} \\ -W_{k\beta} \\ 0 \end{pmatrix} \mathrm{d}\beta,$$

with $W_{xy} = \partial^2 W/(\partial t_x \partial t_y)$ and $W_{x\beta} = \partial^2 W/(\partial t_x \partial\beta)$. From (18), (19), and (27) we get that

$$W_{k\beta} = -W_{\ell\beta} = \Omega_{\ell\beta} := \tilde{\Omega}' + \beta(t_\ell - t_k) \cdot \tilde{\Omega}'' > 0. \tag{28}$$

Hence, we applying Cramer's Rule to (28) we obtain:

$$\frac{\mathrm{d}t_\ell}{\mathrm{d}\beta} = -\frac{1}{D} \cdot \Omega_{\ell\beta} \cdot (G_k^2 + G_\ell G_k) \tag{29}$$

$$\frac{\mathrm{d}t_k}{\mathrm{d}\beta} = \frac{1}{D} \cdot \Omega_{\ell\beta} \cdot (G_\ell^2 + G_\ell G_k) \tag{30}$$

$$\frac{\mathrm{d}(t_\ell - t_k)}{\mathrm{d}\beta} = -\frac{1}{D} \cdot \Omega_{\ell\beta} \cdot (G_k + G_\ell)^2. \tag{31}$$

Here,

$$D = 2G_k G_\ell W_{\ell k} - (G_k^2 W_{\ell\ell} + G_\ell^2 W_{kk})$$

is the determinant of the bordered Hessian on the LHS of (28). In a welfare maximum, $D > 0$ as well as $W_{kk}, W_{\ell\ell} < 0$.

Observe from (28) that the weak assumption $\tilde{\Omega}' > 0$ (the individual feels worse the larger the tax rate differential) suffices to have equity concerns affect tax policies – we do not strictly need to assume that $\tilde{\Omega}'' \geq 0$ (the psychological costs of tax inequity increase more than proportionately with the tax gap).

As can be seen immediately from (31), a stronger concern for tax equity has an unambiguous effect on the tax rate differential: $(t_\ell - t_k)$ is strictly decreasing in β, irrespective of the signs of the partial derivatives of the Laffer curve (G_ℓ, G_k). Starting from $t_\ell > t_k = 0$ at $\beta = 0$, the stronger the tax equity norm, the closer the tax structure moves towards equal tax rates:

$$\frac{\mathrm{d}(t_\ell - t_k)}{\mathrm{d}\beta} < 0.$$

To determine the signs of (29) and (30), we manipulate these expressions in the following way. From (20), (14), (15), (23) and $\Omega_\ell = -\Omega_k$, it follows that we have

$$G_\ell = \frac{1}{k} G_k - \frac{1}{\lambda}\Omega_k(1 + \frac{1}{k}) \tag{32}$$

in an interior equilibrium. Observe from (18) that $G_\ell > 0$ in an optimum. Substituting for G_ℓ from (32) into (29), we obtain

$$\frac{\mathrm{d}t_\ell}{\mathrm{d}\beta} = \underbrace{-\frac{1}{D} \cdot \Omega_{\ell\beta}}_{<0} \cdot G_k(1 + \frac{1}{k}) \left[G_k \underbrace{-\frac{\Omega_k}{\lambda}}_{>0} \right] \gtreqless 0. \tag{33}$$

Thus, the effects from stronger tax equity concerns on the labour tax rate are unclear in sign. If $G_k > 0$, the labour tax decreases with the strength of the equity concern. This accords with intuition: the more upset workers are with privileged capital taxation, the lower the tax burden they are willing to accept on their own incomes. However, the counter-intuitive case, that a stronger desire to correct for tax inequity is associated with higher labour taxation may also occur. This can happen if $G_k < 0$, i.e. if the economy is on the downward-sloped part of the Laffer curve of the capital tax rate (given that G_ℓ and, from (32), $G_k - \frac{\Omega_k}{\lambda}$ are positive). In Example 1 below we will show that under certain conditions government in fact has an incentive to push the economy beyond the maximum of the (partial) Laffer-curve for the capital tax.
Similar as for (33) one can show that

$$\frac{\mathrm{d}t_k}{\mathrm{d}\beta} = -\frac{1}{k}\frac{\mathrm{d}t_\ell}{\mathrm{d}\beta}\frac{1}{G_k}\left[(G_k - \frac{\Omega_k}{\lambda}) - \frac{k\Omega_k}{\lambda}\right]. \tag{34}$$

This expression is positive, irrespective of the sign of G_k. Thus, we get a monotonic increase of the capital tax rate with the strength of equity concerns:

$$\frac{\mathrm{d}t_k}{\mathrm{d}\beta} > 0.$$

The observation that the tax on labour may increase when tax equity concerns grow stronger deserves an explanation. An increase in β calls for a higher t_k. If t_k is high enough, this will ceteris paribus cause tax revenues to drop ($G_k < 0$), due to a reduction both in the capital stock and wages. As revenue shortfalls are not allowed with an exogenous budget requirement, the tax on labour consequently has to rise (but at a lower pace than the capital tax rate as $(t_\ell - t_k)$ is bound to decrease).
To see that $\frac{\mathrm{d}t_\ell}{\mathrm{d}\beta}$ might indeed be an optimal policy response, have a look at

Example 1. In this and the following examples, we consider a Cobb-Douglas technology where per-capita output is produced according to $y = k^\alpha$. We parameterize the disutility from labour by $E = 0.5 \cdot \psi \cdot \ell^2$. The disutility from tax rate differentials is assumed to follow $\Omega = 0.5 \cdot \beta \cdot (t_\ell - t_k)^2$. The parameter α, capital's share of output, is set equal to 0.25. The "dislove for work" parameter, ψ, is set to 0.1, and the world market's rental rate, r, to 0.25. Figure 1 depicts optima for different values of β.

Each graph plots tax indifference curves for $V(t_\ell, t_k)$ (dashed curves) and a government iso-budget contour (solid lines) in (t_ℓ, t_k)-space. The aspired revenue level and (since there are no incentive effects) the iso-budget contours for the government are the same in all panels. The (lower leg of the) iso-budget contour is negatively sloped for moderate capital tax rates: a higher capital tax entails higher tax revenues and, thus, allows for a lower tax rate on labour to meet the budget requirement. However, eventually the negative effect of a higher capital tax rate on tax revenues (a lower tax base induced by capital flight) dominates, such that the same level of g can only be met at higher taxes on labour. The shape of the V-indifference curves varies across the four panels of Figure 1 with the strength β of the tax equity concern. For zero or low values of β indifference curves are negatively sloped since individuals place high emphasis on the adverse effects of capital taxation on consumption ($w' < 0$). For $\beta = 0$ both the labour and the capital tax rate are considered as "bads" – while t_ℓ adversely affects consumption via lower net wages, a higher t_k depresses gross wages. Indifference curves closer to the origin represent higher utility levels. With increasing concerns for tax equity, indifference curves bend upwards. Closing the tax gap is increasingly considered as good, and losses in material consumption can be less easily compensated for by a lower tax burden on labour income.[8]

Geometrically the indifference curve at an optimal tax mix must be tangent to the (lower leg of the) iso-budget contour representing the exogenous revenue requirement $\bar{g}$. In the benchmark case ($\beta = 0$), this tangential point is on the vertical axis where capital is tax exempt. Starting from such a position, the tangential point moves along the budget contour towards the 45°-line. This initially entails a reduction of t_ℓ and an increase in t_k. However, with equity concerns strong enough, eventually the upward-sloped part of the iso-budget contour might be entered. The optimal tax mix then leads the economy on the downward-sloped part of the (partial) Laffer for the capital tax rate (where $G_k < 0$). Thus, it is shown that ($\frac{dt_\ell}{d\beta} > 0$) is possible.[9]

Equity concerns call for narrowing the spread between labour and capital taxation. Indeed, if it is possible to finance the exogenous revenue requirement at equal tax rates (the iso-budget contour intersects with the diagonal), $t_\ell = t_k$ will eventually be implemented when equity concerns β grow strong enough. Such tax rate equalization need not be feasible, in particular not when budget requirements are sufficiently high. An economy with strong tax equity motives will then

[8] In the extreme, when tax equity concern becomes overwhelmingly strong, indifference curves would be linear with slope +1 and the highest utility level is represented by the 45°-line. All tax combinations along the 45°-line are then considered as equally good.

[9] Formally, the tax mix (t_k, t_ℓ) that is at minimum distance to the 45°-line satisfies, on the iso-budget contour for g, the condition $-G_k/G_\ell = 1$. From (29) to (31), this implies that tax rates do no further vary with β.

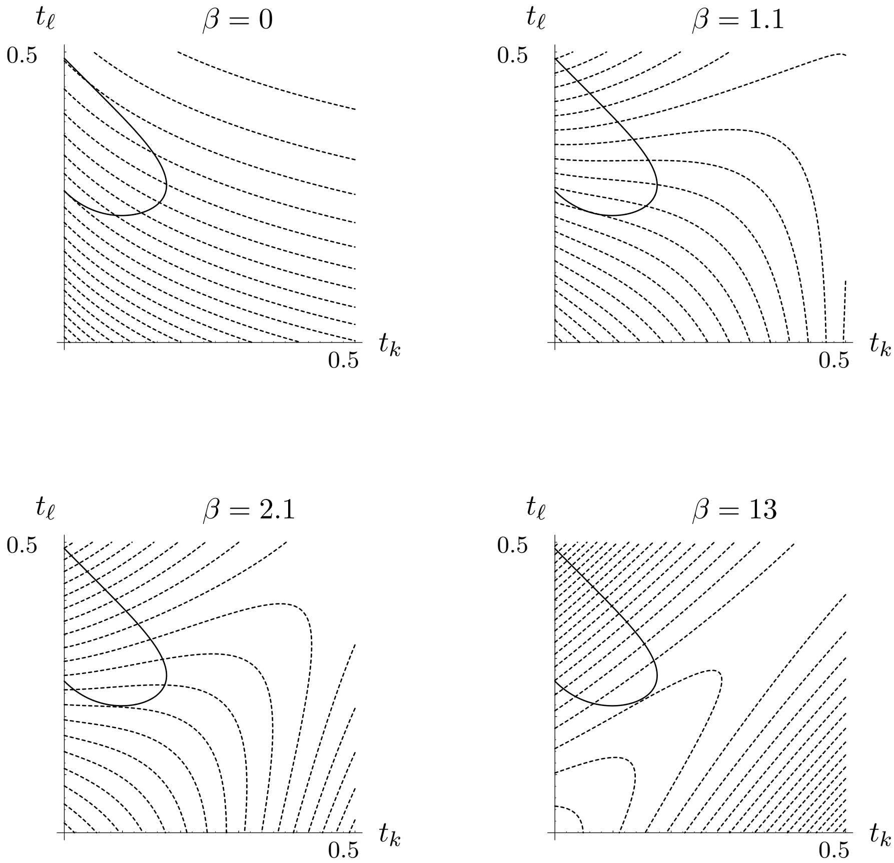

Figure 1: Tax equity without incentive effects. Government iso-budget contour (solid) and indifference curves (dashed) for varying values of β.

(geometrically) remain at that situation on the iso-budget contour that lies at minimal distance to the diagonal. From here onwards, $\frac{\mathrm{d}t_\ell}{\mathrm{d}\beta} = \frac{\mathrm{d}t_\ell}{\mathrm{d}\beta} = 0$.

We sum up the general findings of this section in

Result 2 *Suppose that individual well-being is lower the more tax rates on capital and labour differ.*

1. *A greater concern for tax equity calls for a higher tax on capital and for a more narrow gap between capital and labour tax rate.*
2. *Starting from weak levels, a strengthening of tax equity concerns calls for a lower tax on labour. However, if equity concerns become sufficiently strong, increasing the labour tax rate may eventually become optimal. This happens if and only if the optimal tax mix leads*

the economy onto the decreasing part of the Laffer curve for the capital tax.[10]

The last effect in item b) is interesting in itself. Already Boskin and Sheshinski (1978) conjectured that the inclusion of social preferences (in their case: concerns about relative consumption) potentially removes the economic barriers for increasing tax rates to the point where disincentive effects actually reduce tax revenues. Tax equity concerns provide a case in point here. In an alternative interpretation the equity norm may represent tax envy. Then the choice of economically questionable tax policies (i.e., operating in the decreasing part of the Laffer curve) is reminiscent of Elster's (1991, p. 66) warning that assuaging its envy may come at the expense of a society's substantial economic interests.[11]

It is informative to study how the level of equilibrium labour supply $L^*(t_\ell, t_k)$ varies with the strength of tax equity concerns. From (12) in conjunction with (4) to (6), (34), and (33) we obtain:[12]

$$\begin{aligned}\frac{\mathrm{d}L^*}{\mathrm{d}\beta} &= \frac{\partial L^*}{\partial t_\ell}\frac{\mathrm{d}t_\ell}{\mathrm{d}\beta} + \frac{\partial L^*}{\partial t_k}\frac{\mathrm{d}t_k}{\mathrm{d}\beta} = -\frac{\partial \ell^S}{\partial w}\cdot\left(\frac{\mathrm{d}t_\ell}{\mathrm{d}\beta} + k\frac{\mathrm{d}t_k}{\mathrm{d}\beta}\right)\\ &= -\frac{\partial \ell^S}{\partial w}\cdot\frac{\mathrm{d}t_\ell}{\mathrm{d}\beta}\cdot\frac{(1+k)\Omega_k}{\lambda G_k}\\ &= \underbrace{\frac{\partial \ell^S}{\partial w}}_{>0}\cdot\underbrace{\frac{1}{D}\cdot\Omega_{\ell\beta}\cdot\frac{(1+k)^2}{k}}_{>0}\cdot\underbrace{\left(G_k - \frac{\Omega_k}{\lambda}\right)}_{>0}\cdot\underbrace{\frac{\Omega_k}{\lambda}}_{<0} < 0\end{aligned}$$

Hence,

Corollary 1 *People in an economy with stronger concerns for tax equity work less.*

This observation should be interpreted against the backdrop that the equity norm itself does not exert any incentive effects (in the present scenario). The impact of tax equity concerns on labour supply is entirely indirect, via the attending optimal tax structure.

3.3 Comparative statics with incentive effects

Now we turn to the effects of stronger fairness concerns when tax equity concerns impact on work incentives (i.e., $\psi_\ell > 0 > \psi_k$ and $\Omega_\ell = \Omega_k \equiv 0$). This change affects indifference maps for

[10]The economy will never operate on the downward-sloped part of its total Laffer curve (G_ℓ, G_k both negative); G_ℓ must be positive from the FOC (18).

[11]Lévy-Garboua et al. (2009) experimentally show that workers who respond sensitively to violations of a tax equity norm refuse to work. This implies that higher tax rates (viz., more severe violations of the equity norm) lead to decreasing tax revenues. This undesirable Laffer curve effect has to be clearly distinguished from our observation where it may be optimal to bring the economy on the downward-sloped side of the (partial) Laffer curve.

[12]The positive sign of the bracketed expression is implied by $G_\ell > 0$ in (32).

$V(t_\ell, t_k)$ as well as the iso-budget contour $G(t_\ell, t_k) = \bar{g}$ – which now changes its shape when equity concerns vary.

For low levels of equity concerns, the effects are similar as in the "level effect"-scenario of the previous section: starting from $t_k = 0$, stronger equity concerns call for raising t_k and lowering t_ℓ. Eventually, higher equity concerns may call for an increase in the labour tax rate t_ℓ. However, unlike in the previous scenario, this does neither imply nor necessitate that the economy is on the decreasing leg of its Laffer curve. We demonstrate this in

Example 2. As above, preferences are parameterized by $u = c - 0.5 \cdot \psi \cdot \ell^2$. But now ψ is not a constant but a function given by

$$\psi = \psi_0 + 0.5 \cdot \beta \cdot (t_\ell - t_k)^2. \tag{35}$$

The level of spending is again exogenously fixed. Throughout the numerical examples, we set ψ_0 equal to 0.1 and $\bar{g} = 0.12$; all other parameters take on the same values as in Example 1.[13]

The four panels in Figure 2 depict the government iso-budget contour (solid line) and indifference curves (dashed lines) for different values of β. Unlike in Figure 1, the iso-budget contours vary with the strength of the equity norm. They move into the direction of the 45°-line in (t_ℓ, t_k)-space and tend to bend upwards when β increases. The reason is that (starting from a situation with $t_\ell > t_k$) a higher capital tax motivates people to work more. The same level of tax revenues can be generated at a lower labour tax than in the absence of incentive effects. Moreover, when work disincentives from tax differentials are very large, tax revenues can only be earned when the zax rates are sufficiently close to each other.[14] The effect of β on the shape of indifference curves looks qualitatively similar as in Figure 1.

Figure 2 shows that the optimal capital tax rate decreases monotonically with β. Initially, the tax rate on labour falls. However, as the transition from the third to the fourth panel shows, the labour tax rate eventually may increase again. Observe that all optimal tax mixes lie on the lower and decreasing arc of the iso-budget contours. I.e., tax revenues are increasing in either tax rate.

Result 3 *Suppose that increasing differences between labour and capital tax rates depress work incentives. Starting from weak levels, a strengthening of tax equity concerns calls for a higher tax on capital and a lower tax on labour. However, if equity concerns become sufficiently strong, increasing the labour tax rate may eventually become optimal.*

[13] For $\beta = 0$, scenarios here and in Example 1 coincide. Cf. also the upper left panels in Figures 1 and 2.

[14] In the extreme case when people only care for tax equity, $t_\ell = t_k$ must hold (for any given t_k); otherwise people would not supply any labour at all.

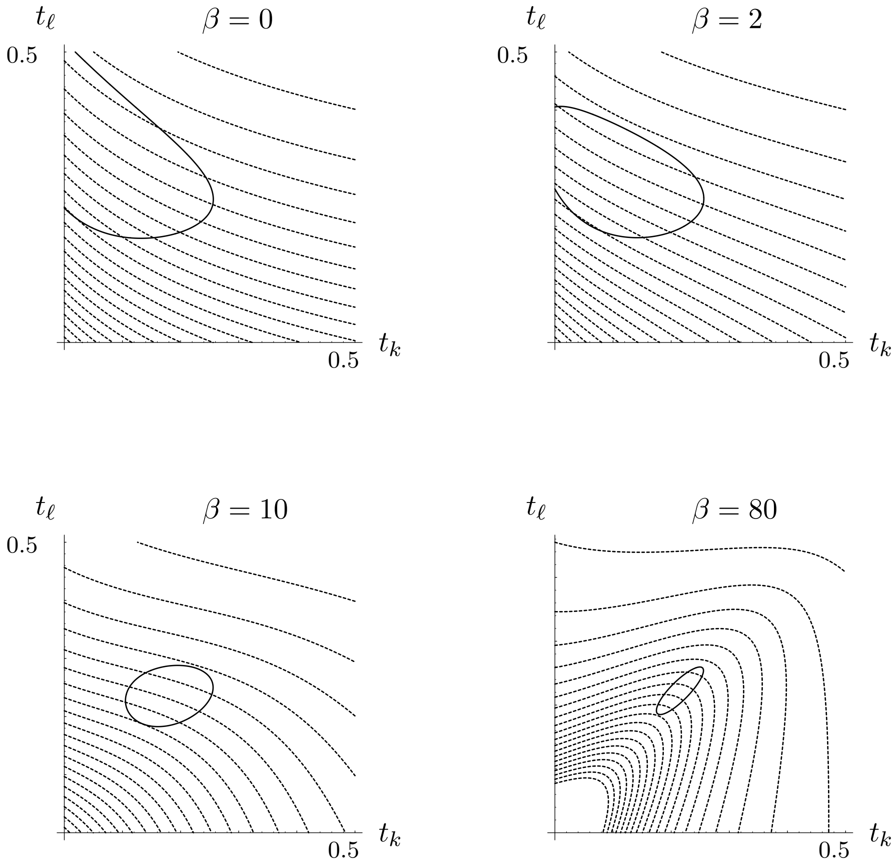

Figure 2: Tax equity with incentive effects. Government iso-budget contours (solid) and indifference curves (dashed) for varying values of β.

4 Endogenous government expenditure

We now analyze the effects of tax equity concerns when government spending is endogenous. Such an exercise appears worthwhile since tax equity norms make government activities less desirable *per se*: Equity concerns call for the adoption of tax mixes that are excessively costly from a pure efficiency perspective; tax norms increase the marginal costs of public funds. This might impact on the optimal level of government expenditures – and a first intuition would suggest that greater concerns for tax equity call for smaller governments. But let us better have a closer look.

4.1 Capital taxation and the size of government

We recycle the set-up of Section 2. Again, the government chooses t_ℓ and t_k in order to maximize social welfare (= indirect utility). Allowing g to vary rather than being preset, the government objective function reads as

$$V(t_\ell, t_k) := (w(r+t_k) - t_\ell) \cdot L^*(t_\ell, t_k) - E(L^*(t_\ell, t_k), \psi(t_\ell, t_k)) + h(G(t_\ell, t_k)) - \Omega(t_\ell, t_k) \quad (36)$$

where $L^*(\cdot)$ and $G(\cdot)$ are defined as in (12) and (13). Differentiating V, as defined in (36), with respect to tax rates (t_k, t_ℓ) and using the Envelope Theorem gives:

$$\frac{\partial V}{\partial t_\ell} = L^* \cdot \left[h'(G) - 1\right] + h'(G) \cdot (t_\ell + t_k k) \cdot \frac{\partial L^*}{\partial t_\ell} - E_\psi \cdot \psi_\ell - \Omega_\ell \quad (37)$$

$$\frac{\partial V}{\partial t_k} = kL^* \cdot \left[h'(G) - 1\right] + h'(G) \cdot \left((t_\ell + t_k k) \cdot \frac{\partial L^*}{\partial t_k} + t_k k' L^*\right) - E_\psi \cdot \psi_k - \Omega_k \quad (38)$$

$$= k \cdot \frac{\partial V}{\partial t_\ell} + h'(G) t_k k' L^* + k\Omega_\ell - \Omega_k.$$

These conditions give rise to

Result 4 *1. In the absence of tax equity concerns, capital should optimally never be taxed.*

2. In the presence of tax equity concerns, whether they shape incentives or just affect utility levels, a zero tax rate on capital is never optimal.

3. The level of the government-provided good is always[15] *inefficiently low.*

The analytical results on the tax structure and their interpretation coincide with those in Section 3.1. Also the proof of items 1 and 2 is similar as for Result 1. Consequently, we omit it (the optimality of a zero tax rate on capital was also proven by Fuest and Huber, 2001).
The underprovision of the government good in the absence of tax equity concerns (i.e., when $\psi_\ell = \Omega_\ell = 0$) can be seen from equating (37) to zero with $t_k = 0$; we then get the Atkinson-Stern Rule:

$$h'(G) = \frac{1}{1 + \frac{\partial \ell^S}{\partial w} \cdot \frac{t_\ell}{\ell^S}} > 1. \quad (39)$$

Hence, the marginal willingness-to-pay for the government good exceeds the marginal rate of transformation (which is equal to one). The reason for the underprovision is the financing through a distortionary (labour) tax. When tax equity concerns only affect the level of well-being (i.e., $\Omega_\ell > 0 = \psi_\ell$), the costs of public funds further increase since government expenditures will now partly be financed through the even less efficient capital tax.

[15] There is one (immaterial) exception: With exogenous labour supply and in the absence of tax equity concerns, government expenditures are optimally at their efficient level. This can be seen in (37) when $\partial L^*/\partial t_\ell = \psi_\ell = \Omega_\ell \equiv 0$.

4.2 Comparative statics with level effects

As in the previous section, let us consider the case that the feeling of inequitable taxation has no incentives effects, i.e., $\psi_k = \psi_\ell \equiv 0$). Only the level effect of tax equity concerns is operative (i.e., $\Omega_k \leq 0 \geq \Omega_\ell$ with at least one strict inequality). For simplicity (and as in Section 3) let us assume that Ω is given by (27): $\Omega = \tilde{\Omega}(\beta \cdot (t_\ell - t_k))$. Though comparative statics get quite messy, some reasonably general results are available. Our first finding is in the spirit of Result 2; it holds irrespective of whether labour supply is endogenous or exogenous:

Result 5 *Suppose that tax equity concerns are not too strong initially (i.e., β is positive, but small).*

1. *A more intense concern for tax equity, represented by an increase β, calls for a decrease in the tax rate on labour, an increase in the tax rate on capital and, consequently, a decrease in the tax rate differential.*
2. *The optimal level of government expenditures decreases when concerns for tax equity get stronger.*

The **proof** of this result is in Appendix 1. From the second item in Result 5, stronger concerns for tax equity call for cutting back the size of the public sector. The intuition is straightforward: Capital taxation is economically more costly than labour taxation. If equity concerns drive the economy to rely on the less efficient tax instrument more strongly, the economic costs of providing the government good increase. Consequently, its optimal supply decreases.

While Result 5 sounds plausible, a strong caveat has to be added: the qualification of weak equity concerns made at the opening of the proposition is indeed essential. If concerns with tax equity are strong already, a further increase may call for an increase in labour taxes and/or a rise in government expenditures. This is illustrated by means of

Example 3: As in Example 1, we choose $y = f(k) = k^\alpha$. To arrive at explicit solutions, we further suppose that labour supply is inelastic at some level $\bar{L} > 0$. Utility is given by $u = c - \Omega$, where $\Omega = 0.5\beta(t_\ell - t_k)^2$.

Figure 3 illustrates optimal policies when parameter values are set to $\bar{L} = 0.2$, $\alpha = 1/3$, and $r = 0.2$. The first graph shows that β and t_k are strictly positively related, as expected. The other three graphs plot, respectively, $(t_\ell - t_k)$, t_ℓ, and optimal government expenditure $G(t_\ell(\beta), t_k(\beta))$ against t_k – which translates, by the positive association between β and t_k from the first graph, into similarly shaped plots against β. As can be seen, t_k and the tax rate differential $(t_\ell - t_k)$ move monotonically with β, but the labour tax rate initially falls and later rises when tax equity concerns intensify beyond some level. This eventual non-monotonicity of the labour tax rate in the strength of equity considerations may be explained as follows:

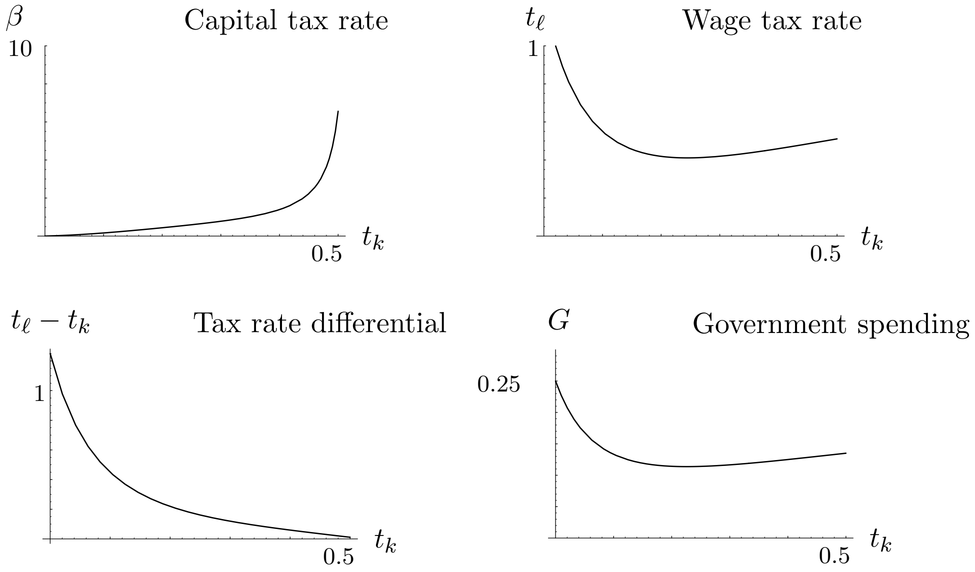

Figure 3: Optimal policies when government spending is endogenous.

With strong equity concerns, the tax rate on capital is quite high and government finance is economically quite costly.[16] To reduce the economic costs of a further narrowing (demanded by even stronger equity concerns) in the tax gap may then call for a stronger reliance on the labour tax, which is lump-sum here. Naturally, the increase in the labour tax must not offset the rise of the capital tax rate; the tax differential is bound to decrease.

The fourth graph in Figure 3 shows that also government expenditures are non-monotonic in β, first falling, then rising. The simultaneous increase in both tax rates just explained yields higher revenues for the government. Thus, the first-order intuition that an increase in the marginal costs of public funds (due to greater reliance on capital taxes, induced by larger equity concerns) always calls for smaller government is not correct. An equity-induced reduction in the tax spread may well go along with a larger government budget.

Result 6 *In spite of a greater reliance of government finance on capital taxes, stronger tax equity concerns may call for an expansion of government expenditures.*

Of course, Result 5 remains valid in that government expenditure is always inefficiently low in the presence of equity concerns, even though it may increase once equity concerns get stronger.[17] The upper left panel in Figure 3 depicts a positive relationship between the strength of equity concerns and the optimal capital tax rate. Other than the effects shown in the remaining three

[16] This effect is more severe the more elastically capital responds to higher taxation.

[17] In the example, an inelastic labour supply is assumed. Hence, the third item in Result 3 does not strictly apply (see previous footnote). Rather, in the example G is at its efficient level for $\beta = 0$: we have $G = 0.25$, which solves $1 = h'(G) = 0.5G^{-0.5}$.

panels, this relationship is indeed general in the case of exogenous labour supply, but not in the case of endogenous labour supply:

Result 7 *1. For endogenous government spending and exogenous labour supply, a stronger concern with tax equity always calls for an increase in the capital tax rate.*

2. For endogenous government spending but endogenous labour supply, a stronger concern with tax equity may call for a lower tax rate on capital. A necessary (but insufficient) condition for this to occur is that the labour supply function is strictly convex in the net wage (i.e., $\partial^2 \ell^S / \partial w^2 > 0$).[18]

The **proof** is in Appendix 2. Result 7 shows that the a priori intution that a higher degree of tax equity will call for higher taxes on capital income is only found to be true for the case of exogenous labour supply. For endogenous labour supply, a higher concern for equal tax rates may also be associated with lower taxes on capital income, given that labour supply is sufficiently convex. The intuition is as follows: With relatively strong concerns for tax equity, the capital tax rate will optimally be positive (this follows from Result 4). Even stronger equity concerns call for further narrowing the spread between labour and capital taxes. One way to achieve this could be to cut back both tax rates, but with a larger reduction in the labour tax rate. These tax cuts will increase the gross wage (lowering t_k boosts k), the net wage ($w - t_\ell$ will increase), indirect utility V, and finally labour supply (both via the standard wage effect and the reduced disincentive by the smaller tax gap). If these effects are strong enough (here the convexity requirement jumps in), such a move need not reduce, and may even increase, government expenditure, rendering the joint tax cut indeed feasible and optimal. Recall, however, the necessary requirements: strong equity concerns and highly elastic labour supply.

For exogenous labour supply, the comparative statics for the capital tax rates are the only ones that can be unambiguously characterized in Result 7. All other comparative statics depend on the sign and magnitude of k'', i.e., on the curvature of the capital demand function or, which is the same, on the third derivative of the production function $f(k)$. In addition, the case of an endogenous labour supply entails a complex interaction between equity and efficiency effects: Closing the spread between labour and capital tax rates leads to a higher labour supply via reduced disincentives for work. On the other hand, it also increases the excess burden of taxation, due to the mobility of capital. These opposing effects make it virtually impossible to derive any predictions of at least moderate generality for the optimal tax mix when fairness concerns are strong and labour supply is exogenous. However, Example 3 shows that counter-intuitive effects may arise already when labour supply is fixed; by a continuity argument this cannot be excluded in case of an endogenous labour supply either.

[18] In our model, this convexity condition is equivalent to the marginal disutility from labour being concave: further implicit differentiation of (3) gives $\partial^2 \ell / \partial w^2 = E_{\ell\ell\ell} / (-E_{\ell\ell})^3$.

5 Conclusion

In this paper, we augmented a standard model for factor taxation in small open economies by concerns about tax equity. Violating standard neoclassical assumptions, we endowed individuals with a direct preference over tax rates, allowing for a distinction between equity considerations that shape work incentives and such that just scale up or down utility levels. Optimal tax policies have to balance three policy goals: (i) maintaining a solid capital base in spite of international mobility, (ii) generating sufficiently high tax revenue, and (iii) avoiding large imbalances between capital and labour taxation.

The third requirement upsets the standard recommendation of exempting capital from taxation. Moreover, our comparative statics reveal some unexpected non-monotonicities: With weak concerns about tax equity the tax on capital should be higher, the tax on labour and (endogenous) government expenditures lower, relative to an economy that is unconcerned with tax equity. However, with strong concerns for tax equity these intuitive patterns turn out to be unstable: capital taxes might decrease, labour taxes increase, and government expenditure go up.

As we have shown, the potential implications of concerns for tax equity on the optimal structure of factor income taxation can be substantial. Moreover, they vary considerably with the strength of equity motives. Yet, while from the arguments provided in the introduction (justice principles, fairness considerations, relative deprivation, envy, etc.) the prevalence of such equity concerns appears highly plausible, we can at present not provide any measurable evidence for their intensity. We hope that by demonstrating the potential policy relevance of equity concerns, we shall encourage empirical work on the subject.

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Appendix 1: Proof of Result 5

Tax rates (item 1)

From (27), $\Omega_{\ell\beta} = -\Omega_{k\beta} = \tilde{\Omega}' + \beta(t_\ell - t_k)\tilde{\Omega}'' > 0$. Using (37) and (38), the comparative statics of (t_ℓ, t_k) with respect to β are given by:

$$\begin{aligned} \begin{pmatrix} V_{\ell\ell} & V_{\ell k} \\ V_{\ell k} & V_{kk} \end{pmatrix} \cdot \begin{pmatrix} \mathrm{d}t_\ell \\ \mathrm{d}t_k \end{pmatrix} &= -\begin{pmatrix} V_{\ell\beta} \\ V_{k\beta} \end{pmatrix} \mathrm{d}\beta \\ &= \left[\tilde{\Omega}' + \beta \cdot (t_\ell - t_k) \cdot \tilde{\Omega}''\right] \cdot \begin{pmatrix} +1 \\ -1 \end{pmatrix} \mathrm{d}\beta \end{aligned}$$

(with $V_{xy} = \partial^2 V/(\partial t_x \partial t_y)$ and $V_{x\beta} = \partial^2 V/(\partial t_x \partial\beta)$). Consequently, by Cramer's Rule:

$$\frac{\mathrm{d}t_\ell}{\mathrm{d}\beta} = \frac{1}{D} \cdot \left[\tilde{\Omega}' + \beta \cdot (t_\ell - t_k) \cdot \tilde{\Omega}''\right] \cdot (V_{kk} + V_{\ell k}) \tag{40}$$

$$\frac{\mathrm{d}t_k}{\mathrm{d}\beta} = -\frac{1}{D} \cdot \left[\tilde{\Omega}' + \beta \cdot (t_\ell - t_k) \cdot \tilde{\Omega}''\right] \cdot (V_{\ell\ell} + V_{\ell k}) \tag{41}$$

$$\frac{\mathrm{d}(t_\ell - t_k)}{\mathrm{d}\beta} = \frac{1}{D} \cdot \left[\tilde{\Omega}' + \beta \cdot (t_\ell - t_k) \cdot \tilde{\Omega}''\right] \cdot (V_{\ell\ell} + V_{kk} + 2V_{\ell k}) . \tag{42}$$

Here,

$$D := V_{\ell\ell} V_{kk} - V_{\ell k}^2 \tag{43}$$

is the determinant of the matrix on the LHS of (28). In a welfare maximum, $D > 0$ as well as $V_{kk}, V_{\ell\ell} < 0$. From (27), $\Omega_{\ell\ell} = \Omega_{kk} = -\Omega_{\ell k} = \beta^2 \tilde{\Omega}'' > 0$. The claims in item 1 of Result 5 are, thus, proven if (but not only if) $V_{\ell k} < 0$.[19]

As an intermediate result (which will also be helpful in the proof of item 2) we report:

$$V_{\ell k} = k V_{\ell\ell} + A_1 \tag{44}$$

$$V_{kk} = k V_{\ell k} + A_2 \tag{45}$$

where we set

$$A_1 := h''(G) \frac{\partial G}{\partial t_\ell} L t_k k' - h'(G) t_k k' \frac{\partial \ell}{\partial w} + (k+1)\beta^2 \tilde{\Omega}'' \geq 0; \tag{46}$$

$$\begin{aligned} A_2 := \; & h''(G) L t_k k' \frac{\partial G}{\partial t_k} - h'(G) k t_k k' \frac{\partial \ell}{\partial w} + h'(G) L (2k' + t_k k'') \\ & -(k+1)\beta^2 \tilde{\Omega}'' - h' k' \frac{\partial \ell}{\partial w}(t_\ell + t_k k) - k' L. \end{aligned} \tag{47}$$

[19] In fact, this condition is overly strict. It would suffice that $V_{\ell k} < \max\{-V_{\ell\ell}, -V_{kk}\}$.

Equations (44) and (45) are proven below.

From Result 3 we get that $t_k = 0$ for $\beta = 0$. Hence, $A_1 = 0$ in this case. However, then $V_{\ell k} < 0$ follows from (44). Hence, at $\beta = 0$, we get from (40 to (42) that $\frac{\mathrm{d}t_\ell}{\mathrm{d}\beta} < 0$, $\frac{\mathrm{d}t_k}{\mathrm{d}\beta} > 0$, and $\frac{\mathrm{d}(t_\ell - t_k)}{\mathrm{d}\beta} < 0$. By continuity, the same holds for small positive values of β (and, thus, t_k). ■

Government expenditures (item 2)

Observe that

$$\frac{\mathrm{d}G}{\mathrm{d}\beta} = G_k \cdot \frac{\mathrm{d}t_k}{\mathrm{d}\beta} + G_\ell \cdot \frac{\mathrm{d}t_\ell}{\mathrm{d}\beta}.$$

Suppose now that $\beta = 0$ and, thus, $t_k = 0$ (from Result 3). Then, using (15) and (14), we obtain

$$\begin{aligned} \frac{\mathrm{d}G}{\mathrm{d}\beta} &= \left(\frac{\partial L}{\partial t_k} t_\ell + L^* k\right) \cdot \frac{\mathrm{d}t_k}{\mathrm{d}\beta} + \left(\frac{\partial L}{\partial t_\ell} t_\ell + L^*\right) \cdot \frac{\mathrm{d}t_\ell}{\mathrm{d}\beta} \\ &= \left[\frac{\partial L}{\partial t_\ell} t_\ell + L^*\right] \cdot \left(k \frac{\mathrm{d}t_k}{\mathrm{d}\beta} + \frac{\mathrm{d}t_\ell}{\mathrm{d}\beta}\right) \\ &= G_\ell \cdot \left(k \frac{\mathrm{d}t_k}{\mathrm{d}\beta} + \frac{\mathrm{d}t_\ell}{\mathrm{d}\beta}\right). \end{aligned}$$

Recall that $G_\ell > 0$ in an optimum.[20] Hence, $\frac{\mathrm{d}G}{\mathrm{d}\beta} < 0$ if and only if $k \frac{\mathrm{d}t_k}{\mathrm{d}\beta} + \frac{\mathrm{d}t_\ell}{\mathrm{d}\beta} < 0$. Verify that, using (44) and (45) and the fact that $A_1 = 0$ for $\beta = 0$,

$$\begin{aligned} k \frac{\mathrm{d}t_k}{\mathrm{d}\beta} + \frac{\mathrm{d}t_\ell}{\mathrm{d}\beta} &= \frac{1}{D} \cdot \left[\tilde{\Omega}' + \beta \cdot (t_\ell - t_k) \cdot \tilde{\Omega}''\right] \cdot (-kV_{\ell\ell} - kV_{\ell k} + V_{kk} + V_{\ell k}) \\ &= \frac{1}{D} \cdot \left[\tilde{\Omega}' + \beta \cdot (t_\ell - t_k) \cdot \tilde{\Omega}''\right] \cdot \left(-k^2 V_{\ell\ell} + k(kV_{\ell\ell} + A_1) + A_2\right) \\ &= \frac{A_2}{D} \cdot \left[\tilde{\Omega}' + \beta \cdot (t_\ell - t_k) \cdot \tilde{\Omega}''\right]. \end{aligned} \tag{48}$$

In (48) both the square-bracketed expression and D are positive. Moreover, using the definition of D in (43) and, again, (44) and (45) and the fact that $A_1 = 0$ at $\beta = 0$,

$$D = V_{\ell\ell}(A_2 - kA_1) - A_1^2 = V_{\ell\ell} A_2.$$

As $V_{\ell\ell} < 0$ in an optimum, D being positive necessitates $A_2 < 0$. In turn, we get that (48) is negative and, thus, $\frac{\mathrm{d}G}{\mathrm{d}\beta} < 0$ at $\beta = 0$. Again, by continuity, this also holds for $\beta > 0$, but small. ■

[20] See (37) and (38): Conditions $V_\ell = V_k = 0$ require that $G_\ell > 0$ and $G_k - \frac{1}{h'}\Omega_k > 0$, respectively.

Proof of (44) and (45)

Calculate:

$$\begin{aligned}
V_{\ell\ell} &= -\frac{\partial L}{\partial t_\ell} + h''(G)\left(\frac{\partial G}{\partial t_\ell}\right)^2 + h'(G)\frac{\partial^2 G}{\partial t_\ell^2} - \Omega_{\ell\ell} \\
&= \frac{\partial \ell}{\partial w} + h''(G)\left(L - (t_\ell + t_k k)\frac{\partial \ell}{\partial w}\right)^2 + h'(G)\left(2\frac{\partial L}{\partial t_\ell} + (t_\ell + t_k k)\frac{\partial^2 L}{\partial t_\ell^2}\right) - \Omega_{\ell\ell} \\
&= \frac{\partial \ell}{\partial w} + h''(G)\left(L - (t_\ell + t_k k)\frac{\partial \ell}{\partial w}\right)^2 + h'(G)\left(-2\frac{\partial \ell}{\partial w} + (t_\ell + t_k k)\frac{\partial^2 \ell}{\partial w^2}\right) - \beta^2\tilde{\Omega}''. \quad (49)
\end{aligned}$$

Moreover,

$$\begin{aligned}
V_{\ell k} &= -\frac{\partial L}{\partial t_k} + h''(G)\frac{\partial G}{\partial t_\ell}\frac{\partial G}{\partial t_k} + h'(G)\frac{\partial^2 G}{\partial t_\ell \partial t_k} - \Omega_{\ell k} \\
&= k\frac{\partial \ell}{\partial w} + h''(G)\left(L - (t_\ell + t_k k)\frac{\partial \ell}{\partial w}\right)\left(L(k + t_k k') + (t_\ell + t_k k)\frac{\partial L}{\partial t_k}\right) \\
&\quad + h'(G)\left(\frac{\partial L}{\partial t_k} + (k + t_k k')\frac{\partial L}{\partial t_\ell} + (t_\ell + t_k k)\frac{\partial^2 L}{\partial t_\ell \partial t_k}\right) - \Omega_{\ell k} \\
&= k\frac{\partial \ell}{\partial w} + h''(G)\left(L - (t_\ell + t_k k)\frac{\partial \ell}{\partial w}\right)\left(k\left[L - (t_\ell + t_k k)\frac{\partial \ell}{\partial w}\right] + L t_k k'\right) \\
&\quad + h'(G)\left(-2k\frac{\partial \ell}{\partial w} - t_k k'\frac{\partial \ell}{\partial w} + k(t_\ell + t_k k)\frac{\partial^2 \ell}{\partial w^2}\right) - \Omega_{\ell k} \\
&= kV_{\ell\ell} + A_1.
\end{aligned}$$

With A_1 as defined in (46), this is (44). Finally,

$$\begin{aligned}
V_{kk} &= w'\frac{\partial L}{\partial t_k} + Lw'' + h''(G)\left(\frac{\partial G}{\partial t_k}\right)^2 + h'(G)\frac{\partial^2 G}{\partial t_k^2} - \Omega_{kk} \\
&= k^2\frac{\partial \ell}{\partial w} - Lk' + h''(G)\left(k\left[L - (t_\ell + t_k k)\frac{\partial \ell}{\partial w}\right] + L t_k k'\right)^2 \\
&\quad + h'(G)\left(2(k + t_k k')\frac{\partial L}{\partial t_k} + (t_\ell + t_k k)\frac{\partial^2 L}{\partial t_k^2} + (2k' + t_k k'')L\right) - \Omega_{kk} \\
&= k^2\frac{\partial \ell}{\partial w} - Lk' + h''(G)\left(k\left[L - (t_\ell + t_k k)\frac{\partial \ell}{\partial w}\right] + L t_k k'\right)^2 \\
&\quad + h'(G)\left(-2k^2\frac{\partial \ell}{\partial w} - k t_k k'\frac{\partial \ell}{\partial w} + k^2(t_\ell + t_k k)\frac{\partial^2 \ell}{\partial w^2} + (2k' + t_k k'')L - k t_k k'\frac{\partial \ell}{\partial w} - k'\frac{\partial \ell}{\partial w}(t_\ell + t_k k)\right) \\
&\quad - \Omega_{kk} \\
&= k^2\frac{\partial \ell}{\partial w} - Lk' + h''(G)\left\{k\left(L - (t_\ell + t_k k)\frac{\partial \ell}{\partial w}\right)\left(k\left[L - (t_\ell + t_k k)\frac{\partial \ell}{\partial w}\right] + L t_k k'\right)\right. \\
&\qquad \left. + L t_k k'\left(L t_k k' + k\left(L - (t_\ell + t_k k)\frac{\partial \ell}{\partial w}\right)\right)\right\} \\
&\quad + h'(G)\left(-2k^2\frac{\partial \ell}{\partial w} - k t_k k'\frac{\partial \ell}{\partial w} + k^2(t_\ell + t_k k)\frac{\partial^2 \ell}{\partial w^2} + (2k' + t_k k'')L - k t_k k'\frac{\partial \ell}{\partial w} - k'\frac{\partial \ell}{\partial w}(t_\ell + t_k k)\right) \\
&\quad - \Omega_{kk} \\
&= kV_{\ell k} + A_2.
\end{aligned}$$

With A_2 as defined in (47), this coincides with (45). ■

Appendix 2: Proof of Result 7

Exogenous labour supply (item 1)

From (41), $\mathrm{d}t_k/\mathrm{d}\beta$ is opposite in sign to $V_{\ell\ell}+V_{\ell k}$. Using (44), we get that $V_{\ell\ell}+V_{\ell k} = (1+k)V_{\ell\ell}+A_1$. With exogenous labour supply, (46) gives $A_1 = h''(G)L^2 t_k k' + (k+1)\beta^2\tilde{\Omega}''$. Moreover, from (49), $V_{\ell\ell} = h''(G)L^2 - \beta^2\tilde{\Omega}''$ when labour supply is exogenous. Hence,

$$V_{\ell\ell} + V_{\ell k} \quad = \quad h''(G)L^2(1 + k + t_k k') = h''(G)L(G_\ell + G_k) < 0,$$

where we used (15) and (14) and exploited that from (32), it follows that

$$G_\ell + G_k = (1 + \frac{1}{k})(G_k - \frac{1}{h'}\Omega_k) \tag{50}$$

must be positive in an inner solution.[21] Thus, $\mathrm{d}t_k/\mathrm{d}\beta > 0$. ■

Endogenous labour supply (item 2)

From (41) and 44, $\mathrm{sign}[\mathrm{d}t_k/\mathrm{d}\beta] = -\mathrm{sign}[(1+k)V_{\ell\ell} + A_1]$. With endogenous labour supply, (49) and (46) give

$$\begin{aligned}&(1 + k)V_{\ell\ell} + A_1 \qquad (51)\\ &= \underbrace{\frac{\partial \ell}{\partial w}(1 + k)(1h')}_{<0} + \underbrace{h''G_\ell(G_\ell + G_k)}_{<0} + \underbrace{h'(-\frac{\partial \ell}{\partial w})(1 + k + t_k k')}_{<0} + h'(t_\ell + t_k k)\frac{\partial^2 \ell}{\partial w^2}(1 + k).\end{aligned}$$

Here we used that $\Omega_{kk} = -\Omega_{\ell\ell}$. The first and second term on the RHS of (51) are negative since $h' > 1$, $G_\ell > 0$ and $G_\ell + G_k > 0$ must hold in an inner optimum. The sign of the third term in (51) can be determined from (15), (14) and (50) which yield that $L(1 + k + t_k k') = G_\ell + G_k + \frac{\partial \ell}{\partial w}(t_\ell + t_k k)(1 + k) > 0$. Thus, $\partial^2\ell/\partial w^2 < 0$ is sufficient for (51) to be negative and, thus, for $\mathrm{d}t_k/\mathrm{d}\beta > 0$. ■

[21] See also footnote 20. Note that in (32) we have to substitute for λ with h' to obtain the analogue for endogenous government spending.