USING MATRIX MODELS FOR SIMULTANEOUS TAX PLANNING AND ACCOUNTING POLICY OPTIMIZATION WITHIN THE GERMAN LEGAL AREA

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Abstract

Matrix models have been developed in order to plan and control the effects of complex interrelationships as well as to prepare for and make optimum decisions. For the purpose of tax planning, our investigations focus particularly on simultaneous analyses of the effects and structure of corporate tax, trade tax, deferred taxes, and performance indicators within the German legal area. In addition, the models can also be useful in accounting policy optimization when taking into account the amendments to the German authoritative principle that tax accounting should be based on commercial accounting.

Keywords: Tax Planning, Accounting Policy, Germany, Law

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1. Introduction

Result-dependent successes (e.g., royalties, corporate income tax, trade tax, and deferred taxes) and the annual balance sheet result are interdependent. On the one hand, the result-dependent successes can only be determined with the final balance sheet result and, on the other hand, the final balance sheet result can only be calculated with the result-dependent successes. Therefore, it is necessary to determine these values by using an equation system with which the balance sheet result and the result-dependent successes can be calculated simultaneously. The benefits of simultaneous planning can be used as an instrument of tax planning and management (Freidank 1996, p. 148-154; Freidank and Sassen 2013, p. 93-115; Herzig and Zimmermann 1998, p. 1141-1150; Horváth 2012, p. 247-256). This system must be able to record the financial interdependencies between tax effects, the commercial-law balance sheet, distribution rules, and accounting-policy objectives at the same time. Therefore, we develop a simultaneous equation system to provide the results necessary to make the required decisions.

Furthermore, these linear equation systems can be used for recording result-dependent outcomes within the scope of balance-sheet design processes (accounting policy) in the German legal area. The developed model approaches show the effective and deferred revenue tax effects of an accounting period transparently. Thus, they are also usable in internal and external tax reporting, which includes, among other things, the planning, controlling, and reporting of tax risks (Freidank and Mammen 2008, p. 285-292; Meyer 2010, p. 353-371; Mammen 2011, p. 299-500). Additionally, the auditor may use the simultaneous equation system to review the individualized result-dependent expenses or revenues. For this purpose, only the corresponding variables (e.g., tax rates, royalty rates, and tax-law modifications) are required to determine the commercial-law result if standard software will be used.

Recent changes to the German commercial and tax law[10] have required the further development of existing simultaneous equation systems (Freidank 1990a, p. 261-279; Freidank 1999, p. 811-820; Freidank 2004, p. 447-469; Hahn and Schneider 1998, p. 333-405). Thus, we will show how these approaches must be adjusted to the current tax and commercial law provisions in order to achieve optimal decisions. The simultaneous equation systems are presented as transparent matrix models. The paper is particularly targeted at the integration of the effective tax result, deferred taxes, and the determination of royalties into the matrix models.

The remainder of this paper is organized as follows: Section 2 contains a modification of the basic model and shows adjustments of the simultaneous equation system, commercial-law conditions for the consideration of deferred taxes and an integration of deferred taxes into the model. Section 3 analyzes expansions for accounting policy optimization based on a standard approach. Furthermore, model variations are shown which take into account the novation of the German authoritative principle that tax accounting should be based on commercial accounting. Finally, section 4 summarizes the results.

[10] The paper focuses on the German Corporate Tax Act L (KStG), Solidarity Surcharge Act (SolZG), Trade Tax Act (GewStG), and the Commercial Code (HGB) in particular.

2. Modification of the Basic Model

2.1 Adjustment of the Simultaneous Equation System

Based on a preliminary annual surplus before taxes (vJvor[11]) and royalties expenses (TA), the commercial-law annual surplus (Jnach) can be defined as follows (KSt = corporate tax; GewSt = trade tax; LS = deferred tax result):

$$vJvor - KSt - GewSt - LS - TA = Jnach \quad (1)$$

$$Jnach + KSt + GewSt + LS + TA = vJvor. \quad (2)$$

The value vJvor can be taken from current accounting. It is basically made up of the preliminary annual surplus of the externally oriented accounting after realization of all annual closing entries (without result-dependent outcome). Assuming that the definite burden for corporation tax purposes (sd) = 15 % is applied to the tax base for corporation tax purposes (zvE) (sec. 23 para. 1 KStG), the following applies when taking into account a solidarity surcharge (soli) of 5.5% to the determined corporate tax (sec. 2 no. 3, sec. 3 para. 1 nos. 1, 2, sec. 4 SolZG):

$$KSt = (1 + soli) \times sd \times zvE \quad (3)$$

or with the corporate tax factor (sk) = (1 + soli) × sd

$$KSt = sk \times zvE. \quad (4)$$

Although the tax accounting should be based on commercial accounting, there are diverse exceptions to this authoritative principle. Furthermore, companies have to consider some corporate and trade tax modifications. Thus, the commercial-law annual surplus (Jnach) and the tax base for corporation tax purposes (zvE) are not identical. These deviations are marked in Fig. 1 with the variable Δk, which can have a positive or negative prefix. This depends on the deviations between the commercial and tax balances, the corporate-tax-law-related modifications, and the tax-loss deduction[12].

[11] All symbols are based on previous papers (Freidank 1990a, p. 261-279; Freidank 1999, p. 811-820; Freidank 2004, p. 447-469; Hahn and Schneider 1998, p. 333-405).
[12] The tax-loss deduction has to be corrected outside of the tax balance sheet.

Figure 1. Calculation of the tax base for corporation tax purposes

	Annual result under commercial law (Jnach)	
±	Deviations between the commercial and tax balance sheet	
=	Annual result under tax law	Δk
±	Result correction due to income- and corporate-tax-law provisions (sec. 8 para. 1 KStG in conjunction with sec. 3, sec. 4 para. 5, sec. 4h EStG; e.g., deferred tax revenue)	
+	Non-deductible tax expenses [e.g., corporate tax (sec. 10 no. 2 KStG), trade tax (sec. 4 para. 5b EStG) or deferred tax expenses]	
+	Other non-deductible expenses (sec. 9 para. 1 no. 2, sec. 10 no. 1, 3, 4 KStG)	
+	Concealed profit distributions (sec. 8 para. 3 KStG)	
–	Concealed contributions	
–	Share in profits and manager compensation of the personally liable shareholder of a partnership limited by shares (sec. 9 para. 1 no. 1 KStG)	
=	Corrected annual result under tax law	
–	Loss deduction under corporate tax law (sec. 8 para. 1 KStG in conjunction with sec. 10d EStG) (Vk)	
=	Tax base for corporation tax purposes (zvE)	

With variable Δk, this results in equation (5).

The condition (Jnach + Δk) ≥ 0 has to apply because the corporate tax (KSt) will be negative otherwise. In the case of a negative tax base for corporation tax purposes (zvE), it is under certain conditions possible to use the losses in former or prospective periods (sec. 8 para. 1 KStG in conjunction with sec. 10d EStG). The single-periodic models of this paper do not use this opportunity. They only consider loss deductions from previous tax periods.

The difference Δk contains KSt, GewSt, and LS. These components of the interdependent equation system must have a dynamic nature. If KSt, GewSt, and LS are now deducted from Δk, this results in the following constant term (equation 6), which records those deviations between Jnach and zvE that do not affect corporate tax, trade tax, and the deferred tax result.

Due to this modification, equation (5) after conversion results in equation (7).

$$KSt = sk \times (Jnach + \Delta k) \tag{5}$$

$$\Delta k^* = \Delta k - (KSt + GewSt + LS) \tag{6}$$

$$-\frac{sk}{(1-sk)} \times Jnach + KSt - \frac{sk}{(1-sk)} \times GewSt - \frac{sk}{(1-sk)} \times LS = \frac{sk}{(1-sk)} \times \Delta k^* \tag{7}$$

Fig. 2 shows the calculation of the tax base for trade tax purposes [trade revenue (GE) (sec. 7 GewStG)]. Therefore, the tax base for corporation tax purposes before loss deduction must be corrected by certain modifications under trade law and the trade loss deduction (Δg).

Figure 2. Calculation of the tax base for trade tax purposes

	Tax base for corporation tax purposes before loss deduction	
±	Modifications under trade tax law (sec. 8, sec. 9 GewStG)	Δg
–	Loss deduction under trade tax law (Vg) (sec. 10a GewStG)	
=	Tax base for trade tax purposes (trade earnings) (GE)	

The trade tax (GewSt) in equation (8) and (9) has to be calculated on the basis of trade earnings (GE) with h = rate of assessment of the municipality in % / 100 and m = trade tax index number in % / 100, and under inclusion of the formulas developed above.

The expression in brackets in formula (9) must be ≥ 0 because the trade tax (GewSt) will be negative otherwise. In the case of a negative tax base for trade tax purposes (GE), it is under certain conditions possible to use the losses in former or prospective periods (sec. 10a GewStG). The single-periodic models of this paper do not use this opportunity. They only consider loss deductions from previous tax periods. With $m \times h = sg$ (trade tax factor), equation (9) can also be written after conversion as shown in formula (10).

$$\text{GewSt} = \text{m} \times \text{h} \times \text{GE} \tag{8}$$

$$\text{GewSt} = \text{m} \times \text{h} \times (\text{Jnach} + \Delta\text{k}^* + \text{KSt} + \text{GewSt} + \text{LS} + \Delta\text{g} + \text{Vk}) \tag{9}$$

$$-\frac{\text{sg}}{(1-\text{sg})} \times \text{Jnach} - \frac{\text{sg}}{(1-\text{sg})} \times \text{KSt} + \text{GewSt} - \frac{\text{sg}}{(1-\text{sg})} \times \text{LS} = \frac{\text{sg}}{(1-\text{sg})} \times (\Delta\text{k}^* + \text{Vk} + \Delta\text{g}). \tag{10}$$

Fig. 3 shows the calculation of the assessment base for royalties. We assume that they are either directly or indirectly calculated based on the annual result under commercial law considering statutory provisions or contractual agreements (e.g., after reconciliation by accounting policy or extraordinary effects). Using the factor tb (royalties' factor), which is to be applied to the assessment basis for royalties (TB), results in the following equation (11) for royalties expenses (TA).

Figure 3. Calculation of the assessment base for royalties

	Annual result under commercial law (Jnach)
±	Changes due to royalties agreements (Δta)
=	Assessment basis for royalties (TB)

$$\text{TA} = \text{tb} \times \text{TB} = \text{tb} \times (\text{Jnach} + \Delta\text{ta}) \text{ with } 0 \leq \text{tb} \leq 1 \text{ or} \tag{11}$$

$$-\text{tb} \times \text{Jnach} + \text{TA} = \text{tb} \times \Delta\text{ta}. \tag{12}$$

Formulas (2), (7), (10), and (12), which concern corporate tax, trade tax, and royalties, describe direct dependencies between these expenses and the annual surplus under commercial law. The next section shows the relationship between the annual surplus under commercial law and the deferred tax result.

2.2 Commercial-Law Conditions for the Consideration of Deferred Taxes

The recognition and measurement differences to be considered according to sec. 274 HGB result from breaking with the authoritative principle that tax accounting should be based on commercial accounting (sec. 5 para. 1 sentence 1 EStG) (Freidank and Velte 2012, p. 33-38; Fuhrmann and Gellrich 2012, p. 107-168; Meyer 2010, p. 353-371). Therefore, certain provisions under commercial law are not valid for the determination of the profit under tax law (e.g., sec. 5 para. 6 EStG). There can be temporary and quasi-permanent differences between the commercial-law values of assets, debts, accruals, and deferrals and their tax-law values, which lead to deferred tax assets or liabilities (sec. 274 para. 1 HGB). In addition, tax loss carried forward according to sec. 274 para. 1 sentence 4 HGB may also lead to deferred taxes because it is a (future) economic benefit of the company (Herzig and Briesemeister 2012, p. 169-221).

The balance sheet value differences do not always affect the earnings. According to the temporary concept, deviations between the commercial and tax balance sheet that do not affect the result are recorded as well. They occur in purchase processes in which differences result between the commercial-law value and the relevant tax value.[13] Usually the recognition of deferred taxes affects the result. In this case the expense or revenue from the change in deferred taxes is to be shown in the profit and loss statement separately under the item "income taxes" (sec. 274 para. 2 sentence 3 HGB). In the case of deviations between recognition and measurement that do not affect the result, the affected changes of deferred taxes in the balance sheet must be shown in equity (e.g., in other retained earnings). The following models assume the usual case that deferred tax revenues and expenses affect the result.

It is possible that firms disclose deferred taxes by the net or gross method (sec. 274 para. 1 sentence 3 HGB). The calculation of deferred tax assets or liabilities is based on sg when it concerns trade tax and by taking into account the solidarity surcharge on sk when it concerns corporate tax. The amount to be recognized as a deferred tax asset or liability results from multiplication of the company's summarized individual tax rate (s = sg + sk) by the temporary balance sheet differences and benefits from chargeable loss carried forward (Fuhrmann and Gellrich 2012, p. 121-122). The following models assume that the deferred taxes are based on a (future) constant revenue tax rate at the time of reduction of the differences.

2.3 Integration of Deferred Taxes

Taking the above commercial law conditions into account, the deferred taxes can now be integrated into

[13] For example, the purchase of assets taking into account a tax investment surcharge that is recorded differently in the commercial and tax balance sheets or contributions in kind to other values in the commercial and tax balance sheets (Bertram 2012, comment 118 on sec. 274 HGB).

the model by using individual differences. This method permits a more transparent view of the company's financial situation due to the recognition of deferred tax assets and liabilities on a gross basis according to sec. 274 para. 1 sentence 3 HGB than when using the net method. This procedure generally corresponds to the international provisions on accounting of deferred taxes (IAS 12.74). Furthermore, the gross method requires separate and simultaneous calculation of the deferred asset and liability value and the deferred tax expense or revenue. If the firm maintains the corresponding difference overview (Freidank and Velte 2013, p. 808-891; Fuhrmann and Gellrich 2012, p. 119), the respective temporary and quasi-permanent differences that result from comparison of the tax and commercial balance sheet values can be taken from it. Finally, we are assuming an obligation to recognize deferred tax assets analogously to international provisions (IAS 12.24).

Fig. 4 shows the components of the assessment basis of deferred tax assets that will lead to the total of the deferred taxes asset item in the annual statement under commercial law when multiplying by the indicated tax factors.

Figure 4. Determination of the deferred tax asset item

	Components of the assessment basis	**Tax factor**
	Temporary differences that lead to the recognition of deferred tax assets (ADt)	
+	Quasi-permanent differences that lead to the recognition of deferred tax assets (ADqp)	
=	Total of those differences that lead to deferred tax assets (AD)	s
+	Loss carried forward of the previous years under corporate tax law, which may be used within the next five years (ΣKVvor5)	sk
+	Loss of the period under corporate tax law that can be carried forward (KVvor) and that arises from a negative tax base for corporation tax purposes (– zvE)	sk
+	Loss carried forward of the previous years under trade tax law, which may be used within the next five years (ΣGVvor5)	sg
+	Loss of the period under trade tax law that can be carried forward (GVvor) and that arises from a negative tax base for trade tax purposes (trade earnings) (– GE)	sg
=	Amount of the deferred taxes asset item (LESTA)	

If the current period has a negative zvE and/or GE, this affects the amount of the deferred tax assets (sec. 8 para. 1 KStG, sec. 10d para. 2, 4 EStG, sec. 10a GewStG). To simplify the model, we assume that there is no loss carry-back (sec. 8 para. 1 KStG, sec. 10d para. 1 EStG) and that the loss of the current accounting period under tax law (sec. 274 para. 1 sentence 4 HGB) can be used within the next five years. According to these assumptions, the loss under corporate and trade tax law must be fully included in the assessment basis of the deferred taxes. Therefore, we assume that the loss of the period under corporate tax law that can be carried forward (KVvor) corresponds to the negative zvE. Equation (13) applies.

According to these conditions, we assume that the loss of the period under trade tax law that can be carried forward (GVvor) corresponds to the negative GE [Equation (14)].

There are four possible cases that have to be considered when model building (Fig. 5).

$$KVvor = zvE = Jnach + KSt + GewSt + LS + \Delta k^*, \quad \text{if } (Jnach + KSt + GewSt + LS + \Delta k^*) < 0. \tag{13}$$

$$GVvor = GE = Jnach + KSt + GewSt + LS + \Delta k^* + Vk + \Delta g, \quad \text{if } (Jnach + KSt + GewSt + LS + \Delta k^* + Vk + \Delta g) < 0. \tag{14}$$

Figure 5. Possible cases for consideration of loss carried forward under tax law

Case 1 zvE > 0 and GE > 0 → LESTA must be determined according to formula (15) (Fig. 7)
Case 2 zvE < 0 and GE < 0 → LESTA must be determined according to formula (22) (Fig. 8)
Case 3 zvE < 0 and GE > 0 → LESTA must be determined according to formula (24) (Fig. 9)
Case 4 zvE > 0 and GE < 0 → LESTA must be determined according to formula (26) (Fig. 10)

The temporary and quasi-permanent balance sheet differences (AD) and losses carried forward of the previous year must be assessed by using the relevant tax rates to determine the value of deferred tax asset item (LESTA).

$$LESTA = AD \times s + \Sigma KVvor5 \times sk + \Sigma GVvor5 \times sg \quad (15)$$

It is necessary to calculate the amount change of the deferred asset item between the current and the previous year (ΔLESTA) to be able to determine the amount of the deferred tax result. The amount of the deferred asset item of the previous period is expressed in the following formula by LESTAvor:

$$\Delta LESTA = LESTA - LESTAvor. \quad (16)$$

If ΔLESTA < 0, the deferred tax assets item decreases and leads to deferred tax expenses in the profit and loss statement under the commercial law in the amount of ΔLESTA. If ΔLESTA > 0, the deferred tax asset item increases and leads to a deferred tax revenue in the amount of ΔLESTA.

Fig. 6 shows the components of the assessment basis for deferred tax liabilities that will lead to the deferred tax liabilities item in the annual statement under commercial law when multiplied by the indicated tax rate (s).

Figure 6. Determination of the deferred liability items

Components of the assessment basis	Tax rate
Temporary differences that lead to the recognition of deferred tax liabilities (PDt)	s
+ Quasi-permanent differences that lead to the recognition of deferred tax liabilities (PDqp)	s
= Total of those differences that lead to deferred tax liabilities (PD)	s
= Amount of the deferred taxes liabilities item (LESTP)	

The temporary and quasi-permanent differences (PD) must be multiplied by the tax rate s to arrive at the deferred tax liabilities.

$$LESTP = PD \times s \quad (17)$$

The change in the deferred tax liability item between the current and previous year (ΔLESTP) must be determined to calculate the deferred tax result. The deferred tax liability of the previous period is represented by LESTPvor in the following formula:

$$\Delta LESTP = LESTP - LESTPvor \quad (18)$$

If ΔLESTP < 0, the deferred tax liability item decreases and leads to deferred tax revenues of ΔLESTP in the profit and loss statement. If ΔLESTP > 0, the deferred tax liability item increases and causes a deferred tax expense in the amount of ΔLESTP.

The deferred tax result of the current period (LS) is determined by the equation (19).

LS results from the change in the deferred tax assets and liabilities. If LS > 0, this leads to deferred tax expenses in the profit and loss statement under commercial law and reduces the annual surplus of the current period. In the case of LS < 0, this leads to deferred tax revenues and increases the annual surplus of the current period. Equation (19) must be transformed for the simultaneous equation system as shown in equation 20.

Finally, equations (2), (7), (10), (12), (15), (17), and (20) must be used in the simultaneous equation system that is shown as a matrix in Fig. 7.

$$LS = LESTP - LESTPvor - (LESTA - LESTAvor) \quad (19)$$

$$LS + LESTA - LESTP = -LESTPvor + LESTAvor. \quad (20)$$

Figure 7. Model 1 as a matrix

$$\begin{bmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 1 \\ -\frac{sk}{(1-sk)} & 1 & -\frac{sk}{(1-sk)} & -\frac{sk}{(1-sk)} & 0 & 0 & 0 \\ -\frac{sg}{(1-sg)} & -\frac{sg}{(1-sg)} & 1 & -\frac{sg}{(1-sg)} & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & -1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ -tb & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} Jnach \\ KSt \\ GewSt \\ LS \\ LESTA \\ LESTP \\ TA \end{bmatrix} = \begin{bmatrix} vJvor \\ \frac{sk}{(1-sk)} \times \Delta k^* \\ \frac{sg}{(1-sg)} \times (\Delta k^* + Vk + \Delta g) \\ -LESTPvor + LESTAvor \\ AD \times s + \Sigma KVvor5 \times sk + \Sigma GVvor5 \times sg \\ PD \times s \\ tb \times \Delta ta \end{bmatrix}$$

If zvE and GE are negative, the resulting loss under tax law leads to capitalization of deferred tax assets, if sufficient positive earnings will be realized within five years to offset the tax losses and under consideration of the minimum taxation condition. In this case, the following equation (21) must be used to determine LESTA.

After insertion of the corresponding expressions for zvE and GE and conversion, it results in the equation (22).

This equation must be used to modify the approach shown for matrix model 1 in Fig. 7 as explained in Fig. 8. Equations (2), (12), (17), (20), and (22) have been entered into this system. Formulas (7) and (10) for KSt and GewSt are not included in Fig. 8 because KSt and GewSt do not arise from a negative zvE and GE. We assume in this and the following cases for the royalties that its assessment basis TB is positive, because otherwise the variable TA must be removed from the matrix as well.

$$LESTA = AD \times s + (\Sigma KVvor5 - zvE) \times sk + (\Sigma GVvor5 - GE) \times sg \tag{21}$$

$$\begin{aligned} &s \times Jnach + s \times KSt + s \times GewSt + s \times LS + LESTA \\ &= AD \times s + sk \times \Sigma KVvor5 - s \times \Delta k^* + sg \times (\Sigma GVvor5 - Vk - \Delta g). \end{aligned} \tag{22}$$

Figure 8. Model 2 as a matrix

$$\begin{bmatrix} 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & -1 & 0 \\ s & s & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ -tb & 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} Jnach \\ LS \\ LESTA \\ LESTP \\ TA \end{bmatrix} = \begin{bmatrix} vJvor \\ -LESTPvor + LESTAvor \\ AD \times s + sk \times \Sigma KVvor5 - s \times \Delta k^* + sg \times (\Sigma GVvor5 - Vk - \Delta g) \\ PD \times s \\ \Delta tb \times ta \end{bmatrix}$$

If zvE is negative and GE is positive, the formula for LESTA must be modified as shown in equation 23.

After insertion of the corresponding expression for zvE, it results in the following equation (24) after conversion.

Equations (2), (10), (12), (17), (20), and (24) must be entered into the simultaneous equation system. Equation (7) for KSt is not contained in the matrix. Fig. 9 shows the changed matrix model.

$$LESTA = AD \times s + (\Sigma KVvor5 - zvE) \times sk + \Sigma GVvor5 \times sg\,. \tag{23}$$

$$\begin{aligned} &sk \times Jnach + sk \times KSt + sk \times GewSt + sk \times LS + LESTA \\ &= AD \times s + \Sigma KVvor\,5 \times sk - \Delta k^* \times sk + \Sigma GVvor5 \times sg \end{aligned} \tag{24}$$

Figure 9. Model 3 as a matrix

$$\begin{bmatrix} 1 & 1 & 1 & 0 & 0 & 1 \\ -\frac{sg}{(1-sg)} & 1 & -\frac{sg}{(1-sg)} & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & -1 & 0 \\ sk & sk & sk & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ -tb & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} Jnach \\ GewSt \\ LS \\ LESTA \\ LESTP \\ TA \end{bmatrix} = \begin{bmatrix} vJvor \\ \frac{sg}{(1-sg)} \times (\Delta k^* + Vk + \Delta g) \\ -LESTPvor + LESTAvor \\ AD \times s + \Sigma KVvor5 \times sk - \Delta k^* \times sk + \Sigma GVvor5 \times sg \\ PD \times s \\ tb \times ta \end{bmatrix}$$

If zvE is positive and GE negative, the equation for LESTA must be modified as shown in equation (25).

After insertion of the corresponding expression for GE and conversion, it results in the following equation (26).

Equations (2), (7), (12), (17), (20), and (26) must be inserted into the equation system, whereas formula (10) for GewSt is omitted. Fig. 10 shows the adjusted matrix model.

$$LESTA = AD \times s + \Sigma KVvor5 \times sk + (\Sigma GVvor5 - GE) \times sg \quad (25)$$

$$sg \times Jnach + sg \times KSt + sg \times GewSt + sg \times LS + LESTA = \\ = AD \times s + sk \times \Sigma KVvor5 + sg \times (\Sigma GVvor5 - \Delta k^* - Vk - \Delta g). \quad (26)$$

Figure 10. Model 4 as a matrix

$$\begin{bmatrix} 1 & 1 & 1 & 0 & 0 & 1 \\ -\frac{sk}{(1-sk)} & 1 & -\frac{sk}{(1-sk)} & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & -1 & 0 \\ sg & sg & sg & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ -tb & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} Jnach \\ KSt \\ LS \\ LESTA \\ LESTP \\ TA \end{bmatrix} = \begin{bmatrix} vJvor \\ \frac{sk}{(1-sk)} \times \Delta k^* \\ -LESTPvor + LESTAvor \\ AD \times s + sk \times \Sigma KVvor5 + sg \times (\Sigma GVvor5 - \Delta k^* - Vk - \Delta g) \\ PD \times s \\ tb \times ta \end{bmatrix}$$

Finally, the distribution restriction must be observed. Sec. 268 para. 8 HGB gives three scenarios that might lead to an amount blocked from distribution (Fig. 11).

Figure 11. Determination of the amount blocked from distribution

	Amount of the self-created intangible assets (sec. 248 para. 2 sentence 1 HGB) (IVGav)
–	Deferred tax liabilities formed for the amount of the self-created intangible assets (sec. 248 para. 2 sentence 1 HGB) (LSPIVGav)
+	Difference between the fair value and the acquisition costs of assets for old-age pension (sec. 246 para. 2 sentence 2 HGB) (ΔZAalt)
–	Deferred tax liability formed for the difference between the fair value and the acquisition costs of assets for old-age pension (sec. 246 para. 2 sentence 2 HGB) (LSPΔZAalt)
+	Amount of deferred tax assets (LESTA)
–	Amount of deferred tax liabilities (LESTP)
=	Asset surplus
+	Deferred tax liabilities formed for the amount of the self-created intangible assets (sec. 248 para. 2 sentence 1 HGB) (LSPIVGav)
+	Deferred tax liability formed for the difference between the fair value and the acquisition costs of assets for old-age pension (sec. 246 para. 2 sentence 2 HGB) (LSPΔZAalt)
=	Amount blocked from distribution (AG)

In this context, there are two possible scenarios. If LESTA > LESTP, the following formula must be used:

$$AG = IVGav - LSPIVGav + \Delta ZAalt - LSP\Delta ZAalt + (LESTA - LESTP + LSPIVGav + LSP\Delta ZAalt) \quad (27)$$

or

$$AG = IVGav + \Delta ZAalt + LESTA - LESTP. \quad (28)$$

If LESTA < LESTP, the following formula must be used:

$$AG = IVGav - LSPIGav + \Delta ZAalt - LSP\Delta ZAalt. \quad (29)$$

After determining the amount blocked from distribution by using expression (28) or (29), the distributable amount (AF) must be calculated by taking into account legal rules or provisions of the articles of incorporation that may provide for mandatory additions from the annual surplus to the reserves (REIN), as shown in Fig. 12 (Wulf and Bosse 2012, comment 86 on sec. 268 HGB).

Figure 12. Determination of the distributable amount

	Freely available reserves before endowment (Rfrei)
+	Annual surplus including profit or loss carried forward (Jnach – VV + GV)
–	Mandatory transfer from annual surplus to reserves (REIN)
–	Amount blocked from distribution (AG)
=	Distributable amount (AF)

Fig. 12 leads to the following equation (30).

$$AF = Rfrei + Jnach - VV + GV - REIN - AG. \quad (30)$$

Depending on the amount of LESTA and LESTP, formula (28) or (29) is now entered in formula (30). If LESTA > LESTP, it results in the following equation (31).

$$AF = Rfrei + Jnach - VV + GV - REIN - IVGav - \Delta ZAalt - LESTA + LESTP. \quad (31)$$

If LESTA < LESTP, the distributable amount is determined as shown in equation (32).

$$AF = Rfrei + Jnach - VV + GV - REIN - IVGav + LSPIGav - \Delta ZAalt + LSP\Delta ZAalt. \quad (32)$$

Two independent calculations must be performed to determine the distributable amount. In the first step, the matrix models developed above must be used to determine the variables Jnach, KSt, GewSt, LS, LESTA, LESTP, and TA. Then AF must be determined according to formula (31) or (32) in the second step. These different cases will be needed due to possible loss scenarios that cannot be integrated into the simultaneous models in the form of side conditions. If loss situations are excluded, the successive procedure can be dispensed with and the equation system can be solved simultaneously.

3. Expansions for Accounting Policy Optimization

3.1 Standard Approach

The developed models can also be used for accounting-policy objectives. In this case the preliminary annual surplus before result-dependent expenses assumes the nature of a value that can be influenced by accounting policy hereinafter referred to as policy-responsive amount. If management wants to publish an annual surplus of a specific amount, it is necessary to know at which amount the preliminary annual surplus (vJvor) must be changed to precisely indicate the intended target annual surplus (sJnach) considering the result-dependent earnings. The above formal dependency between the annual surplus and result-dependent earnings has to be changed. Thus, the equations must be transformed in order to be usable in the accounting optimization process to obtain the policy objectives. The transformation for the first version of the basic model (section 2) is shown below.

(1) Preliminary annual surplus (vJvor) depending on the annual surplus (Jnach)

(1.1) vJvor = f (Jnach) or after conversion

(1.2) vJvor – KSt – GewSt – LS – TA = Jnach

(2) Corporate tax expenses (KSt) depending on the preliminary annual surplus

(2.1) KSt = f (vJvor) or after conversion

(2.2) $-sk \times vJvor + KSt + sk \times TA = sk \times \Delta k^*$

(3) Trade tax expenses (GewSt) depending on the preliminary annual surplus

(3.1) GewSt = f (vJvor) or after conversion

(3.2) $-sg \times vJvor + GewSt + sg \times TA = sg \times (\Delta k^* + Vk + \Delta g)$

(4) Royalties expenses (TA) depending on the preliminary annual surplus

(4.1) TA = f (vJvor) or taking into account KSt, GewSt, LS, and after conversion

(4.2) $-tb \times [(1 - sk) - sg] \times vJvor + tb \times LS + \{1 + tb \times [(1 - sk) - sg]\} \times TA = -tb \times [s \times \Delta k^* + sg \times (Vk + \Delta g) - \Delta ta]$

The transformed equation system may now be used to obtain accounting policy objectives. There is the possibility of replacing the term Jnach with certain intended targets (e.g., target annual surplus and target distribution). The solution of the equation system then indicates the results for vJ (preliminary annual surplus before result-dependent results after use of policy-responsive amount), KSt, GewSt, LS, and TA by using the accounting policy instruments that affect the result. The policy-responsive amount required for this purpose is calculated by comparing the initial preliminary annual surplus and the final preliminary annual surplus indicated by the solutions of the simultaneous planning approach.

Fig. 13 shows the converted equation system as a matrix, which includes equations (1.2), (2.2), (3.2), (4.2), and the above equations for recording the deferred taxes [equations (15), (17), and (20) in section 2.3]. However, this procedure assumes that use of policy-responsive amount does not affect the deferred tax result. Therefore, the policy-responsive amount used changes the preliminary annual surplus before result-dependent expenses (vJvor) and the tax base for corporation tax purposes (zvE) as well as the tax base for trade tax purposes (GE) by the same amount (e.g., selection of the linear depreciation method both in commercial and tax balance sheets). This means that this standard approach has not yet established any dependency between the deferred tax result and the preliminary annual surplus.

Figure 13. Transformed equation system as a matrix

$$\begin{bmatrix} 1 & -1 & -1 & -1 & 0 & 0 & -1 \\ -sk & 1 & 0 & 0 & 0 & 0 & sk \\ -sg & 0 & 1 & 0 & 0 & 0 & sg \\ 0 & 0 & 0 & 1 & 1 & -1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ -tb \times [(1-sk)-sg] & 0 & 0 & tb & 0 & 0 & 1+tb \times [(1-sk)-sg] \end{bmatrix} \times \begin{bmatrix} vJ \\ KSt \\ GewSt \\ LS \\ LESTA \\ LESTP \\ TA \end{bmatrix} = \begin{bmatrix} Jnach \\ sk \times \Delta k^* \\ sg \times (\Delta k^* + Vk + \Delta g) \\ -LESTPvor + LESTAvor \\ AD \times s + \Sigma KVvor5 \times sk + \Sigma GVvor5 \times sg \\ PD \times s \\ -tb \times [s \times \Delta k^* + sg \times (Vk + \Delta g) - \Delta ta] \end{bmatrix}$$

The model is able to specify a target value. In addition, it is possible to maximize or minimize Jnach. For this purpose, it is necessary to determine the available action parameters that can be used to influence the annual surplus indicated in the preliminary income statement to its limits (maximum or minimum). These data must be used to calculate the upper and lower limits of the preliminary annual surplus as follows:

(5) vJ (Max) = vJvor + total of all profit-increasing action parameters

(6) vJ (Min) = vJvor – total of all profit-decreasing action parameters.

3.2 Model Variations Taking into Account the Novation of the German Authoritative Principle

3.2.1 Legal Background

The German authoritative principle that tax accounting should be based on commercial accounting has not been changed in the scope of the novation of commercial law in 2009 by the German Bilanzrechtsmodernisierungsgesetz (BilMoG). Formerly, the reverse authoritative principle (sec. 5 para. 1 sentence 2 EStG old version) required tax values to be reported in the commercial balance sheet to ensure that these values were also reportable in the tax balance sheet. Since the novation in 2009, this reverse authoritative principle has been inapplicable, which leads to partial disconnection between the commercial and tax balance sheet. Now there is an option to utilize tax-law recognition and assessment independently of the commercial balance sheet. This triggers deferred taxes because the commercial- and tax-law values will deviate from each other in this case (sec. 5 para. 1 sentence 1 EStG).

However, the range of an autonomous tax-accounting policy is disputed in the literature (Freidank and Velte 2010, p. 185-194). The possibility of autonomously exercising the accounting options refers to both the wording of the law and the intention of the legislator only as they regard those tax accounting options that are incompliant with the German generally accepted accounting principles. Other tax-accounting options still require the authoritative principle to be applied. This means that the decision to execute a parallel commercial and tax-accounting option generally must be made in the commercial balance sheet. This does not lead to any differences between the asset or liability values under commercial and tax law. Thus, no deferred taxes need to be considered in the annual statement under commercial law.

Deviating from this assumption, some authors and the German Federal Ministry of Finance assume, according to the BilMoG, the removal of the formal relevance of commercial accounting for tax-accounting purposes (Federal Ministry of Finance, letter from March 12, 2010 – IV C 6 – S 2133/09/10001). Thus, according to no. 16 of this letter, accounting options under commercial and tax law may always be utilized differently in the commercial and tax balance sheets (e.g., the individual assessment of assets in the commercial balance sheet and according to a consumption tracking method in the tax balance sheet). The autonomous utilization of accounting options in the commercial and tax balance sheet consequently causes deferred taxes in the case of different utilization of these options. However, the Federal Ministry of Finance believes that accounting options under commercial law that do not have any independent tax provisions (e.g., loan capital interest according to sec. 255 para. 3 sentence 2 HGB; R 6.3 para. 4 EStR) should continue to be determined by the authoritative principle. We do not follow this deviating opinion in our further models because it is not covered by the intention of the authoritative principle (Freidank and Velte 2010, p. 189-191). This leads to the following consequences for the design of expanded accounting-policy matrix models.

3.2.2 Structure of the Expanded Model

Based on the standard approach from section 3.1, the following modifications are needed to include the illustrated model concept (XH = accounting policy options only permitted under commercial law; XI = accounting policy options only permitted under tax law; XK = accounting policy options permitted under commercial and tax law). The indication "+" expresses an increase in profit and "–" the reduction of profit associated with the individual accounting option groups.

(1) $vJvor - KSt - GewSt - LS - TA + XH^{+} - XH^{-} + XK^{+} - XK^{-} = Jnach$

(2) $KSt = sk \times (vJvor - TA + \Delta k^{*} + XI^{+} - XI^{-} + XK^{+} - XK^{-})$ or

(3) $-sk \times vJvor + KSt + sk \times TA - sk \times XI^{+} + sk \times XI^{-} - sk \times XK^{+} + sk \times XK^{-} = sk \times \Delta k^{*}$

(4) $GewSt = sg \times (vJvor - TA + \Delta k^{*} + Vk + \Delta g + XI^{+} - XI^{-} + XK^{+} - XK^{-})$ or

(5) $-sg \times vJvor + GewSt + sg \times TA - sg \times XI^{+} + sg \times XI^{-} - sg \times XK^{+} + sg \times XK^{-} = sg \times (\Delta k^{*} + Vk + \Delta g)$

(6) $TA = tb \times (vJvor - KSt - GewSt - LS - TA + XH^{+} - XH^{-} + XK^{+} - XK^{-} + \Delta ta)$ or

(7) $-tb \times vJvor + tb \times KSt + tb \times GewSt + tb \times LS + (1 + tb) \times TA - tb \times XH^{+} + tb \times XH^{-} - tb \times XK^{+} + tb \times XK^{-} = tb \times \Delta ta$

It is necessary to modify the equations LESTA and LESTP (formulas (15) and (17) in section 2.3) in order to consider the effects of the accounting option groups XH and XI on the deferred taxes. The accounting option group XK is not relevant because its use changes the commercial and tax balance sheet values by the same amount and does not trigger any effect on deferred taxes. Furthermore, it is necessary to determine whether the use of the accounting option groups XH and XI changes the preliminary differences between the commercial and tax balance sheet values in terms of the deferred tax assets (AD) or liabilities (PD). The following applies:

(8) $LESTA = s \times [AD - XH^{+}(AD) + XH^{-}(AD) - XI^{+}(AD) + XI^{-}(AD)] + \Sigma KVvor5 \times sk + \Sigma GVvor5 \times sg$ or
(9) $LESTA + s \times XH^{+}(AD) - s \times XH^{-}(AD) + s \times XI^{+}(AD) - s \times XI^{-}(AD) = s \times AD + \Sigma KVvor5 \times sk + \Sigma GVvor5 \times sg$
(10) $LESTP = s \times [PD + XH^{+}(PD) - XH^{-}(PD) + XI^{+}(PD) - XI^{-}(PD)]$ or
(11) $LESTP - s \times XH^{+}(PD) + s \times XH^{-}(PD) - s \times XI^{+}(PD) + s \times XI^{-}(PD) = s \times PD.$

Each action parameter of the accounting option groups XH and XI must be inserted into equation (9) or (11). Their assignment corresponds to the changes in the preliminary differences between the commercial and tax balance sheet values. If the company decides to form a tax-free reserve [accounting option group $XI^{-}(PD)$], for example, this leads to an increase in LESTP. Furthermore, the decision to recognize self-created intangible assets (sec. 248 para. 2 sentence 1 HGB) [accounting option group $XH^{+}(PD)$] will also lead to an increase in LESTP. If management has decided to use these options even before the preparation of the preliminary annual statement, its effects on the deferred tax liabilities would already be included in PD. In the case of reversion of these options, they must be assigned to the variables $XI^{+}(PD)$ or $XH^{-}(PD)$ in equation (11).

The action parameters of the six accounting option groups must be used in the planning approach as ≤ restrictions (H^{+}, H^{-}, I^{+}, I^{-}, K^{+}, K^{-} = maximum possible policy-responsive amount of the respective option groups with H^{+}, H^{-}, I^{+}, I^{-}, K^{+}, $K^{-} \geq 0$) to meet the target of the transformed simultaneous model.

(12) $XH^{+} \leq H^{+}$
(13) $XH^{-} \leq H^{-}$
(14) $XI^{+} \leq I^{+}$
(15) $XI^{-} \leq I^{-}$
(16) $XK^{+} \leq K^{+}$
(17) $XK^{-} \leq K^{-}$

If the commercial- or tax-law provisions permit any number of interim values regarding the individual option groups, it is possible to include the restrictions for the three option groups in the planning model. If some option groups are only relevant for decisions in the amount of their maximum value or a zero amount, the restriction must be modified. In this case, the optimization of the target function must be based on a mixed integer approach to ensure that the action parameters of the three option groups can be used in the best solution with both their upper and lower limits (Freidank 1990b, p. 124-130; Freidank and Velte 2013, p. 905-906).

Fig. 14 shows the expanded model using the equations (1), (3), (5), (7), (9), (11) and (12) to (17) (Fig. 13 in section 3.1) (RS = Right side, x = variable, y = restriction, Z = target function). The simplex tableau illustrates that the previously designed matrix models can be extended to optimization approaches by taking into account a target function regarding the annual surplus and restrictions in the form of ≤ or = conditions. This is now possible by using the available policy-responsive amount of the groups XH, XI, and XK to maximize, minimize, or fix the annual surplus (Freidank 1990b, p. 76-78; Freidank and Velte 2013, p. 874-875). We assume in these designs that the commercial-law principles regarding recognition and assessment continuity (sec. 252 para. 1 no. 6 HGB) do not limit the best solutions. In the case of targeting a specific annual result (fixing approach), restriction y (14) must be included in the tableau if a target function to be maximized is assumed. In the case of a minimization approach, the coefficients of the target function must be multiplied by –1.

4. Summary

This paper has shown the development of simultaneous models with their expansion options. They are planning alternatives that firms may use for effect and design analyses of effective and deferred taxes as well as performance indicators under commercial law. The presented matrix models are decision-oriented instruments that have high efficacy according to the provisions of the German commercial and tax law regarding tax planning and accounting policy design. Furthermore, the models in their different versions offer options for the use of IT-supported solutions (e.g., spreadsheet programs). Additionally, the matrix models may be integrated into menu-controlled software packages in terms of an expert system (Freidank 1993, p. 312-323). This system must be able to determine the optimal profit and loss statement according to input of the preliminary profit and loss statement, intended target values, legal framework conditions, and the available policy-responsive amount.

A limitation of the models may be seen in their reference to the accounting provisions under German commercial and tax law and the single-period model design, but this does not limit the concept necessarily. First, the different expansions have already made clear the high flexibility of the matrix models. Thus, an adjustment to the provisions of the International Financial Reporting Standards (IFRS) (IAS 12) should not only be possible but easy. Such model expansions should mainly affect deferred taxes that do not have an effect on the result and the obligation to prepare a reconciliation statement that shows the difference between the effective tax result and the tax rate. This applies accordingly to the transfer of the matrix models to comparable situations in other legal areas as well. Second, if management plans steady earnings or specific tax results over several periods, the (transformed) matrix models may be used to determine the necessary policy-responsive amount per period in order to gain a specific result or optimal distribution or profit.

Figure 14. Expanded optimization model

	vJvor	**KSt**	**GewSt**	**LS**	**LESTA**	**LESTP**	**TA**	**XH^+**	**XH^-**	**XI^+**	**XI^-**	**XK^+**	**XK^-**	**RS**
	x1	**x2**	**x3**	**x4**	**x5**	**x6**	**x7**	**x8**	**x9**	**x10**	**x11**	**x12**	**x13**	
Z	x1	–x2	–x3	–x4			–x7	x8	-x9			x12	–x13	= Jnach
y(1)								x8						$\leq H^+$
y(2)									x9					$\leq H^-$
y(3)										x10				$\leq I^+$
y(4)											x11			$\leq I^-$
y(5)												x12		$\leq K^+$
y(6)													x13	$\leq K^-$
y(7)	x1													= vJvor
y(8)	–sk × x1	x2					sk × x7			–sk × x10	sk × x11	–sk × x12	sk × x13	= sk × Δk*
y(9)	–sg × x1		x3				sg × x7			–sg × x10	sg × x11	–sg × x12	sg × x13	= sg × (Δk* + Vk + Δg)
y(10)				x4	x5	-x6								= –LESTPvor + LESTAvor
y(11)					x5			s × x8	–s × x9	s × x10	– s × x11			= s × AD + ΣKVvor5 × sk + ΣGVvor5 × sg
y(12)						x6		–s × x8	s × x9	–s × x10	s × x11			= s × PD
y(13)	–tb × x1	tb × x2	tb × x3	tb × x4			(1 + tb) × x7	–tb × x8	tb × x9			–tb × x12	tb × x13	= tb × Δta
y(14)	x1	–x2	–x3	–x4			–x7	x8	–x9			x12	x13	= Jnach

The main work of the tax planner is not to determine the optimal profit change per period but rather the respective matching accounting options with an effect on the result (Heinhold 1985, p. 56). Therefore, the model versions would have additional importance for management when taking into account the novation regarding the German authoritative principle that tax accounting should be based on commercial accounting. In this context, this paper has shown that a differentiated simultaneous determination of the effective and deferred tax result is possible by dividing the available accounting options into three groups due to its integration in the matrix models.

Furthermore, the developed optimization models may be used to maximize, minimize, or fix given targets. In this case the equations for effective and deferred tax effects must be integrated into the target function. Thus, the optimization models can be fully replaced with regard to the integration of accounting-policy intensions as primary or secondary conditions. This offers high model flexibility.

In summary, performance capacity and the use of the IT-supported matrix models can be measured by the fact that optimal financial decisions are difficult to reach manually under realistic conditions due to the complexity of their interrelations. At the same time, these decisions have fundamental effects on central aspects such as the earnings situation, tax-result effects, distribution power, and/or royalties of the company.

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