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## The development of the shadow economy under changing tax systems and structures: Some theoretical and empirical results for Austria

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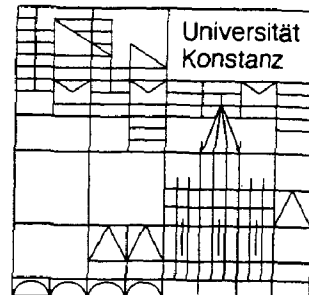
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Friedrich Schneider  
Reinhard Neck

**The Development  
of the Shadow Economy under  
Changing Tax Systems and Structures:  
Some Theoretical and Empirical Results  
for Austria**

**THE DEVELOPMENT OF THE SHADOW ECONOMY  
UNDER CHANGING TAX SYSTEMS AND STRUCTURES:  
SOME THEORETICAL AND EMPIRICAL RESULTS FOR AUSTRIA \*)**

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## **A B S T R A C T**

In this paper we investigate how different tax systems and structures affect the extent of the shadow economy. First, we formulate a simple theoretical microeconomic model of household behavior, where the household can participate in the official and in the shadow economy. Using comparative statics, we show that a measure of "complexity" of the tax system affects participation in the shadow economy negatively, i.e., a more "complex" tax system implies, *ceteris paribus*, a smaller labor supply in the shadow economy. Next, we analyze the determinants of the shadow economy empirically for Austria. Various methods to estimate the size of the shadow economy are discussed. Empirical results for Austria obtained by using the currency demand approach are presented. Finally, we examine three case studies to show quantitatively how the size of the shadow economy can be influenced by changes in the tax structures.

JEL Classification: H 26.

## 1. INTRODUCTION

Over the last two decades a growing concern over the phenomenon of the shadow economy has increased attention among officials, politicians, and social scientists. For Austria, as for many other industrial countries, there are several important reasons why politicians and the general public should be concerned about the growth and size of the shadow economy. Among the most important are the following:

(1) A continuous increase in the size of the shadow economy, usually caused by a rise in the overall burden of taxes and regulations, may lead to an erosion of the tax base, a decrease in tax receipts and thus to a further increase in the budget deficit.

(2) Under a growing shadow economy, economic policy is based on mistaken "official" indicators (like unemployment, official labour force, income, consumption), which, to say the least, may be wrong in magnitude. In such a situation a prospering shadow economy may cause politicians severe difficulties, because it "provides" unreliable official indicators; the very direction of intended policy measures may therefore be in doubt.

These growing concerns have led many economists to the challenging task of measuring the size and growth rate of the shadow economy, to trace back the main causes of it and to analyse the interactions of the official and unofficial economies.<sup>1</sup> As there have been a number of studies measuring the size of the shadow economy and its consequences on the official economy, in this paper the main focus is on the effects of changing tax systems and structures on the size and growth of the shadow economy. In section 2 a simple theoretical model of the "complexity" of the tax system is developed. In sections 3 and 4 an attempt is made to test some hypotheses of the model in section 2. In section 3, first, the various approaches, which have been used are briefly discussed and, second, the empirical results of the growth in the size of the shadow economy over time for Austria are presented. In section 4 the question of whether and how the size of the shadow economy can be influenced by changing tax systems and structures is investigated. Finally, section 5 summarizes the results and discusses some difficulties of measuring the shadow economy and studying the effects of changing tax structures on it.

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<sup>1</sup>) Compare, e.g., the work by Hofreither and Schneider (1989), and Schneider, Hofreither, and Neck (1989).

## 2. THE "COMPLEXITY" OF THE TAX SYSTEM AND THE SHADOW ECONOMY: A THEORETICAL MODEL

As there have been a number of theoretical studies investigating the influence of the direct and indirect tax system on the shadow economy, in this section we investigate how the "complexity" of the tax system affects the size of the shadow economy. We use a simple microeconomic model of household behavior and restrict our attention to the income tax and the labor-supply decision. Starting with Allingham and Sandmo (1972), many authors have focused on the determinants of tax evasion and participation in the underground economy using theoretical microeconomic models.<sup>2</sup> Obviously, in a theoretical analysis it is necessary to consider relatively simple tax schedules; hence this literature has not paid much attention to the question of how the "complexity" of the tax system affects the shadow economy. Even when concentrating upon the income tax, one cannot incorporate every feature of an actual tax schedule into the analysis. Here we try to capture the notion of the "complexity" of the income tax by making the following observation: a "complex" income tax schedule allows for more possibilities of legal tax avoidance than a "simple" one by providing tax exemptions and reductions of various kinds. For example, the Austrian tax reform of 1989 is generally considered to have made the income tax schedule less "complex" because it has reduced marginal income tax rates and simultaneously broadened the tax base by abolishing several exemptions and loopholes in the income tax schedule. According to this view, a "comprehensive income tax" can be considered to display a very low degree of "complexity".

Thus, if the government changes the amount of "complexity" of the income tax, it affects the choice of the taxpayers between legal tax avoidance and illegal tax evasion. These effects have been studied by Alm (1988) and Cowell (1988; 1990, pp. 176 ff.). Apart from different ways of modelling the costs of tax sheltering, our analysis differs from theirs by explicitly taking into account the distinction between an official and an underground labor market instead of regarding income as exogenous. Thus we follow the modelling framework of Isachsen and Strøm (1980), but we include a progressive instead of a proportional linear income tax and the possibility of legal tax avoidance. Unfortunately, this complicates the analysis considerably as compared to the models of Alm and Cowell and makes most comparative statics effects indeterminate; however, for the effect of the "complexity" of the tax system on the size of the underground economy we can derive an unambiguous result.

We start from the partial model of the household developed in Neck, Schneider and Hofreither (1989). The household is the only active decision-maker considered; we assume a non-strategic government and ignore its budget constraint and objective function. Labor is the only source of income for the household; there are two kinds of labor in the economy, official and underground, denoted by superscripts  $o$  and  $u$ , respectively. The hourly wages for both

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<sup>2</sup>) For a recent survey, see Cowell (1990).

kinds of labor are  $W^O$  and  $W^U$ , respectively, and are assumed to be given. Both kinds of labor are assumed to be homogeneous; there are different risks associated with them, otherwise they are perfect substitutes. The household can allocate its available time, say  $T$ , among labor supply in the official economy ( $S^O$ ), labor supply in the underground economy ( $S^U$ ), and leisure ( $L$ ).

Starting from a linear progressive income tax, it may be assumed that the household's pre-tax income from the official economy,  $W^O S^O$ , is subject to a tax of  $t_1 W^O S^O - t_0$ , where  $t_1$  is the marginal tax rate and  $t_0$  is a minimum income guaranteed by the government. This "simple" linear income tax can now be generalized to a "complex" tax schedule with the possibility of tax avoidance or sheltering, namely,  $t_1 (W^O S^O - a) - t_0$ , where  $a$  is the income exempt from taxation or the amount of tax avoidance. Under any realistic tax schedule, this amount will depend both on the household's behavior and on the tax laws, possibly also on the government's discretionary decisions.

To make the analysis manageable, we assume an extremely simple function for  $a$ :

$$a = a_1 f(e). \quad (1)$$

Here  $e$  is the "effort" the household applies to take advantage of the possibility of tax avoidance; this may consist of "labor" (learning the tax laws etc.), but may also include outlays for advice and any other costs the household may incur to secure tax avoidance.  $f(\cdot)$  can be interpreted as the household's "tax avoidance production function"; it relates its effort to the amount of avoidance the household can secure for itself, given  $a_1$ . Denoting partial derivatives by subscripts, we assume positive but diminishing returns to effort:  $f_e > 0$ ,  $f_{ee} < 0$ .

The parameter  $a_1$ , which is determined by the government or the tax laws, translates the results of the household's efforts into the actual amount of avoidance. It can be interpreted as a measure of the "complexity" of the tax system: if  $a_1 = 0$ , we are back to the "simple" linear income tax without any exemptions; the greater  $a_1$  is, the more the household, *ceteris paribus*, will be able to avoid taxes legally by applying some amount of effort for this purpose, and the greater the income exempt from taxation will be. Needless to say, this is a rather crude model for an income tax schedule with exemptions, but it captures the essential idea of what is meant by a "complex" tax schedule. The amount of tax avoidance secured by household's effort  $e$  is now  $t_1 a_1 f(e)$ ; since this cannot exceed the amount of taxes to be paid (net of the lump-sum transfer  $t_0$ )  $t_1 W^O S^O$ , we assume  $W^O S^O \geq a_1 f(e)$  for the following analysis to hold.

Apart from the possibility of engaging in (legal) tax avoidance activities, the household can also obtain income from (illegal) participation in the shadow economy. We assume a fixed penalty tax rate  $t_2 \leq 1$  for working in the underground economy. The probability of being detected is  $p$ ; both  $p$  and  $t_2$  are determined by the government. If the household works in the shadow economy, it may find itself in two situations: not being detected (situation 1) or being



detected (situation 2). The disposable income of the household in situation  $i$ ,  $i = 1, 2$ , is given, respectively, by

$$y_1 = (W^0 S^0 - a) (1 - t_1) + a + t_0 + W^u S^u, \quad (2)$$

$$y_2 = (W^0 S^0 - a) (1 - t_1) + a + t_0 + W^u S^u (1 - t_2). \quad (3)$$

For notational convenience, we write

$$t_2' = \begin{cases} 0 & \text{for } y = y_1 \text{ (non-detection),} \\ t_2 & \text{for } y = y_2 \text{ (detection).} \end{cases} \quad (4)$$

Next, the household is assumed to have a cardinal utility function  $U$  depending positively on income and negatively on labor supplied in the official and the shadow economy and on the household's effort to obtain tax avoidance. The latter is considered to be independent of the two kinds of labor supply, as it need not involve actual work (such as information - gathering activities) by the household but may be delegated to a tax consultant. By including both  $S^0$  and  $S^u$  instead of leisure as arguments of the utility function, differential disutilities of both kinds of labor can be incorporated. Thus we have

$$U = U (y, S^0, S^u, e) \quad (5)$$

with  $U_y > 0$ ,  $U_{S^0} < 0$ ,  $U_{S^u} < 0$ ,  $U_e < 0$ , and assume concavity:

$U_{yy} < 0$ ,  $U_{S^0 S^0} < 0$ ,  $U_{S^u S^u} < 0$ ,  $U_{ee} < 0$ . Moreover, we assume additive separability of the utility function:

$$U_{y S^0} = U_{y S^u} = U_{y e} = U_{S^0 S^u} = U_{S^0 e} = U_{S^u e} = 0. \quad (6)$$

This is also a very restrictive assumption, but it would be nearly impossible to obtain results which can be interpreted in economic terms without it. The household maximizes its von Neumann-Morgenstern expected utility function

$$E [U] = (1 - p) U (y_1, S^0, S^u, e) + p U (y_2, S^0, S^u, e) \quad (7)$$

with respect to  $S^0$ ,  $S^u$  and  $e$ , where  $y_1$ ,  $y_2$  and  $a$  are given by (2), (3) and (1), respectively, subject to

$$S^0 + S^u \leq T, S^0 \geq 0, S^u \geq 0, e \geq 0. \quad (8)$$

Assuming an interior solution ( $L > 0$ ,  $S^0 > 0$ ,  $S^u > 0$ ,  $e > 0$ ), we can write the first-order conditions for a maximum as

$$E [U_y] W^0 (1 - t_1) + E [U_{S^0}] = 0, \quad (9)$$

$$E [U_y (1 - t_2')] W^u + E [U_{S^u}] = 0, \quad (10)$$

$$E [U_y] a_1 f_e t_1 + E [U_e] = 0, \quad (11)$$

where we have defined

$$E [U_y] = (1-p) U_y (y_1, S^0, S^u, e) + p U_y (y_2, S^0, S^u, e) \quad (12)$$

and similarly for  $E [U_{S^0}]$ ,  $E [U_{S^u}]$  and  $E [U_e]$ . Conditions (9) and (10) are identical to the case without the possibility of tax avoidance and can be interpreted in the same way as in Neck et al. (1989, p. 156). Condition (11) can be written as

$$t_1 a_1 f_e = - E [U_e] / E [U_y], \quad (13)$$

which says that the marginal tax avoidance income from household's avoidance effort must be equal to the ratio of the expected marginal disutility from avoidance effort to the expected marginal utility from income both from official and underground work. The conditions (9) - (11) determine implicitly two labor supply functions and one effort supply function, depending on the parameters  $p$ ,  $t_0$ ,  $t_1$ ,  $t_2$ ,  $a_1$ ,  $W^0$  and  $W^u$ ; for a corner solution, these functions additionally depend on  $T$ .

In order to determine the comparative statics effects of parameter changes on  $S^0$ ,  $S^u$  and  $e$ , we write for the necessary first-order conditions (9) - (11):

$$F_i (S^0, S^u, e, \zeta) = 0, \quad i = 1, 2, 3, \quad (14)$$

where  $\zeta = [p, t_0, t_1, t_2, a_1, W^0, W^u]$  is the vector of the parameters. Using the notation

$$F_{i1} = \frac{\delta F_i}{\delta S^0}, \quad F_{i2} = \frac{\delta F_i}{\delta S^u}, \quad F_{i3} = \frac{\delta F_i}{\delta e}, \quad \text{we obtain}$$

$$F_{11} = (W^0)^2 (1 - t_1)^2 E [U_{yy}] + E [U_{S^0 S^0}] < 0, \quad (15)$$

$$F_{12} = F_{21} = W^0 W^u (1 - t_1) E [U_{yy} (1 - t_2')] < 0, \quad (16)$$

$$F_{13} = F_{31} = W^0 (1 - t_1) a_1 t_1 f_e E [U_{yy}] < 0, \quad (17)$$

$$F_{22} = (W^u)^2 E [U_{yy} (1 - t_2')^2] + E [U_{S^u S^u}] < 0, \quad (18)$$

$$F_{23} = F_{32} = W^u a_1 t_1 f_e E [U_{yy} (1 - t_2')] < 0, \quad (19)$$

$$F_{33} = a_1^2 t_1^2 f_e^2 E [U_{yy}] + a_1 t_1 f_{ee} E [U_y] + E [U_{ee}] < 0. \quad (20)$$

Comparative statics effects of changes of an element of the parameter vector  $\zeta$ , say  $\zeta_i$ , are given by

$$\begin{bmatrix} \delta S^0 / \delta \zeta \\ \delta S^u / \delta \zeta \\ \delta e / \delta \zeta \end{bmatrix} = -\underline{E}^{-1} \begin{bmatrix} \delta F_1 / \delta \zeta \\ \delta F_2 / \delta \zeta \\ \delta F_3 / \delta \zeta \end{bmatrix}, \quad (21)$$

with  $\underline{E} = [F_{ij}]$ ,  $i, j = 1, 2, 3$ .

The cofactors  $A_{ij}$  of the elements  $F_{ij}$  of the matrix  $\underline{E}$  are given as follows:

$$\begin{aligned} A_{11} = & (W^u)^2 a_1^2 t_1^2 t_2^2 f_e^2 p(1-p) U_{yy}(y_1) U_{yy}(y_2) + \\ & + \{(W^u)^2 E[U_{yy}(1-t_2')^2] + E[U_S^u S^u]\} \{a_1 t_1 f_{ee} E[U_y] + E[U_{ee}]\} + \\ & + a_1^2 t_1^2 f_e^2 E[U_{yy}] E[U_S^u S^u] > 0, \end{aligned} \quad (22)$$

$$A_{21} = A_{12} = -W^0 W^u (1-t_1) E[U_{yy}(1-t_2')] \{a_1 t_1 f_{ee} E[U_y] + E[U_{ee}]\} < 0, \quad (23)$$

$$\begin{aligned} A_{31} = A_{13} = & -W^0 (W^u)^2 (1-t_1) a_1 t_1 t_2^2 f_e p(1-p) U_{yy}(y_1) U_{yy}(y_2) - \\ & - W^0 (1-t_1) a_1 t_1 f_e E[U_{yy}] E[U_S^u S^u] < 0, \end{aligned} \quad (24)$$

$$\begin{aligned} A_{22} = & (W^0)^2 (1-t_1)^2 E[U_{yy}] \{a_1 t_1 f_{ee} E[U_y] + E[U_{ee}]\} + \\ & + E[U_S^0 S^0] \{(W^u)^2 E[U_{yy}(1-t_2')^2] + E[U_S^u S^u]\} + \\ & + a_1 t_1 f_{ee} E[U_y] + E[U_{ee}] > 0, \end{aligned} \quad (25)$$

$$A_{32} = A_{23} = -W^u a_1 t_1 f_e E[U_S^0 S^0] E[U_{yy}(1-t_2')] < 0, \quad (26)$$

$$\begin{aligned} A_{33} = & (W^0)^2 (W^u)^2 (1-t_1)^2 t_2^2 p(1-p) U_{yy}(y_1) U_{yy}(y_2) + \\ & + E[U_S^0 S^0] \{(W^u)^2 E[U_{yy}(1-t_2')^2] + E[U_S^u S^u]\} + \\ & + (W^0)^2 (1-t_1)^2 E[U_{yy}] E[U_S^u S^u] > 0. \end{aligned} \quad (27)$$

Here we have used the fact that

$$E[U_{yy}] E[U_{yy}(1-t_2')^2] - \{E[U_{yy}(1-t_2')]\}^2 = t_2^2 p(1-p) U_{yy}(y_1) U_{yy}(y_2). \quad (28)$$

Next, we have:

$$\frac{\delta F_1}{\delta p} = W^0 (1-t_1) [U_y(y_2) - U_y(y_1)] + [U_S^0(y_2) - U_S^0(y_1)] > 0, \quad (29)$$

$$\frac{\delta F_1}{\delta t_0} = W^0 (1-t_1) E[U_{yy}] < 0, \quad (30)$$

$$\frac{\delta F_1}{\delta t_1} = -W^0 E[U_y] - W^0 (1-t_1) (W^0 S^0 - a_1 f) E[U_{yy}], \quad (31)$$

$$\frac{\delta F_1}{\delta t_2} = -W^0 W^u S^u (1-t_1) p U_{yy} (y_2) > 0, \quad (32)$$

$$\frac{\delta F_1}{\delta a_1} = W^0 (1-t_1) t_1 f E [U_{yy}] < 0, \quad (33)$$

$$\frac{\delta F_1}{\delta W^0} = (1-t_1) E [U_y] + W^0 S^0 (1-t_1)^2 E [U_{yy}], \quad (34)$$

$$\frac{\delta F_1}{\delta W^u} = W^0 S^u (1-t_1) E [U_{yy} (1-t_2')] < 0, \quad (35)$$

$$\frac{\delta F_2}{\delta p} = W^u [U_y (y_2) (1-t_2) - U_y (y_1)] + [U_S^u (y_2) - U_S^u (y_1)], \quad (36)$$

$$\frac{\delta F_2}{\delta t_0} = W^u E [U_{yy} (1-t_2')] < 0, \quad (37)$$

$$\frac{\delta F_2}{\delta t_1} = -(W^0 S^0 - a_1 f) W^u E [U_{yy} (1-t_2')] > 0, \quad (38)$$

$$\frac{\delta F_2}{\delta t_2} = -W^u p U_y (y_2) - (W^u)^2 S^u (1-t_2) p U_{yy} (y_2), \quad (39)$$

$$\frac{\delta F_2}{\delta a_1} = W^u t_1 f E [U_{yy} (1-t_2')] < 0, \quad (40)$$

$$\frac{\delta F_2}{\delta W^0} = W^u S^0 (1-t_1) E [U_{yy} (1-t_2')] < 0, \quad (41)$$

$$\frac{\delta F_2}{\delta W^u} = E [U_y (1-t_2')] + W^u S^u E [U_{yy} (1-t_2')^2], \quad (42)$$

$$\frac{\delta F_3}{\delta p} = a_1 t_1 f_e [U_y (y_2) - U_y (y_1)] + [U_e (y_2) - U_e (y_1)] > 0, \quad (43)$$

$$\frac{\delta F_3}{\delta t_0} = a_1 t_1 f_e E [U_{yy}] < 0, \quad (44)$$

$$\frac{\delta F_3}{\delta t_1} = a_1 f_e E [U_y] - (W^0 S^0 - a_1 f) a_1 t_1 f_e E [U_{yy}] > 0, \quad (45)$$

$$\frac{\delta F_3}{\delta t_2} = -W^u S^u a_1 t_1 f_e p U_{yy} (y_2) > 0, \quad (46)$$

$$\frac{\delta F_3}{\delta a_1} = t_1 f_e E [U_y] + a_1 t_1^2 f f_e E [U_{yy}], \quad (47)$$

$$\frac{\delta F_3}{\delta W^0} = S^0 (1 - t_1) a_1 t_1 f_e E [U_{yy}] < 0, \quad (48)$$

$$\frac{\delta F_3}{\delta W^u} = S^u a_1 t_1 f_e E [U_{yy} (1 - t_2')] < 0. \quad (49)$$

The determinant of the matrix  $\underline{F}$  is given as

$$\begin{aligned} \Delta = \det \underline{F} = & (W^0)^2 (1 - t_1)^2 \{ (W^u)^2 t_2^2 p (1 - p) U_{yy} (y_1) U_{yy} (y_2) + \\ & + E [U_{yy}] E [U_S^u S^u] \} \{ a_1 t_1 f_{ee} E [U_y] + E [U_{ee}] \} + \\ & + E [U_S^0 S^0] \{ (W^u)^2 a_1^2 t_1^2 t_2^2 f_e^2 p (1 - p) U_{yy} (y_1) U_{yy} (y_2) + \\ & + [(W^u)^2 E [U_{yy} (1 - t_2')^2] + E [U_S^u S^u] \} \{ a_1 t_1 f_{ee} E [U_y] + E [U_{ee}] \} + \\ & + a_1^2 t_1^2 f_e^2 E [U_{yy}] E [U_S^u S^u] \} < 0. \end{aligned} \quad (50)$$

Because of  $F_{11} < 0$ ,  $A_{33} > 0$  and  $\Delta < 0$ , the second-order conditions for a local maximum are fulfilled.

The comparative statics effect of parameter changes can now be calculated as

$$\frac{\delta S^0}{\delta \zeta} = -\frac{1}{\Delta} \left( A_{11} \frac{\delta F_1}{\delta \zeta} + A_{21} \frac{\delta F_2}{\delta \zeta} + A_{31} \frac{\delta F_3}{\delta \zeta} \right), \quad (51)$$

$$\frac{\delta S^u}{\delta \zeta} = -\frac{1}{\Delta} \left( A_{12} \frac{\delta F_1}{\delta \zeta} + A_{22} \frac{\delta F_2}{\delta \zeta} + A_{32} \frac{\delta F_3}{\delta \zeta} \right), \quad (52)$$

$$\frac{\delta e}{\delta \zeta} = -\frac{1}{\Delta} \left( A_{13} \frac{\delta F_1}{\delta \zeta} + A_{23} \frac{\delta F_2}{\delta \zeta} + A_{33} \frac{\delta F_3}{\delta \zeta} \right). \quad (53)$$

Unfortunately, it turns out that most of these expressions do not provide qualitative information as to the signs of these effects. For the effect which interests us most, however, we do get an unambiguous result, namely:

$$\frac{\delta S^u}{\delta a_1} = -\frac{1}{\Delta} W^u t_1 E [U_{SOS_0}] E [U_{yy} (1 - t_2')] \{ a_1 t_1 E [U_y] (f_{ee} - f_e^2) + f E [U_{ee}] \} < 0. \quad (54)$$

This means that a more "complex" tax system (a tax schedule which admits more exemptions) implies, *ceteris paribus*, a smaller labor supply in the shadow economy. The economic reason for this is the following: a more "complex" tax system makes individual efforts to avoid taxation legally more profitable. At the same time it encourages households to work in the official economy instead of the underground economy, as the reduced tax burden makes tax evasion (with the risk of being caught and punished) less attractive. Broadening the income tax base and removing tax exemptions, as was done in Austria in 1989, for example, can therefore increase the size of the shadow economy, *ceteris paribus*.

### 3. METHODS TO ESTIMATE THE SIZE OF THE SHADOW ECONOMY AND RESULTS FOR AUSTRIA

In order to test some of the theoretical hypotheses developed above, the size of the shadow economy first has to be estimated and then influences of changing tax structures on the shadow economy can be investigated.

#### 3.1 METHODS TO ESTIMATE THE SIZE OF THE SHADOW ECONOMY

Most studies measuring the shadow economy start with a commonly-used working definition of it: all currently unregistered economic activities which contribute to "value added" should be included in the national income, in accordance with national accounting conventions.<sup>3</sup> Using this definition, two different types of methods are most widely used to measure the size and development of the shadow economy.

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<sup>3</sup>) This definition is used in most studies which try to measure the size of the shadow economy, see e.g. Smith (1981), Feige (1982), Weck (1983), Frey and Pommerehne (1984), Kirchgässner (1984), and Schneider (1986).

### 3.1.1 DIRECT APPROACHES

These micro-approaches employ either well designed surveys and samples based on voluntary replies<sup>4</sup> or tax auditing and other compliance methods.<sup>5</sup> In most cases they lead only to point estimates (i.e., one estimate at a specific point in time). It is unlikely that they capture all "shadow" activities, so they can be seen as providing lower bound estimates. Moreover, they are unable (at least at present) to provide estimates of the growth of the shadow economy over time. But they have at least one considerable advantage: they can provide detailed information about the structure and composition of the labor force in the shadow economy.

### 3.1.2 INDIRECT APPROACHES

These approaches, which are also called "indicator" approaches, are macroeconomic ones and use various economic indicators that contain information about the development of the shadow economy (over time). There are at least four macro-economic indicators which trace the growth of the shadow economy:

#### 3.1.2.1 THE DISCREPANCY BETWEEN NATIONAL EXPENDITURE AND INCOME STATISTICS

In most OECD-countries the size of GDP is computed both from the expenditure and income side of national accounts; this often reveals that expenditure is higher than income. This "initial discrepancy" can be seen as a result of activity in hidden economy.<sup>6</sup> The weakness of this "fiscal" method is that the differences may arise not only because of activities in the shadow economy, but also because of other errors in measurement statistics. These estimates may therefore be very crude and of questionable reliability.

#### 3.1.2.2 THE DISCREPANCY BETWEEN THE OFFICIAL AND ACTUAL LABOR FORCE

If total labor force participation is assumed to be constant, a decreasing official rate of participation can be seen as an indicator of the increase in activity in the shadow economy.<sup>7</sup> The weakness of this method is that differences in the rate of participation may also have other causes. Moreover, people can work in the shadow economy and have a job in the

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4) The direct method of voluntary sample surveys has been used for Norway by Isachsen, Klovland and Strom (1982), and Isachsen and Strøm (1985). An attempt to use this method for Denmark is made by Mogensen (1985) in which he reports an "estimate" of the shadow economy of 5.5 % (of GDP) for the year 1984 as a minimum figure.

5) Compare for the United States, IRS (1979), Simon and Witte (1982) and Clotefelter (1983).

6) Compare, e.g., Macafee (1980) for Great Britain, Petersen (1982) for Germany, and Park (1979) for the United States.

7) Such studies have been made for Italy, see, e.g., Contini (1981) and Del Boca (1981), and for the United States, compare O'Neill (1983).

"official" economy. Again, such estimates may be viewed as weak indicators of the size of the shadow economy.

### 3.1.2.3 THE TRANSACTIONS APPROACH

This approach, developed by Feige,<sup>8</sup> assumes that there is a constant relation over time between the volume of transactions and official GDP. The method, therefore, starts from Fisher's quantity equation,  $M \cdot v = p \cdot T$  (with  $M$  = money,  $v$  = velocity,  $p$  = prices, and  $T$  = total transactions). Assumptions have to be made about the velocity of money and about the relationship between the value of total transactions ( $p \cdot T$ ) and total nominal GDP. Relating total nominal GDP to total transactions, GDP in the shadow economy can be derived by subtracting the official GDP from total nominal GDP. To derive figures for the shadow economy, Feige has had to assume a base year in which there is no shadow economy, and therefore the ratio of  $p \cdot T$  to total nominal (official=total) GDP was "normal" and would have been constant over time if there had been no shadow economy. This method, too, has several weaknesses: for instance, the assumption of a base year with no shadow economy, and the assumption of a "normal" ratio of transactions, constant over time. Moreover, to obtain reliable estimates, precise figures for the total volume of transactions should be available. This availability might be especially difficult to achieve for cash transactions, because they depend, among other factors, on the quality of paper used in the currency.<sup>9</sup> In general, although this approach is theoretically attractive, the empirical requirements necessary to obtain reliable estimates are so difficult to fulfil that its application may lead to doubtful results.

### 3.1.2.4 THE CURRENCY DEMAND APPROACH

This approach assumes that shadow (or hidden) transactions are undertaken in the form of cash payments, so as to leave no observable traces for the authorities.<sup>10</sup> An increase in the size of the shadow economy will therefore increase the demand for currency. To isolate the resulting "excess" demand for currency, an equation for currency demand is econometrically estimated over time, with controls for all possible conventional factors, such as the development of income, payment habits, interest rates, and so on.

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<sup>8</sup>) For an extended description of this approach see Feige (1979, 1982), and for a further application for the Netherlands, Boeschoten and Fase (1984), and for Germany, Langefeldt (1984).

<sup>9</sup>) For a detailed criticism of the transaction approach see Boeschoten and Fase (1984), Frey and Pommerehne (1984), and Kirchgässner (1983, 1984).

<sup>10</sup>) The currency demand approach was first used by Cagan (1958), who calculated a correlation of the currency demand and the tax pressure as one cause of the shadow economy for the United States over the period 1919 to 1955. 20 years later, Gutmann (1979) used the same approach, but did not use any statistical procedures; instead he "only" looked at the ratio between currency and demand deposits over the years 1937 to 1976. Cagan's approach was further developed by Tanzi (1980, 1983) who estimated a currency demand function for the United States for the period 1929 to 1980 in order to measure the shadow economy.



Additionally, such variables like the tax burden and government regulations, which are assumed to be important major factors that cause people to work in the shadow economy, are included in the estimation equation. The "excess" increase in currency, which is the amount unexplained by the conventional or normal factors (mentioned above), is then attributed to such variables like a rising tax burden and regulations. Figures for the size and development of the shadow economy can be calculated by a comparison of the difference between the development of currency when the tax burden and government regulations are held at their lowest values, and the development of currency with the current (much higher) burden of taxation and government regulations. The currency demand approach is one of the most commonly used. It has been applied to 14 of the 17 OECD-countries,<sup>11</sup> but has nevertheless been criticized on various grounds.<sup>12</sup> The most commonly raised objections to this method are stated below:

The first objection relates to the fact that not all transactions in the shadow economy are paid in cash. Isachsen and Strøm (1981) used the survey method to discover that in Norway in 1980 roughly 80 % of all transactions in the hidden sector were paid in cash. The size of the total shadow economy (including barter) may thus be even larger than previously estimated. Most studies consider only one particular factor, the tax burden, as a cause of the shadow economy. Other reasons (such as the impact of regulation, the complexity or visibility of the tax system, taxpayers' attitudes to the state, "tax morality", and so on) are not considered because data for most countries are not available. If, as seems likely, these other factors also have an impact on the extent of the hidden economy, it might be larger than reported in most studies.<sup>13</sup>

A further weakness of this approach, at least when applied to the United States by Tanzi (1980, 1983), is discussed by Garcia and Pak (1979). They point out that increases in currency demand deposits are due largely to a slow-down in demand deposits rather than to an increase in currency caused by activity in the shadow economy. Blades criticizes Tanzi's studies on the grounds that the US-Dollar is used as an international currency, so that Tanzi should have considered (and compensated for) the amount of US-Dollars held in cash abroad. Finally, Frey and Pommerehne (1984) claim that Tanzi's parameter estimates are not very stable.<sup>14</sup>

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<sup>11</sup>) Compare, e.g., Boeschoten and Fase (1984) and Lundager and Schneider (1986).

<sup>12</sup>) See, e.g., Garcia (1978), Blades (1982), Frey and Pommerehne (1984), Klovland (1984), Kirchgässner (1983, 1984), and Schneider (1986).

<sup>13</sup>) One (weak) justification for the use of the tax variable only is that this variable has by far the strongest impact on the size of the shadow economy in all studies known to the author. The only exception is the study by Frey and Weck-Hannemann (1984), where the variable "tax immorality" has a quantitatively larger and statistically higher influence in the model than the direct tax share. In a study of the U.S. shadow economy by Pommerehne and Schneider (1985), where data on various tax measures as well as on regulation, tax immorality and minimum wage rates are available, the tax variable has a dominating influence and contributes roughly 70-78% to the size of the shadow economy.

<sup>14</sup>) In studies for European countries, Kirchgässner (1983, 1984) and Schneider (1986) reach the conclusion that the estimation results for Germany, Denmark, Norway and Sweden are quite robust when using this approach.

Another weak point of this procedure, as applied in most studies, is the assumption that the velocity in both types of economy is the same. As Klovland (1984) argues for the Scandinavian countries, there is already considerable uncertainty about the velocity of circulation of currency in the official economy; the velocity of currency in the hidden sector is even more difficult to estimate. Without knowledge about the velocity of currency in the shadow economy, one has to accept the assumption of currency velocity in both sectors to be the same. Finally, the assumption of no shadow economy in a base year is open to criticism. Relaxing this assumption would again imply an upward adjustment of the figures attained in the bulk of the studies already undertaken.

### 3.2. EMPIRICAL RESULTS FOR THE SIZE OF THE AUSTRIAN SHADOW ECONOMY OVER TIME

In view of the large number of studies measuring the size of the shadow economy in Austria's neighbouring countries Germany, Switzerland and Italy, it is somewhat surprising that only a few attempts have been made to measure the size of the Austrian shadow economy.<sup>15</sup> Frey and Weck-Hannemann (1984) used the technique of the unobserved variables to compute the size of the shadow economy for the OECD-countries and estimated a shadow economy of 8.9 percent (of official GDP) for Austria in 1978. Franz (1985) computed the scope of the shadow economy on the basis of official data which were available in a very detailed form only for 1976. Comparing the income earned in different occupational sectors, Franz estimated the size of the shadow economy to be 3.5 percent of official GDP of 1976. Furthermore, he argued that this figure remained more or less constant until 1982.<sup>16</sup> Apart from these two studies, which only provide results for certain years, only Hofreither and Schneider (1987) have made an attempt to measure the size and the growth of the Austrian shadow economy over an extended period of time.

The method chosen for estimating the shadow economy in Austria over time is the currency demand approach. Having discussed its major weaknesses in section 2, the question may arise as to why we have chosen this approach. The answer is that: (i) we have reliable time-series data for Austria over the period 1956 to 1991 concerning the monetary sector and different measures of the tax burden, the complexity of the tax system and the intensity of regulation, which are major causes of the shadow economy; and (ii) the currency demand approach is the most widely used. In applying the currency demand approach, we follow the procedure developed by Klovland (1984). His basic model relates the stock of currency demanded by

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<sup>15</sup>) This short description is a summary of a much larger study by Hofreither and Schneider (1987). A comprehensive survey concerning all aspects of the Austrian shadow economy is given in Skolka (1985).

<sup>16</sup>) Franz reached this conclusion quoting a study by Mooslechner (1985) who tried to apply monetary approaches (including the currency demand approach) for measuring the shadow economy. Mooslechner argued that on the basis of financial indicators, it is not likely that the shadow economy has increased significantly in the last decade.

the public (outside banks) to the price level, the volume of transactions in the regular economy and the interest rate as a measure of the opportunity costs of holding currency.<sup>17</sup> Furthermore, he uses only the marginal tax rate as a causal variable for shadow economy activities.

In this study we will extend the procedure developed by Klovland by adding a close substitute for cash money (the amount of Eurocheque systems,<sup>18</sup> negative sign expected in the regression analysis) and by including more possible causes of shadow economy activities in order to empirically test our theoretical hypothesis about the influence of complexity on the shadow economy. As argued elsewhere, the following four types of causes for working in the shadow economy are distinguished:<sup>19</sup>

- (i) The burden of total direct taxation (DIRT), both average and marginal;<sup>20</sup>

$$\text{with } \text{DIRT}_t = \text{TATRY}_t + \text{AMTRY}_t,$$

where  $\text{TATRY}_t$  = total average tax rate (including social security payments) on wage income in the year  $t$  and

$\text{AMTRY}_t$  = average marginal tax rate on wage income in the year  $t$ .

A rising burden of total direct taxation provides a strong incentive to work in the shadow economy.

- (ii) The burden of indirect taxation (INDT), which is defined as the percentage ratio of the sum of all indirect taxes to gross domestic production net of indirect taxes. Again a rising burden of indirect taxation provides a strong incentive to work in the shadow economy.

- (iii) The complexity of the tax system (VIST), which, following Wagner (1976) and Clotefelter (1975), is defined with the help of the Herfindahl-Hirschmann concentration measure:

$$\text{VIST}_t = \sum_{i=1}^m (\text{REV}_{it})^2 + \sum_{j=1}^n (\text{EXEM}_{jt})^2, \text{ where}$$

<sup>17</sup>) In order to avoid the difficult problem of money illusion, we deflated the dependent variable, currency per capita, and the independent variable, consumption and interest rates, with the GDP-deflator. The interest rate on bonds proved to be the best measure for the opportunity cost of holding currency. For further empirical investigations using different deflators and different opportunity cost measures, see Hofreither and Schneider (1987 and 1989).

<sup>18</sup>) As a proxy for the total value of Eurocheques and Eurocheque-cards (as money substitute) in a year, the number of valid Eurocheque-cards held by the public are used.

<sup>19</sup>) Compare, for example, Pommerehne (1983, 1986), Hofreither and Schneider (1987) and Neck, Schneider and Hofreither (1989).

<sup>20</sup>) Most studies stress that both average and marginal tax rates induce people to work in the shadow economy (compare the references in footnote 19).

$REV_{it}$  equals the  $i$ -th revenue share of the total revenue amount for all  $m$  revenue items in a year  $t$ ;

$EXEM_{jt}$  equals the  $j$ -th tax exemption of the total tax exemptions  $n$  in a year  $t$ .<sup>21</sup>

Thus VIST is equal to 2 if only one revenue source exists in a year  $t$  and if there is one tax exemption. In this case, the tax system is highly simple and every change will be immediately recognized by the taxpayer, e.g. an increase in the tax burden will immediately lead to more shadow economy activities. The more revenue sources and tax exemptions exist, the more complex the tax system becomes, i.e. VIST tends to 0. In this case, a tax increase is much less recognizable ("felt" much less) by the taxpayer and hence leads to a lower increase in shadow economy activities than under a highly simple tax system.<sup>22</sup>

- (iv) The intensity of regulations (REG), as proxy for all other state activities, which is defined as the stock of all existing and enforced laws concerning federal, state and local regulatory activities.<sup>23</sup> It is assumed, too, that increases in the burden of regulation provide a strong incentive to enter the shadow economy.

The estimation results of the currency demand functions are shown in table 1. All coefficients

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TABLE 1

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of independent variables have the theoretically expected signs and, with the exception of the indirect tax burden, are statistically significant at the 95% confidence level. Also the other test-statistics show satisfactory results; especially the "true" ex-post forecast over the period 1985 to 1991 indicates that the major independent factors in the currency demand function are included.<sup>24</sup>

As in most studies for Austria's neighbouring countries as well as for the Scandinavian countries, it is assumed that there would have been no shadow economy if the direct and indirect tax burdens as well as the complexity of the tax system and the amount of regulation

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<sup>21</sup>) The tax exemptions refer to direct and indirect taxes. For statistical reasons REV and EXEM are combined to one variable.

<sup>22</sup>) There is an extensive literature on this type of "fiscal illusion", compare, e.g., Pommerehne and Schneider (1978), and Pommerehne (1983, 1986).

<sup>23</sup>) In the area of foreign labor, social security, working hours and other working conditions regulations. The authors are aware that is an extremely crude measure, which is open to severe criticism, but we do not know of any better measure, which is available on a time series basis.

<sup>24</sup>) Some further results (e.g. transforming the dependent variable into first differences) are shown in the appendix. The log transformation of the dependent and independent variables seems to be the best functional form.

had remained at their historical minimum from 1960 until 1991. Keeping these variables at their minimum level in the year 1960, the "normal" (without shadow economy) level of currency holdings is calculated by undertaking a dynamic simulation. The difference between the actually observed and the simulated currency holdings is assumed to reflect the amount of currency used for shadow economy transactions. Assuming the same income velocity for currency used in the shadow economy as for legal M1 in the official economy, the size of the shadow economy is computed and compared to the official GDP<sup>25</sup>.

In table 2 the results for the growth of the Austrian shadow economy over the period from 1965 to 1990 are shown.

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TABLE 2

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The Austrian shadow economy increased more or less steadily and reached a peak value in 1991 with 5.3 percent of official GDP. The conclusion by Franz (1985) and Mooslechner (1985) that the shadow economy did not grow from 1976 to 1982 is not supported by these findings.<sup>26</sup>

#### **4. THE INFLUENCE OF CHANGING TAX RATES AND STRUCTURES ON THE SIZE OF THE SHADOW ECONOMY**

Table 2 indicates that the Austrian shadow economy has more or less grown steadily over time. This is extremely surprising as we had major changes (in both directions!) in the direct and indirect tax rates and structures over the period 1965 to 1991. In the following, we want to investigate what influences the effects of these tax changes had on the development of the shadow economy and test our theoretical hypothesis on the complexity of the tax system, considering three cases:<sup>27</sup>

- (i) 1972/73
  - the introduction of the value-added tax, a rate of 16% (1.1.1973)
  - switch from family (joint) to individual income taxation
  - additional tax exemptions to stimulate investment and accumulation of capital

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<sup>25</sup> Because of a complete lack of knowledge about the velocity of money in the shadow economy, the same assumption is made here as in most other studies using this approach (e. g., Tanzi, 1980, 1983; Kirchaessner, 1983, 1984; Isachsen and Strøm, 1985; Schneider, 1986).

<sup>26</sup> Due to the different specification and the inclusion of the additional independent variables as causes for working in the shadow economy, the results in Table 2 differ from the results in Hofreither and Schneider (1987 and 1989) and Schneider, Hofreither and Neck (1989).

<sup>27</sup> In the following, only the most important tax rate and structure changes are discussed; for detailed information see Bös (1975), Genser and Holzmann (1986, 1990).

- (ii) 1983/84
  - increase of most indirect tax rates (e.g. value added tax from 18 to 20 %, value added tax on luxury goods from 30 to 32 %, etc.)
  - new tax on interest rates
  - tax exemptions to stimulate venture capital
  
- (iii) 1988/89 (major income tax reform)
  - considerable reduction of all marginal tax rates on income, e.g. from 62 to 50 % (top marginal tax rate)
  - reduction of the number of income tax rates from 10 to 5
  - decrease in the average tax rates of between 8 to 10 percentage points
  - reduction in tax exemptions and tax loopholes
  - considerable decrease of the tax rates on capital gains and profits and simplification of the system

The influence of these three major tax changes on the development of the shadow economy is shown in table 3 and in figures 3.1, 3.2 and 3.3.<sup>28</sup> If one first considers case (i), the changes

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TABLE 3

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FIGURES 3.1, 3.2 and 3.3

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in direct taxation (e.g., switch from family to individual taxation) had the strongest effect on the shadow economy (42% of the increase of the shadow economy was caused by them). The introduction of the highly simple value added tax (compared to the old turnover tax) had a stronger effect on the reduced complexity than on the rise in the indirect tax burden. Switching to case (ii), the "cold progression effect" of income taxation dominated the increase in the rates of a number of indirect taxes. Whereas the first was responsible for 58.4 % of the increase of the shadow economy, raised indirect taxes contributed only 40.5 %. Most interesting seems to be case (iii), the major tax reform in 1989. Under ceteris paribus conditions the considerable reduction in the direct marginal and average tax burden would have decreased the shadow economy by 1.15 Bill.AS (a reduction of 2.5 % in a shadow economy of 46.37 Bill.AS in 1988). However, the negative effect of the decreased personal income tax rates is more than doubly offset by the strongly reduced complexity of the tax

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<sup>28</sup>) The influences of the tax changes (i) to (iii) are reflected in changes of the yearly values of the three independent tax variables DIRT, IND and VIST.

system. The increased regulation intensity compensates the negative effect of the reduced income tax rates, too.

In table 4 and figure 4 the percentages for the four causes of the shadow economy are

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TABLE 4

FIGURE 4

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shown. If one first considers the the direct tax burden, it has by far the biggest influence over the whole period; however, it is a strongly declining one: up to the year 1977 roughly 50 % of all shadow economy activities were caused by the burden of direct taxation, but by the beginning of the nineties this impact had diminished to 34 %. The opposite trend holds for the influence of the indirect tax burden. Whereas in the sixties "only" 12 % of shadow economy activities were caused by this factor, in the years 1990 and 1991 the influence has risen to 24 %! The influence of the complexity of the tax system on the shadow economy also declined over time compared to the seventies; in the sixties we had quite a simple tax system causing 25 % of all shadow economy activities. This influence diminished to 17 % in the years 1990/91. On the other hand, we can observe a strong increase over time in the percentage share of the shadow economy due to the intensity of regulation. In the sixties and seventies this factor caused "only" 10-12% of all shadow economy activities, but increased to 23-24 % in the years 1990 and 1991.

Finally, if one considers the influence of the change of tax systems and structures, one realizes that quite sizeable changes in the relative percentage shares (or weights) took place. From 1972 to 1973 the proportion of the shadow economy caused by the indirect tax burden increased from 13.9 to 16.5 % (a rise of 2.6 percentage points!) and the proportion due to the complexity of the tax system from 22.8 to 24.3 %. From 1988 to 1989 the share due to the direct tax burden decreased from 41.0 to 35.1 % (a decrease of 4.9 percentage points!), however, the share caused by the complexity of the tax system increased from 13.2 to 17.5 % (a rise of 3.3 percentage points).

These findings confirm our theoretically developed hypothesis about the influence of the complexity on the shadow economy, but the increase in the size of the shadow economy over the last years is not in line with the simulation results of Schneider, Hofreither and Neck (1989), where it was shown that lowering the direct tax burden has a significant negative impact on the shadow economy. In their study it is assumed, as it is in most other studies, that only a high direct and/or indirect tax burden causes shadow economy activity. If the government now undertakes tax-reform, i.e., if it lowers a direct tax rate, it can hope that

people will reduce their shadow economy activities. In their simulation the government reduces the wage-earners' tax burden by 5 % every year, as compared to the control solution, starting in the year 1975. The aim of lowering the marginal tax burden to such an extent is to let people have less (more) incentive to work in the shadow (official) economy. This means that the suppliers of unofficial activities will react with a reduction in the shadow economy activities when tax rates are decreased.<sup>29</sup> The simulations in Schneider, Hofreither and Neck (1989) show that the shadow economy decreases on average by 8.81 percentage points over the period 1975 to 1985 which is quite a considerable amount.

However, as the results in this study indicate (compare table 3), such a development did not occur in the years 1989, 1990 and 1991, in spite of the fact that in 1989 we had a significant decrease in the direct tax burden. The decline of the direct tax burden in 1989 had a negative effect on the size of the shadow economy, but it had been offset by a decrease in complexity of the tax system and an increase in regulations (especially in the labor market).

## 5. SUMMARY AND FUTURE RESEARCH AREAS

Coming back to the question at the beginning of this paper, one realizes that there are many obstacles to be overcome when measuring the shadow economy and when analysing the consequences of changing tax systems, but some progress has been made. We hope to have shown that although it is difficult to estimate the size of the shadow economy, it is not impossible! We have introduced, discussed and criticized various methods and have demonstrated that, at least with the currency demand approach, some insights can be gained about the size and development over time of the Austrian shadow economy. Using this approach, we showed that the shadow economy increased from 5.14 Bill. AS (1.16 % of the official GDP) in the year 1965 to 59.89 Bill. AS (5.32 % of the official GDP) in the year 1991.

The next step was to theoretically and empirically analyze the effects of changing tax systems and structures on the development of the shadow economy, emphasizing the negative effect of the complexity of the tax system on the extent of the shadow economy. When the tax system and structure was significantly changed by the Austrian government (like, e.g., in 1973, 1984 and 1989), one would expect that, for example, a massive decrease in the direct tax burden would lead to a decline in the shadow economy. Such a result was actually found in a simulation study by Schneider, Hofreither and Neck (1989), but considering the actual development of the shadow economy, it did not show up, especially when considering the massive change in the tax structure in 1989. The explanation offered by in this paper is that

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<sup>29</sup>) This assumption of such a "symmetric" reaction is implicitly made in the currency demand approach; it is, however, questionable whether people react to a decrease in the tax burden with an equivalent reduction of the shadow economy activities (compare Pommerehne (1986)).



not only the direct and indirect tax burden is an important factor influencing the shadow economy, but also the complexity of the tax system and the burden of regulation. The theoretical and empirical results in this study clearly indicate that both factors more than offset the significantly lower direct tax burden in 1989 showing that only lowering the tax burden is not sufficient to bring about a decline of the shadow economy.

In general, these results should be seen as a first step in studying the complicated interactions between changing tax structures and their effect on the shadow economy. The next step is to study the influence of changing tax systems on the shadow economy and the consequences for the official economy. It is important to stress that these are preliminary results but they are interesting enough to stimulate further research (at least in the opinion of the authors).

**Table 1: Estimation Results of the Currency Demand Function for Austria<sup>1)</sup>**

Independent Variables	Dependent Variable: Real Currency per Capita, $\ln(\text{CUR}_t/\text{POP}_t)$	
	Estimation Period:	
	1956 -1991	1956-1985
Lagged Dependent Variable $\ln(\text{CUR}_{t-1}/\text{POP}_{t-1})$	0.534** (8.91)	0.551** (9.43)
Real Consumption per capita $\ln(\text{C}_t/\text{POP}_t)$	0.703** (5.49)	0.724** (5.99)
Number of Eurocheque Systems per capita $\ln(\text{ES}_{t-1}/\text{POP}_{t-1})$	- 0.213* (-2.51)	- 0.174* (- 2.09)
Real Interest Rate on Bonds $\ln(\text{IR}_t)$	- 0.123* (- 2.51)	- 0.139* (- 2.65)
Direct Tax Burden (including social security payments) $\ln(\text{DIRT}_t)$	0.173** (3.09)	0.182* (2.86)
Indirect Tax Burden $\ln(\text{INDT}_t)$	0.117(*) (1.88)	0.123(*) (1.92)
Visibility of the Tax System $\ln(\text{VIST}_t)$	0.154** (2.77)	0.147** (2.86)
Intensity of Regulation $\ln(\text{REG}_t)$	0.186** (2.94)	0.179** (2.72)
Constant Term	- 2.24(*) (- 1.80)	- 2.39(*) (- 1.74)
Test Statistics		
$R^2$	0.992	0.990
S.E.	0.014	0.015
Durbin's h	1.06	1.16
rho(1)	0.18	0.20
D.F.	27	21
Ex-post Forecast 1985-1991		
RMSE	-	1.51
Theil's U 1	-	0.42

1) All equations are estimated by an ordinary least-squares procedure using annual data.  $R^2$  is the coefficient of determination (corrected for the degrees of freedom); S.E. shows the standard error of the estimation. Durbin's h is Durbin's h-test against autocorrelation when lagged dependent variables are used as regressors. Rho (1) is the autocorrelation coefficient of first order. D.F. stands for the "degrees of freedom". RMSE is the root mean squared error and Theil's U 1 stands for Theil's inequality coefficient. The term "ln" indicates that these variables have been transformed to natural logarithms. Numbers in parentheses below coefficient estimates are t-values. (\*), \*, and \*\* indicate significance at the 90%, 95%, and 99%-level, respectively.

**Table 2: Size of the Austrian Shadow Economy<sup>1)</sup>**

Year	Official Gross Domestic Production, real	Value Added in the Shadow Economy, real	Size of the Shadow Economy in per cent of the "official" GDP
1965	440.95	5.14	1.16
1966	466.20	5.69	1.22
1967	479.98	5.49	1.14
1968	502.18	6.21	1.24
1969	533.44	8.31	1.56
1970	571.25	10.47	1.83
1971	600.31	9.58	1.59
1972	637.69	10.41	1.63
1973	669.29	13.34	1.99
1974	695.79	12.46	1.79
1975	692.84	12.02	1.73
1976	724.75	15.39	2.12
1977	756.12	18.01	2.38
1978	760.23	20.06	2.63
1979	795.96	22.88	2.87
1980	820.03	24.98	3.05
1981	818.58	26.96	3.29
1982	828.62	29.09	3.51
1983	845.54	31.86	3.77
1984	862.66	36.38	4.22
1985	887.39	36.98	4.16
1986	904.46	39.64	4.38
1987	924.84	41.22	4.46
1988	959.91	46.37	4.83
1989	1004.09	50.89	5.07
1990	1061.32	54.56	5.14
1991	1126.32	59.89	5.32

1) Assumptions made for the calculation of the shadow economy:

- (i) All transactions in the shadow economy are made in cash.
- (ii) Direct and indirect tax burdens, the visibility of the tax system and the intensity of regulations are the reasons for working in the shadow economy.
- (iii) In 1960 the shadow economy did not exist.
- (iv) The velocity of currency is the same in the shadow economy as in the official economy and is calculated by dividing total official income by M1.
- (v) For the calculation, the currency-demand equation from Table 1 is used.

**Table 3: The Influence of Changing Tax Systems on the Growth of the Austrian Shadow economy.**

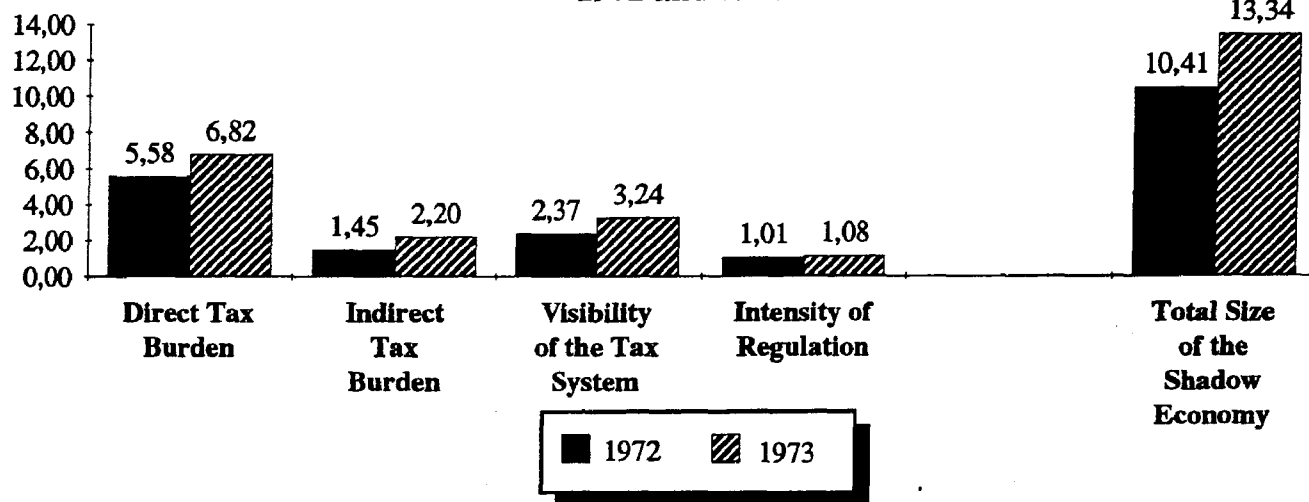
Year	Size of the Shadow Economy	Amount of the Shadow Economy Attributed to			
		Direct Tax Burden	Indirect Tax Burden	Visibility of the Tax System	Intensity of Regulation
	Bill. AS	Bill. AS	Bill. AS	Bill. AS	Bill. AS
Case (i)					
1972	10.41	5.58	1.45	2.37	1.01
1973	13.34	6.82	2.20	3.24	1.08
Diff. (73-72) (rel. weight)	2.93 (100.0 %)	1.24 (42.3 %)	0.75 (25.6 %)	0.87 (29.7 %)	0.07 (2.4 %)
Case (ii)					
1983	31.86	13.48	7.74	5.19	5.45
1984	36.38	16.12	9.57	5.16	5.53
Diff. (84-83) (rel. weight)	4.52 (100.0 %)	2.64 (58.4 %)	1.83 (40.5 %)	- 0.03 (-0.7 %)	0.08 (1.8 %)
Case (iii)					
1988	46.37	19.01	11.27	6.12	9.97
1989	50.89	17.86	12.21	8.90	11.91
Diff. (89-88) (rel. weight)	4.52 (100.0 %)	- 1.15 (- 25.4 %)	0.94 (20.8 %)	2.79 (61.7 %)	1.94 (42.9 %)

Figure 3.1.:

### The Influence of Changing Tax Systems on the Shadow Economy (case i)

Year	Size of the Shadow Economy (bill. Aus. S.)	Share of			
		Direct Tax Burden	Indirect Tax Burden	Visibility of the Tax System	Intensity of Regulation
1972	10,41	5,58	1,45	2,37	1,01
1973	13,34	6,82	2,20	3,24	1,08
Diff.	2,93	1,24	0,75	0,87	0,07

Shares and Total Size of the Shadow Economy (bill. Aus. S.)  
1972 and 1973



Difference (bill. Aus. S.) between 1972 and 1973

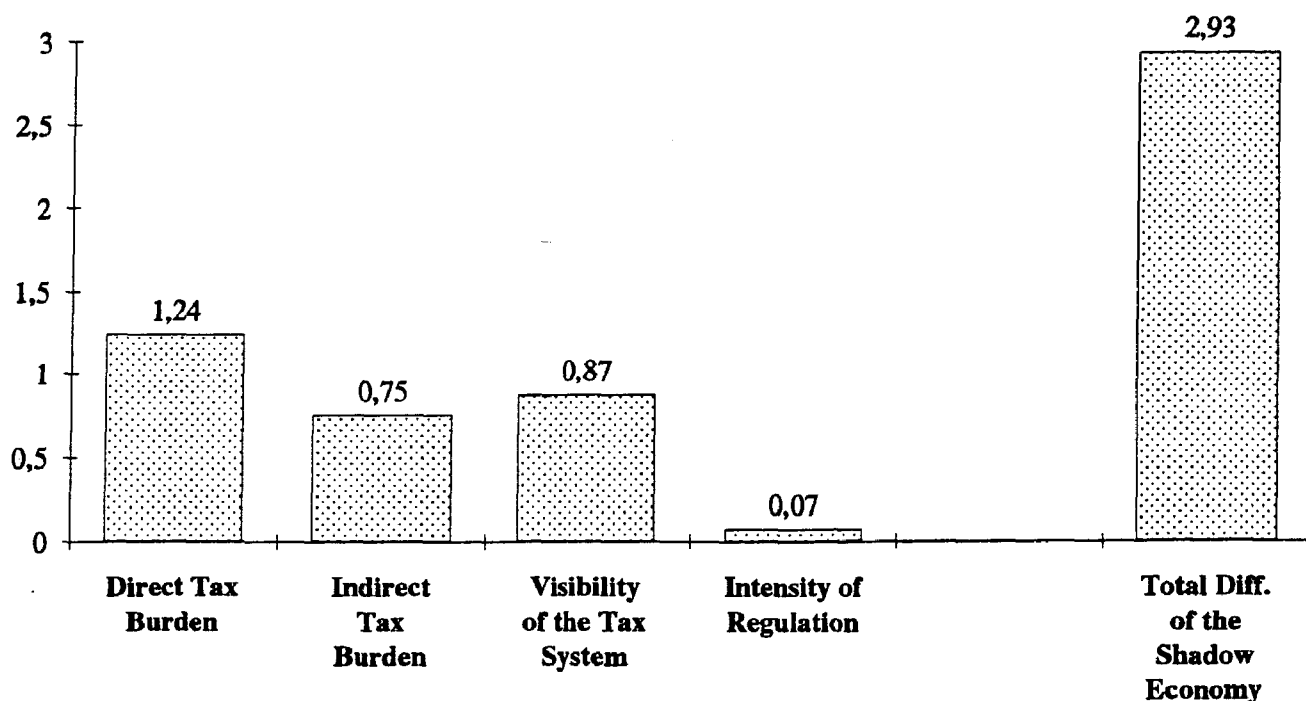
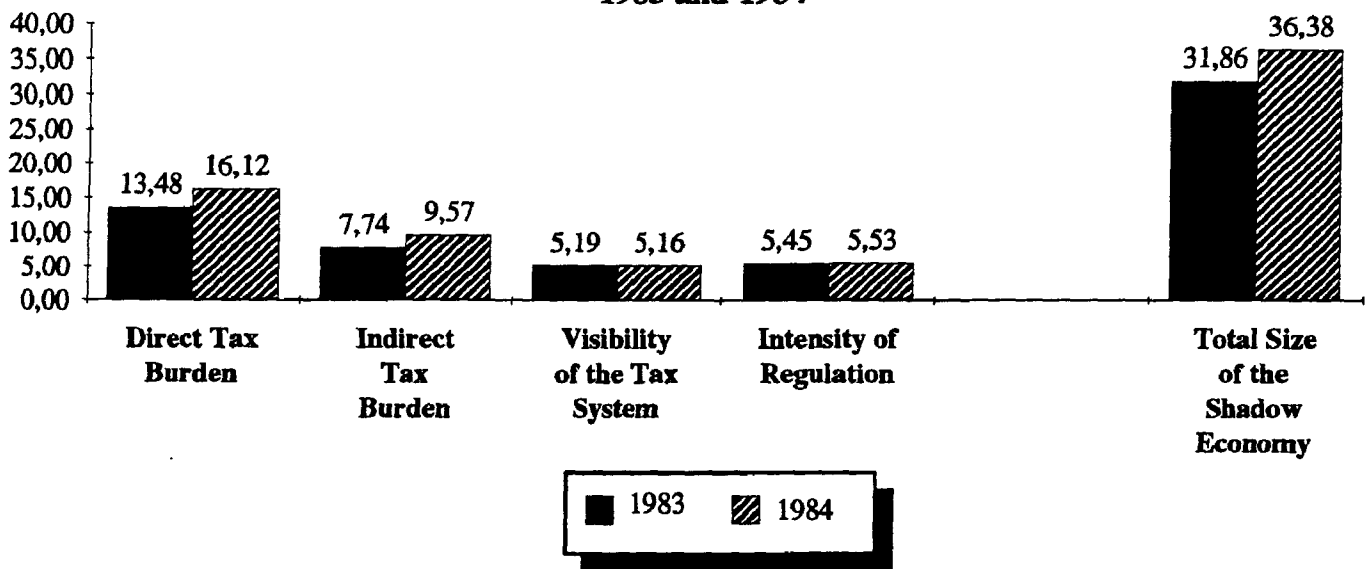


Figure 3.2.:

### The Influence of Changing Tax Systems on the Shadow Economy (case ii)

Year	Size of the Shadow Economy (bill. Aus. S.)	Share of			
		Direct Tax Burden	Indirect Tax Burden	Visibility of the Tax System	Intensity of Regulation
1983	31,86	13,48	7,74	5,19	5,45
1984	36,38	16,12	9,57	5,16	5,53
Diff.	4,52	2,64	1,83	-0,03	0,08

Shares of and Total Size of the Shadow Economy (bill. Aus. S.)  
1983 and 1984



Difference (bill. Aus. S.) between 1983 and 1984

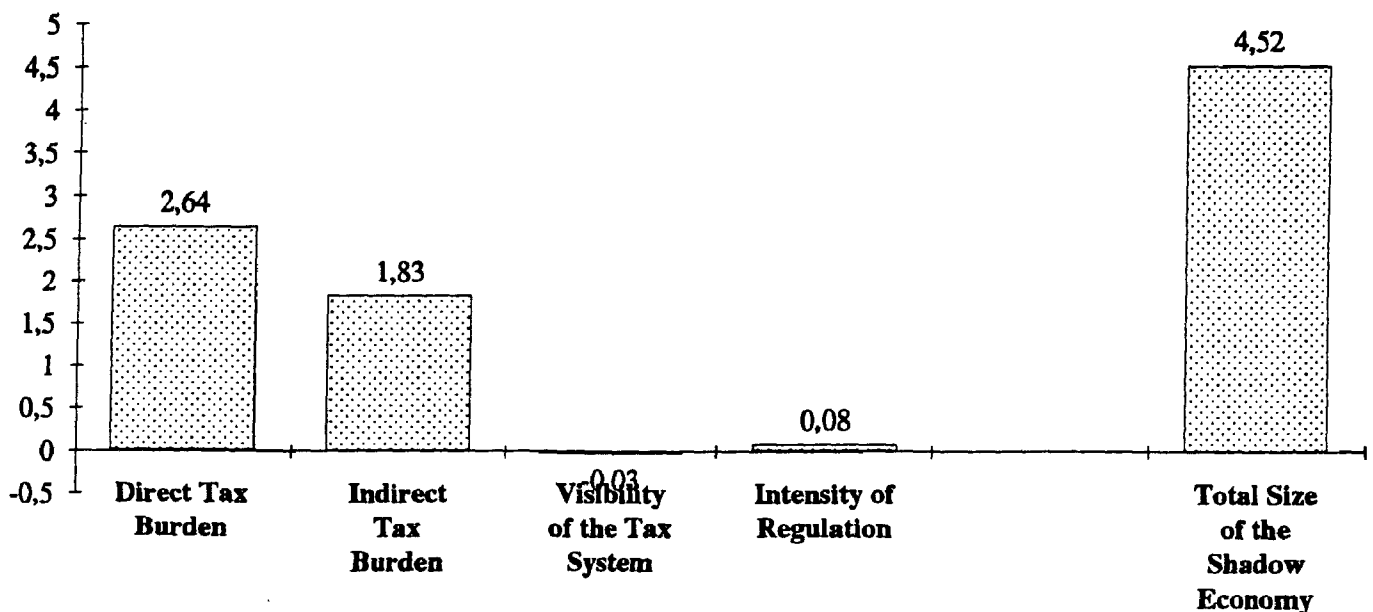
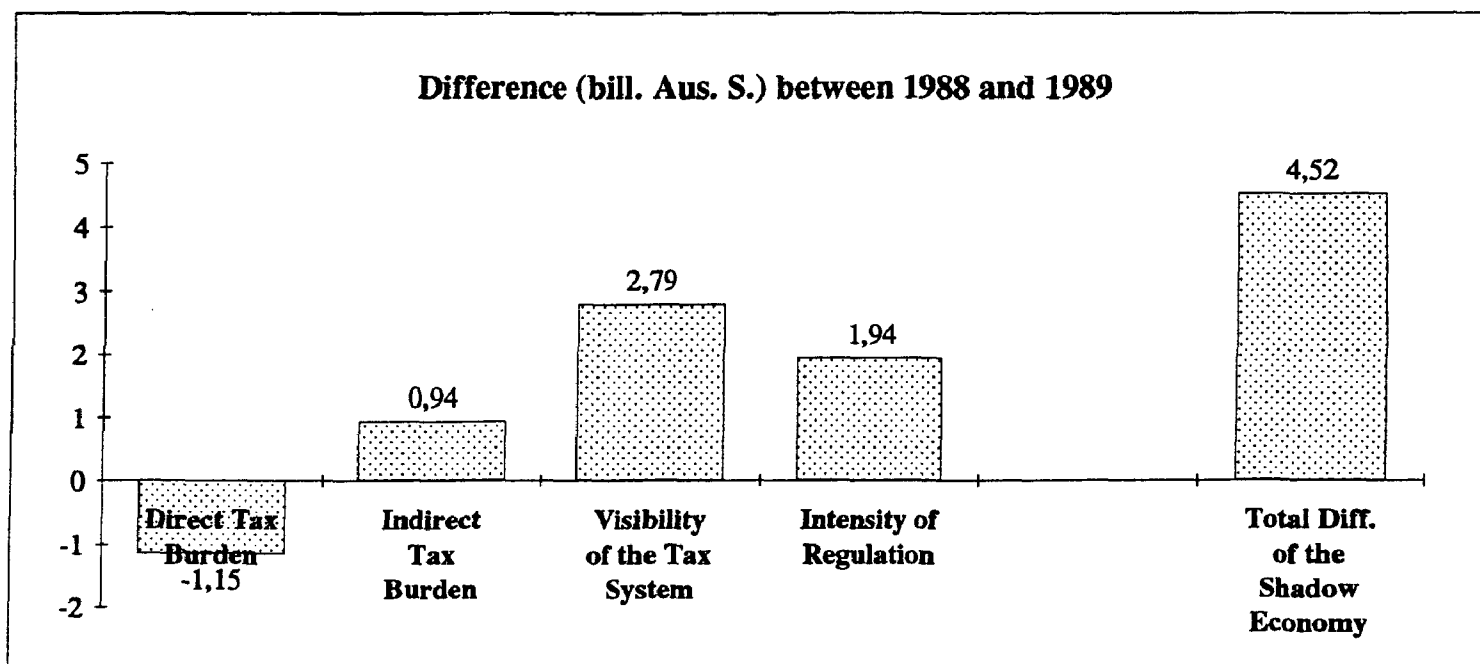
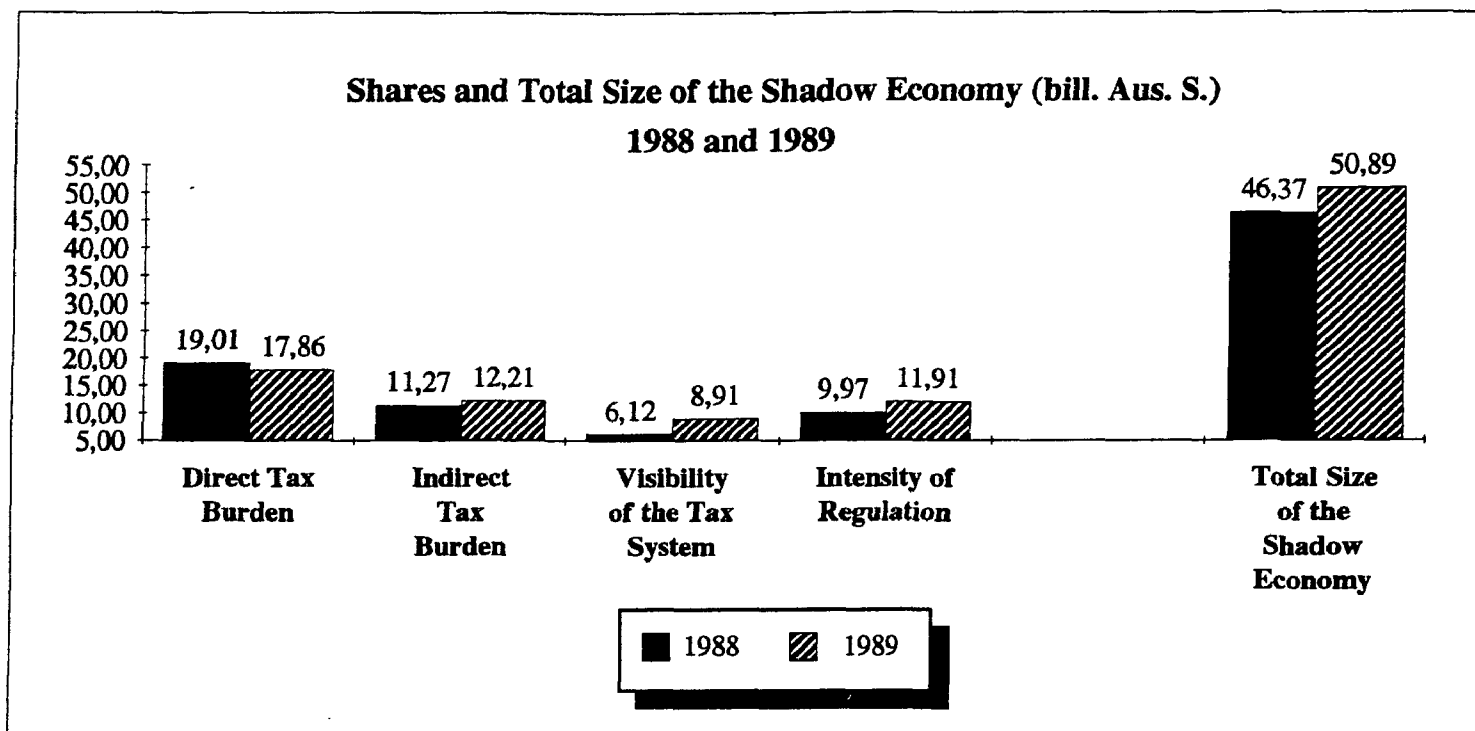


Figure 3.3.:

### The Influence of Changing Tax Systems on the Shadow Economy (case iii)

Year	Size of the Shadow Economy (bill. Aus. S.)	Share of			
		Direct Tax Burden	Indirect Tax Burden	Visibility of the Tax System	Intensity of Regulation
1988	46,37	19,01	11,27	6,12	9,97
1989	50,89	17,86	12,21	8,91	11,91
Diff.	4,52	-1,15	0,94	2,79	1,94

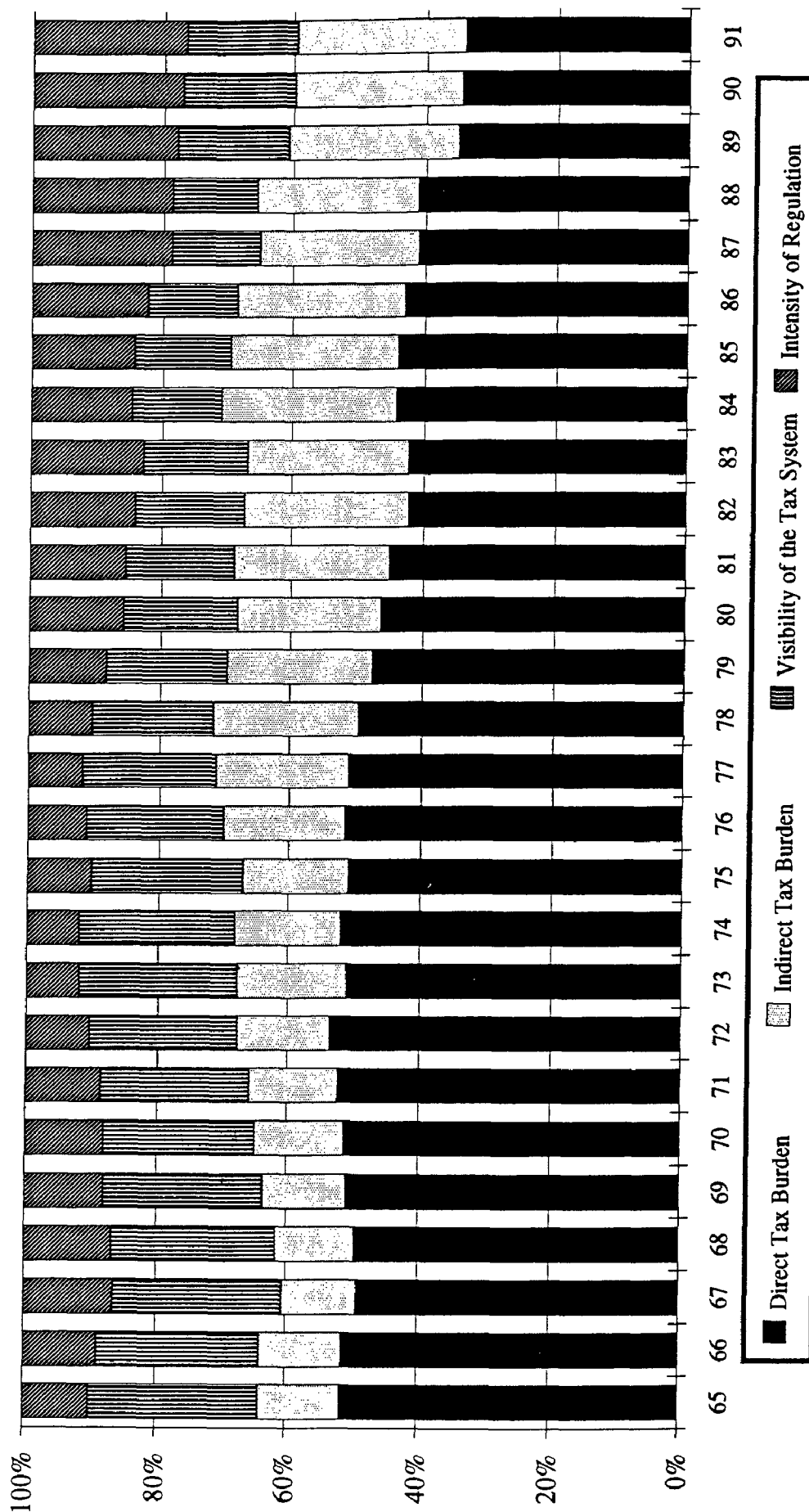


**Table 4: Breakdown of the Shadow Economy according to the Four Causes.**

Year	Percent Share of the Shadow Economy from				Size of the Shadow Economy in Bill. AS
	Direct Tax Burden  %	Indirect Tax Burden  %	Visibility of of the Tax System  %	Intensity of Regulation  %	
1965	51.2	12.1	25.9	9.8	5.14
1966	51.8	12.4	25.3	11.1	5.69
1967	49.3	11.2	26.1	13.4	5.49
1968	49.6	11.9	25.3	13.2	6.21
1969	50.9	12.6	24.6	11.9	8.31
1970	51.3	13.5	23.4	11.8	10.47
1971	52.3	13.3	23.0	11.4	9.58
1972	53.6	13.9	22.8	9.7	10.41
1973	51.1	16.5	24.3	8.1	13.34
1974	52.0	16.0	24.0	8.0	12.46
1975	50.9	15.9	23.4	9.8	12.02
1976	51.4	18.4	21.2	9.0	15.39
1977	51.0	20.1	20.6	8.3	18.01
1978	49.6	22.0	18.7	9.7	20.06
1979	47.6	21.9	18.8	11.7	22.88
1980	46.3	21.6	17.9	14.2	24.98
1981	45.0	23.3	17.0	14.4	26.96
1982	42.2	24.9	17.1	15.8	29.09
1983	42.3	24.3	16.3	17.1	31.86
1984	44.3	26.3	14.2	15.2	36.38
1985	44.0	25.2	15.2	15.6	36.98
1986	43.1	25.2	14.1	17.6	39.64
1987	40.9	24.0	13.7	21.4	41.22
1988	41.0	24.3	13.2	21.5	46.37
1989	35.1	25.6	17.1	22.2	50.89
1990	34.6	25.1	17.3	23.0	54.56
1991	34.1	25.4	17.0	23.5	59.89



Figure 4: Percentage Share of the Shadow Economy from the Four Causes



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University of Konstanz  
Sonderforschungsbereich 178  
"Internationalization of the Economy"

**Workshop on  
International Political Economics of Taxation**

July 2-3, 1992  
University of Konstanz  
Großer Sitzungssaal, V 1001

**Thursday, July 2, 1992**

- 10.00 Opening Address  
Hans-Jürgen Vosgerau (Speaker of the SFB 178)  
Introduction  
Bernd Genser (SFB 178)
- 10.30 Chair: Bernd Genser (SFB 178)  
"Intergovernmental Tax Competition"  
Bruno S. Frey (University of Zürich)
- 11.30 "International Tax Competition and Public Goods Supply:  
Alternative Views of Government Behaviour"  
Andreas Haufler (University of Konstanz)
- 12.30-14.00 Lunch (IBZ, University of Konstanz)
- 14.00 Chair: Gebhard Kirchgässner (University of St.Gallen)  
"Explaining the Use of Related Tax Instruments"  
Stanley L. Winer (Carleton University/Ottawa) and Walter  
Hettich (California State University/Fullerton)
- 15.00 "Intertemporal Commitment Problems and Voting on  
Redistributive Taxation"  
Amihai Glazer (Carnegie Mellon University/Pittsburgh)  
and Kai A. Konrad (University of München)
- 16.00-16.30 Coffee Break
- 16.30 Chair: Friedrich Breyer (University of Konstanz)  
"The Effects of Tax Administration on Tax Morale"  
Werner W. Pommerehne (University of Saarbrücken)  
and Bruno S. Frey (University of Zürich)
- 17.30 "Fuel Taxation in EC Countries: A Political-Economy  
Approach"  
Bernd Genser and Hannelore Weck-Hannemann (SFB 178)
- 19.30 Dinner (Schwedenschenke, Insel Mainau)

**Friday, July 3, 1992:**

- 08.30 *Chair: Heinrich Ursprung (SFB 178)*  
"Fiscal Policy During the Transition in Eastern Europe"  
Roger H. Gordon (University of Michigan/Ann Arbor)
- 09.30 "Corporate Income Tax Competition, Double Taxation  
Treaties, and Foreign Direct Investment"  
Eckhard Janeba (University of Bonn)
- 10.30-11.00 Coffee Break
- 11.00 *Chair: Hannelore Weck-Hannemann (SFB 178)*  
"The Development of the Shadow Economy under Changing Tax  
Systems and Structures: Some Theoretical and Empirical  
Results for Austria"  
Friedrich Schneider (University of Linz) and Reinhard Neck  
(University of Bielefeld)
- 12.00 Closing Address  
Bernd Genser (SFB 178)
- 12.30 End of Workshop
- 13.00 Lunch (Hotel Mainaublick, Egg)

**Organization:** Bernd Genser/Hannelore Weck-Hannemann  
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