Increasing the Value-Added Tax to Re-Finance a Reduction of Social Security Contributions?

A behavioral microsimulation analysis for Germany

by

Stefan Bach[a], Peter Haan[a,b], Onno Hoffmeister[a,c] and Viktor Steiner[a,b]

Preliminary Version

February 2006

Abstract

The new coalition government in Germany decided to increase the normal VAT rate by 3 percentage points in 2007. The additional revenue should partly be used to finance the reduction of social security contributions, partly to reduce the bulging budget deficits. We analyze the effect of this major reform on consumption behavior, the income distribution and labor supply effects using micro-simulation models which combine micro data from consumption and general household surveys and macro data from national accounts. We find that the reform slightly increases overall income inequality and has also modest positive employment effects.

Keywords: Social security contributions, consumption taxation, household labor supply, demand-system estimation, micro simulation

JEL Classification: H31; D12; J22

Acknowledgement : Viktor Steiner wants to thank the Fritz Thyssen Foundation for funding under the project "Arbeitsmarkt- und Wohlfahrtsseffekte der Familienförderung – Eine Mikrosimulationsstudie für Deutschland".

Correspondence
Dr. Stefan Bach
DIW Berlin
14191 Berlin
sbach@diw.de

a) German Institute for Economic Research, Berlin (DIW Berlin). sbach@diw.de, phaan@diw.de, ohoffmeister@diw.de, vsteiner@diw.de
b) Free University of Berlin (FU Berlin).
c) European University Viadrina Frankfurt (Oder).

1 Introduction

Re-financing social security to reduce unemployment and, at the same time, fulfiling distributional aims is one of the magic formulas politicians in Germany are striving for. High social security contributions, in particular, are widely seen as one of the main reasons for the high level of long-term unemployment among low-skilled workers, because of their alleged negative work incentive effects or impact on firms' labor costs. Furthermore, the high level of social security insurance contributions is also criticized for equity reasons since they are used to finance a large share of general public expenditures on social security to which civil servants or the self-employed do not contribute (see, e.g., Schmähl 1998, Meinhardt and Zwiener 2005). It is therefore not surprising that a strategy to reduce the high contribution rates to social security is supported by both policymakers and economist. About the financing of these cuts, there is less agreement, although the idea to increase indirect taxes seems to have become more popular recently. So it was the case in 1998 when VAT normal rate was increased by 1 percentage point in order to plug rising budget gaps of the public pension system. With a VAT normal rate of 16 % Germany seems to have still relative low consumption tax burden compared to its European neighbor countries.

One of the first policy reforms the new conservative/social-democratic coalition government announced after the election in 2005 was to increase the normal rate of the value-added tax (VAT) from 16 to 19 percent. This reform is to become effective on January 1, 2007. Amounting to roughly 25 billion EURO or 1.1 % of GDP, this is labeled as the largest tax increase in German post-war history ever. Although the social democrats were strictly against increasing VAT during the poll campaign, the new government readily agreed that this huge increase in the nominal rate was unavoidable for two reasons; first, to reduce the budget deficit in order to meet the Maastricht criteria in the foreseeable future and, second, to reduce social security contributions with the aim to reduce unemployment. In particular, the coalition agreement stipulates that the social security contribution rate should nominally be reduced by roughly 1.6 percentage points, containing a reduction of 2 percentage points in the public unemployment insurance system accompanied by an increase of 0.4 percentage points in the public pension system. The remaining receipts from the VAT increase are being used for reducing the budget deficit.

According to an empirical evaluation not accounting for any behavioral adjustment by Bach (2005a), this reform will, on average, reduce real income of private households by about 0.8 percent in the short-run, due to an increase of consumer prices of 1.7 %. He also shows that the negative impact of the reform on real incomes is stronger for households with low

levels of current income, i.e. is regressive with respect to this income measure, whereas the reform is neutral or even progressive if current expenditures are used to classify households.

Previous studies on the labor market effects of re-financing social security in Germany have mainly focused on the impact on aggregate employment using highly aggregated models of the economy, e.g., Buscher et al. (2001), Steiner (2003), Böhringer, Boeters and Feil (2005), Meinhardt and Zwiener (2005), Feil and Zika (2006). Most of these studies tend to find that reductions of social security contributions re-financed by increasing direct or indirect taxation have only a modest impact on aggregate employment. Little can be learned from these aggregate models, however, about the disaggregated effect of the reform on various types of households and on the income distribution. The impact of re-financing social security contributions by increasing indirect taxes depends on the level of individual earnings subject to social security contributions in relation to other income sources as well as savings and consumption patterns at the individual level. The only study we are aware of which analyzes the labor market effects of re-financing social security for Germany is by Schneider and Bonin (2005) who do not, however, account for the response of consumers to the increase in indirect taxes.

Our analysis extends previous work. In this paper we analyze the distribution, work incentive and labor supply effects of the mentioned reform accounting for the adjustment of individual household consumption and labor supply behavior on the basis of integrated behavioral microsimulation models. Starting from the first-round effects of the percentage point increase in the VAT normal rate and the accompanying reduction of social security contributions we calculate its impact allowing for both the adjustment of the savings rate and the allocation of consumption goods at the household level using individual-level data from the Income and Consumption Survey for Germany. We use the theory of exact aggregation of consumer demand systems to link own-price and cross-price effects of the demand for goods estimated on macro time-series data to income effects at the level of individual households estimated on pooled cross-section household budget surveys. By way of a statistical matching technique, we link these "second-round" effects to our behavioral tax-benefit microsimulation model STSM which includes a structural labor supply model estimated on the German Socio Economic Panel. On the basis of this model we simulate the work incentive and labor supply effects of the reform. We find that the reform increases overall income inequality as well as labor force participation and employment, especially at the bottom of the income distribution, but these effects are relatively small.

The remainder of this paper proceeds as follows: In the next section we provide some institutional background information on the recent reform we analyze here and some stylized

facts on the distributional effects of VAT before the reform. Section 3 describes in detail how we model the distribution and allocation effects of the recent reform, in section 4 we summarize and discuss our simulation results, and section 5 concludes.

2 Institutional Background and Stylized Facts

In this section we briefly describe some important facts concerning the value-added tax (VAT) and social security contributions (SSC), the two components of the recent policy reform we analyze in this paper, and which will subsequently be referred to as VAT/SSC reform.

The VAT in Germany is a general multi-stage consumption tax according to the harmonized European VAT system with tax credit on the firm's intermediate inputs.[1] Basically all goods and services are taxed at the normal rate of 16 %. Some goods and services, which are considered to satisfy some basic needs or deemed as merit goods are taxed at the reduced rate of 7 %; these goods include food, local public transport, medical equipment for disabled persons, print media, social and health services of public or non-profit organizations. Certain goods are exempted from VAT at the final stage of consumption, such as leasing or letting of immovable property (except hotels), health services and financial services. Since the suppliers are not allowed to credit input tax, these services are in fact charged with VAT at the previous stage, which has to be born by the consumer anyway.[2]

SSC consist of contributions to unemployment insurance, public pension, and health and long-term care insurance schemes. Membership in these insurance schemes is mandatory for employees with earnings above the lower social security threshold (of 400 € per month). SSC for the various public insurance schemes is basically proportional[3] below the upper SSC threshold, which differs between insurance schemes. Currently (2006), the SSC rate is 6.5 % for the unemployment insurance, 19.5 % for the public pension schemes, on average 14.0 % for the health insurance and 1.7 % for the long-term care insurance schemes. Employees with earnings exceeding the upper SSC threshold of the public health insurance scheme can opt out of the public system and buy private health insurance instead. SSC are formally split equally between employees and their employers. These regulations do not apply to the self-employed,

---

1 As the most important regulation see the Sixth Council Directive on the harmonization of the laws of the Member States relating to turnover taxes (77/388/EEC). (OJ L 145, 13.6.1977, p. 1). http://europa.eu.int/eur-lex/en/consleg/pdf/1977/en_1977L0388_do_001.pdf

2 See Bach (2005b) for a detailed description of the calculation of VAT.

3 Since April 2003 there is a subsidy to SSC on earnings in the range between 401 and 800 € per month; the subsidy declines with monthly earnings and expires at the upper earnings threshold when the full SSC rate paid by the employee of about 20% is due (see Steiner and Wrohlich (2005) of an evaluation of this so-called "mini-jobs" reform).

civil servants and pensioners of the civil service who are usually covered by other, generally non-mandatory insurance schemes.

Recent empirical research for Germany has established a couple of facts relevant for the evaluation of the distribution effects of an increase in indirect taxes, and in VAT in particular (see, e.g., Fritzsche et al. 2003, Bach 2005b). One established stylized fact is that VAT is regressive if measured by current disposable income, although it is more or less proportional if normalized by current consumption expenditure (Bach 2005a). This is related to two other established stylized facts: first, differences in savings rates across the income distribution and, secondly, the differential taxation of goods at reduced rates or exempted at the final stage (without input tax credit) on a number of goods disproportionately consumed by households at the bottom of the income distribution.

Table 1 shows the relationship between disposable income, consumption expenditures, savings, and the VAT burden across the income distribution as derived from the Expenditure and Consumption Survey (EVS) for 2003. The EVS is a cross-section household survey collected by the German Statistical Offices every 5 years. The sample includes about 60,000 households, of which a 80 % random sample is provided to researchers by the Federal Statistical Office as a scientific use files. The main aim of the survey is to collect accurate information about the economic and social situation of households in Germany by capturing all incomes, other revenues and all expenditures as well as the main components of financial and other household wealth. It is the only source of detailed and consistent information about household consumption expenditures and savings in Germany.[4] Based on the detailed information on consumption expenditure (132 items) we run a microsimulation model that calculates the VAT burden for each good assuming fully shifting of the tax burden to the final consumers.[5]

In Table 1, we use net equivalent household income to sort households into deciles of the income distribution. For simplicity, the equivalence scale we use here is given by the square root of the number of household members. Household income – normalized to 100 in

---

4 The EVS does not sample households with a monthly income of more than 18,000 Euro in 2003. In the current version of this paper we do not account for this truncation of our sample. Since only about 1.5 % of the population exceeds this threshold we do not expect our results to be significantly affected by this truncation.

5 Some assumptions have to be made in the case of public transport (only local transport is eligible to the reduced rate) and for several marginal expenditures taxed at reduced rates or exempted without input tax credit. For housing expenditure which, on average, amounts to about one quarter of total consumption expenditure, we have calculated the VAT as follows: In a first step, we have estimated the running costs which are largely liable to VAT from the observed rental fee or, in case of home owners, the imputed rent applying average rates from rent index statistics used by the real estate industry. In a second step, we have calculated the long-run VAT burden on construction investment (for which no input tax could be credited) by applying average multipliers derived from simple investment models. For the details of these calculations, see Fritzsche et al. (2003) or Bach (2005b).

all income deciles – is divided between total consumption and savings. Following the categories of the Statistical Office, we differentiate between private consumption expenditures and "other expenditures"; the latter include voluntary social security contributions, insurance premiums, certain other taxes, interest payments on loans or other transfers. These "other expenditures" are not liable to VAT. Note that savings are defined residually including a statistical difference between the entire household expenditure and the revenues, including transactions of capital stocks.[6] We also differentiate consumption expenditures liable to VAT between expenditures taxed by the normal rate (including tax-exempted goods without input tax credit) and the reduced rate. The last two columns show the distribution of the VAT burden across the income distribution for 2003, measured as a percentage of disposable household income and private consumption, respectively.

Table 1
Use of disposable income of private households, VAT base and VAT burden 2003
Structure in %

Deciles net equivalent household income[1)]	Disposable income[2)]	Private consumption expenditure	Other expenditure[3)]	Saving[4)]	Consumption expenditure liable to VAT				VAT burden relative to	
					Taxed at normal rate		Taxed at reduced rate	Total		
					Total	thereof: exempted			disposable income	consumption exp.
1st decile	100.0	108.3	7.1	- 15.4	67.2	17.4	19.5	86.6	10.3	9.5
2nd decile	100.0	95.1	8.3	- 3.4	61.1	13.8	16.8	77.9	9.3	9.8
3rd decile	100.0	89.6	9.2	1.1	58.7	12.3	15.2	73.9	8.9	10.0
4th decile	100.0	84.9	9.9	5.2	56.7	11.4	14.1	70.8	8.6	10.1
5th decile	100.0	83.9	10.8	5.3	56.3	10.9	13.3	69.6	8.5	10.1
6th decile	100.0	80.1	11.8	8.1	54.5	10.4	12.1	66.6	8.2	10.2
7th decile	100.0	77.1	12.2	10.7	52.7	9.7	11.3	64.1	7.9	10.2
8th decile	100.0	73.3	13.9	12.8	51.0	9.2	10.2	61.2	7.6	10.3
9th decile	100.0	69.3	15.5	15.3	48.6	8.7	9.2	57.9	7.2	10.4
10th decile	100.0	56.5	17.7	25.8	40.0	7.4	6.7	46.7	5.9	10.4
Total	100.0	75.6	13.1	11.2	51.4	10.1	11.2	62.6	7.7	10.2

1) Equivalence scale: square root of the number of household members.- 2) Net household income plus other earnings (e.g. from household production, from refunds on purchases, from daily allowances).- 3) Voluntary SSC and other insurance premium expenditure, other taxes (e.g. motor vehicle tax, inheritance and gift tax), interest payment on bank loans, other transfers payed.- 4) Including statistical difference (defined residually).
Source: German Income and Consumption Survey (EVS) 2003; own calculations.

As Table 1 shows, the share of private consumption expenditures in disposable income is monotonically decreasing from almost 110 % in the lowest decile to a little more than 50 % in the highest decile, compared to an average of about 75 % in the population. As expected, the savings rate varies hugely across the income distribution, ranging from about -15 % in the lowest to more than 25 % in the highest income decile. That is, the poorest households finance a large share of their current consumption from liquidating savings or taking out loans,

6 In particular, households with low observed income show a remarkable statistical difference which indicates neglected liquidation of capital stock as well as current receipt e.g. private transfers or moonlighting income.

whereas the average savings rate at the top of the income distribution is more than twice the national average of about 11%. The second part of the table shows that, relative to total consumption expenditure, the share of consumption taxed at the normal VAT rate and the share taxed by the reduced rate decline with increasing deciles, so that the difference of the total is small across the distribution.

By deciles of net equivalent household income, the distributional impact of VAT show a clear "regressive" trend measuring the tax burden relative to disposable income. This well-known fact widely reflects the rising impact of savings and other expenditure in periodical income across increasing deciles. The stronger decreasing share of consumption expenditure taxed at reduced or exempted rates (without input tax credit) does not offset this effect. Note that according to the European VAT guidelines (see footnote 1) the German VAT does not apply zero rates (maintaining the input tax credit) on basic needs such as food, non-alcoholic beverages or public transportation, in contrast to, e.g., the UK or the state sales tax systems in the USA. However, if we base the VAT burden upon current consumption expenditure (see Table 1), a slightly progressive tax scheme emerges, reflecting the tax reductions and exemptions. This corresponds more to a life-cycle view with respect to current savings, taking into account that future consumption will be liable to consumption tax as well.

3 Modeling the Impact of the Reform on Real Household Incomes, Consumption, and Labor Supply

As described in the introduction, the VAT/SSC reform consists of two components: first, an increase of the normal rate of VAT by 3 percentage points and, second, of a reduction of social security contributions by about 1.6 percentage points. Since we do not base our analysis on a general equilibrium model of the economy, we have to make various auxiliary incidence assumptions. First, we assume full shifting of the VAT increase onto prices in the long-run, which implies perfectly elastic supply curves for goods and perfect competition in all goods markets (Fullerton and Metcalf 2002). Incomplete tax-shifting in the short-run due to, e.g., adjustment costs is not considered here. However, not all prices are increased proportionally because only the normal VAT rate is increased. We will thus differentiate goods by the level of VAT they are taxed, as described above. Second, we assume that both employees' and employers' SSC, which are formally shared equally between the two parties, are fully born by the employee. Hence, the equal reduction of the employer's SCC by 1 percentage point is assumed to increase earnings by the full amount.

Given these incidence assumptions, we proceed in the following steps to calculate the first-, second-, and third-round effects of the VAT/SCC reform. For the *first-round* effects we

assume that households maintain their level of consumption in real terms by adjusting their savings to absorb any price increase without adjusting their consumption bundle to the change in relative prices. Thus, we effectively calculate the increase in the cost-of-living index due to the reform at given consumption bundles for each household. Subsequently, we will calculate the increase in the cost-of-living accounting for both adjustments in the saving rate and in consumption patterns at the household level on the basis of behavioral consumer demand model estimated on household budget survey data (*second-round* effects). Based on our estimated second-round effects of the VAT/SSC reform we estimate the work-incentive and labor supply effects of the reform using our behavioral microsimulation model estimated on the German Socio-Economic Panel (*third-round* effects). Since the data base on which we estimate our empirical labor supply model does not contain sufficient information on consumption, we merge the real income effects accounting for the second-round effects to the SOEP data using statistical matching techniques.

3.1 Impact of the reform on the real cost of living – first-round effects

As mentioned above, in a first step we calculate the increase in the cost-of-living index due to the VAT/SSC reform at given consumption bundles for each household and assuming that the resulting price increase is absorbed by the saving rate of private households. To calculate the increase in the VAT, differentiated by type of consumption good, we employ the household's expenditure (cost) function, which will also allow us to account for behavioral response in households consumption induced by the reform in a straightforward way (see section 3.2).

The private households' cost of living which are necessary to maintain a given standard of living, or utility level *(u)* are determined by the cost function

$$(1) \qquad c(u,p)=\sum_{i=1}^{n} q_i p_i \,,$$

where $u=u(q)$ is the household's utility level, p is a vector of prices (p_i) and q is a vector of quantities (q_i) consumed from the i-th good. The increase of the cost of living due to a tax increase can be measured by a cost of living index, taking the general form:

$$(2) \qquad P=\frac{c(u,p_1)}{c(u,p_0)}.$$

A common method is to evaluate the pre-reform consumption bundle with the post-reform prices and divide this amount by the cost of living before the reform:

$$(3) \qquad P_L = \frac{\sum_{i=1}^{n} q_{0,i} p_{1,i}}{\sum_{i=1}^{n} q_{0,i} p_{0,i}}.$$

Since formula (3), which defines a Laspeyres price index, can be rewritten into

$$(4) \qquad P_L = \sum_{i=1}^{n} \frac{q_{0,i} p_{0,i}}{\sum_{i=1}^{n} q_{0,i} p_{0,i}} \frac{p_{1,i}}{p_{0,i}} = \sum_{i=1}^{n} w_{0,i} \frac{p_{1,i}}{p_{0,i}},$$

knowledge of pre-reform budget shares, $w_{0,i}$, and the change of prices due to the reform is sufficient to calculate this price index; knowledge of the vector of pre-reform or post-reform prices is not required. Given the first incidence assumption mentioned above, the change in prices is given by:

$$(5) \qquad \frac{p_{1,i}}{p_{0,i}} = \frac{1 + t_{1,i}^{VAT}}{1 + t_{0,i}^{VAT}},$$

where $t_{0,i}^{VAT}$ and $t_{1,i}^{VAT}$ are the consumption tax rates, respectively, before and after the reform for a given type of good.

Since the EVS includes a fine disaggregation of private consumption (by 132 goods and services), we can classify household budgets by the differential tax treatment of goods (as described in section 2) and calculate for any good in a household's consumption bundle the relevant price increase. Pre-reform budget shares, $w_{0,i}$, for the various categories of goods and services can also be derived from the EVS for the year 2003.

Regarding the other component of the VAT/SSC reform, the EVS also contains information about the amount of SSC actually paid, differentiated by the various insurance schemes. This is important because the reduction of SSC is composed of a reduction of the unemployment insurance fund by 2 percentage points and by a 0.4 percentage point increase of the contribution rate to the public pension fund (see section 2).

3.2 Accounting for behavioral adjustments in savings and consumption patterns

Private households can be expected to adjust their consumption to the change in consumer prices induced by the VAT/SCC reform in various ways. First, they may revise the allocation of their net disposable income on present and future consumption, thereby changing the amount of money which they will spend for consumption in the current period. Second, they may adjust the quantities they consume from different consumption items, both in response to

the changed overall budget available for consumption in the present (net of savings) and to changes in relative prices.

Adjustment of the savings rate of private households

As a first step in the calculation of the second-round effects of the reform we estimate the adjustment of the savings rate to changes in real current household income on the basis of the pooled cross-sectional EVS data of 1998 and 2003. We assume that, in a first-stage, households choose between current and future consumption on the basis of their current income, and then allocate in a second step their current consumption to the various consumer goods in the current period (see, e.g., Deaton and Muellbauer 1980b: chapter 5 for the assumptions underlying two-stage budgeting)

Thus, for the first stage, we estimate simple savings equations on the pooled EVS cross-section data 1998 and 2003 of the following form:

$$(6) \qquad \left(\frac{S}{Y}\right)_{k,t} \equiv s_{k,t} = \alpha_0^s + \alpha_i^Y D_{k,t}^Y + \alpha_Q^s D_{k,t}^Q + \beta^s \log\left(\frac{Y_{k,t}}{P_t^s}\right) + \beta_H^s D_{k,t}^H \log\left(\frac{Y_k}{P_t^s}\right) + u_{k,t}^s$$

where *t* is a subscript for each quarter in either 1998 or 2003 in which the household interview has been realised, where $D_{k,t}^Y$ is a year dummy (equal to 1 in 2003), $D_{k,t}^H$ is a vector of dummies characterizing household *k,* $D_{k,t}^Q$ is a vector of seasonal dummies and $D_{k,t}^Y$ is a dummy of the interview year, P_t^s is a price index defined below, and $u_{k,t}^s$ is an error term. Since we are using this equation simply to calculate the conditional expectation of the savings rate for alternative levels of real income, we need not give a causal interpretation to the estimated parameters of this equation and, therefore, need not to be worried about the simultaneity between the savings rate and the income variable, e.g. related to measurement error in this variable.[7] of The estimated coefficient β^s measures the expected absolute increase in the savings rate, when real income of the reference household increases by 1 percent. The coefficients β_H^s of the interaction terms between the $D_{k,t}^H$ variables and log real income show the deviations of the budget effects across household types. For the estimation results see Table A1 in the Appendix.

[7] A potentially serious problem is that the use of current income to explain the savings rate may be inappropriate because households respond to changes in permanent rather than current income, in accordance with life-cycle income hypothesis (see, e.g., Poterba 1989, Metcalf 1994, Caspersen and Metcalf 1994). We plan to take up this issue in future research.

Adjustment of households' budgets to price increases

Given a certain level of consumption expenditures, households will adjust their consumption bundle by substituting goods whose price has increased due to the VAT/SSC reform relative to others, thereby reducing costs without diminishing their standard of living. The Konüs cost-of-living index measures the change of the expenditure required to achieve a constant standard of living before and after the reform (see Deaton and Muellbauer 1980b: 170ff.):

$$(7) \qquad P_K = \frac{c(u_0, p_1)}{c(u_0, p_0)} = \frac{\sum_{i=1}^{n} q_{i,1}^H p_{i,1}}{\sum_{i=1}^{n} q_{i,0}^H p_{i,0}} = \sum_{i=1}^{n} w_{i,0} \frac{q_{i,1}^H}{q_{i,0}^H} \frac{p_{i,1}}{p_{i,0}} = \sum_{i=1}^{n} w_{i,0} (1 + \frac{\Delta q_i^H}{q_{i,0}^H}) \frac{p_{i,1}}{p_{i,0}},$$

where $q_{i,1}^H = q_i(u_0, p_1)$ and $q_{i,0}^H = q_i(u_0, p_0)$ are Hicksian demand functions. If households did not adjust to price changes, Δq_i^H would be zero and P_K would be equal to the Laspeyres index (3). If households do adjust to price changes, $\Delta q_i^H / q_{i,0}^H$ has to be empirically estimated. To derive the equations to be estimated, we transform Hicksian into Marshallian demand functions using the Slutsky equation:

$$(8) \qquad \Delta q_i^H = \Delta p_j \frac{\partial q_i^H}{\partial p_j} = \Delta p_j q_j \frac{\partial q_i^M}{\partial m} + \Delta p_j \frac{\partial q_i^M}{\partial p_j},$$

where $q_i^M = q_i^M(m, p)$ and m is the budget available for consumption, measured in nominal terms. Since $w_i = q_i^M p_i / m$, the differentials of the Marshallian demand functions can be expressed in terms of differentials of expenditure shares:

$$(9) \qquad \frac{\partial q_i^M}{\partial m} = \frac{\partial w_i}{\partial m} \frac{m}{p_i} + \frac{w_i}{p_i},$$

$$(10) \qquad \frac{\partial q_i^M}{\partial p_i} = \frac{\partial w_i}{\partial p_i} \frac{m}{p_i} - \frac{w_i m}{p_i^2} \text{ and}$$

$$(11) \qquad \frac{\partial q_i^M}{\partial p_j} = \frac{\partial w_i}{\partial p_j} \frac{m}{p_i} \text{ for } i \neq j.$$

Following Deaton and Muellbauer (1980a), we analyze the effect of changes in the total budget and prices on the structure of consumption on the basis of the Almost Ideal Demand System (AIDS), which is given by

$$(12) \qquad w_i = \alpha_i + \sum_{j=1}^{n} \left[\gamma_{i,j} \log p_j \right] + \beta_i \left(\log m - \sum_{j=1}^{n} \left[w_j \log p_j \right] \right),$$

The AIDS is linear homogeneous in prices and expenditures, and the price effects satisfy the Slutsky symmetry. The expenditure share differentials, included in the formulas (9) to (11), can be directly inferred from the estimated coefficients β_i and $\gamma_{i,j}$:

$$(13) \qquad \frac{\partial w_i}{\partial \log m} = \beta_i \Leftrightarrow \frac{\partial w_i}{\partial m} = \frac{\beta_i}{m}$$

$$(14) \qquad \frac{\partial w_i}{\partial \log p_j} = \gamma_{i,j} - w_j \beta_i \Leftrightarrow \frac{\partial w_i}{\partial p_j} = \frac{\gamma_{i,j} - w_j \beta_i}{p_j}$$

These estimates can be used to calculate the derivatives of the Marshallian demand functions with respect to budget and prices in the equations (9) to (11). Putting them into equation (8), the change in the compensated demand for goods, $\Delta q^H_{i,0}$, can be calculated. Finally, inserting these estimates into equation (7), we derive the Konüs cost-of-living index.

The income effect β_i can be assessed from cross-sectional household data on expenditure included in the 1998 and 2003 cross sections of the EVS. This database, however, does not contain sufficient information for investigating the effects of changes in relative prices.[8] We therefore combined the micro-data analysis with an analysis of aggregated time-series data on prices and expenditures. In contrast to Nichèle and Robin (1995), we do not employ the minimum-distance estimation method to weigh micro and macro price and income elasticities, because currently we do not dispose of a sufficient number of cross sections to estimate micro price elasticities on the basis of the EVS data without imposing fairly strong assumptions about pure time and saisonal effects.[9]

The exclusion of price effects from the AIDS model given in (12) results in Engel curves (see Deaton and Muellbauer 1980b:19f.). We estimate these Engel curves at the micro level by pooling the EVS waves of 1998 and 2003 and employing the following system of share equations:

$$(15) \qquad w_{i,k,t} = \alpha_i + \alpha_i^Y D_{k,t}^Y + \alpha_i^Q D_{k,t}^Q + \alpha_i^H D_{k,t}^H + \beta_i \log\left(\frac{m_{k,t}}{P_t^S}\right) + \beta_i^H D_{k,t}^H \log\left(\frac{m_{k,t}}{P_t^S}\right) + u_{i,k,t}^w .$$

where P_t^S is a Stone price index defined as

$$(16) \qquad P_t^S = \prod_{i=1}^{n} p_{i,t}^{\overline{w}_i} .$$

---

8 Price data are available only for quarters. Thus, we can match the EVS households with only eight observations on prices. As we are controlling also for seasonal effects and the effect of the interview year, the number of degrees of freedom left for the analysis of the price effect is not sufficient to obtain reliable results.

9 We plan to use additional cross sections of the EVS which will soon become available as scientific use files to estimate price effects from the micro data as well.

and the other variables are defined as above in equation (6)[10]. Here, the coefficient β_i measures the expected absolute increase of expenditure shares (in 100 percentage points) to a 1% increase of the real income of the reference household, and the coefficients β_i^H show the differences of the budget effects on the respective expenditure share across household types.

The results of the GLS estimations are presented in Table A2 in the Annex. Couple households without children living in West Germany, consisting of a male German full-time worker, who is between 26 to 35 years old, and a not-working spouse, have been chosen as the reference group. This household type's budget effects (β_i) are shown in the first row of the table. The second row shows the corresponding budget elasticities of quantity demand at the point where the expenditure shares are equal to their mean. The remaining rows contain the components of β_i^H measuring the deviation from the reference group's budget effect. Food, alcoholic beverages, housing, water, electricity and gas, fuels and lubricants and transport can be identified as necessities (with a significance of less than one percent), whereas health and recreation and culture, financial services and 'others' are luxuries. Moreover, the table shows the familiar picture that the budget elasticity of demand for necessities decreases with household size. Homogeneity in prices requires that the β_i, β_i^H, and α_i^H coefficients sum up to 0 and the α_i's sum up to 1 over all consumption categories (additivity). This has been tested with t-tests; the results are presented in the last column of the table. For none of the mentioned coefficients additivity could be refuted at the one-percent significance level.

Turning to the assessment of the price effect, we use time-series on private household expenditure and prices included in the German National Accounts Statistics, spanning from 1991 to 2004. For the macro-level analysis we estimate the model

$$(17) \qquad \overline{w}_{i,t} = \alpha_i + \sum_{j=1}^{n} \gamma_{i,j} \log p_{j,t} + \beta_i \log\left(\frac{\overline{m}_t}{P_t^S}\right) + u_{i,t},$$

where $\overline{w}_{i,t}$ is the share of expenditure for the consumption category *i* in the total expenditure, summed up over all private households in Germany, and $\overline{m}_t$ is average total expenditure per capita. Deaton and Muellbauer (1980b: 154-158) show that β_i and $\gamma_{i,j}$ obtained from the aggregated model (17) are identical to the β_i and $\gamma_{i,j}$ coefficients of households with average total expenditure, as long as the distribution of total expenditure over households does not change.

The time index *t* takes values from 1 for the first quarter year of 1991 to 56 for the last quarter year of 2004. The data on expenditure shares, prices and total expenditure have been

[10] Here, $p_{i,t}$ is indexed to the *i*-th categorie's price in the base period (first quarter of 2003) in order to guarantee invariance to changes in scale, see Moschini (1995).

cleaned from seasonal effects and time trends using seasonal dummies, first differencing and controlling for second order autocorrelation. The price effects of accommodation, energy, fuel and financial services are likely to work especially slow and are not included in the regressions for that reason. We interpret the model (17) as a SURE system, which we estimate without any further restrictions in a first step. Homogeneity over prices requires that the compensated price-effects ($\gamma_{i,j}$) sum up to zero within a certain consumption category i. Furthermore, from the Slutsky symmetry follows equality of the compensated cross-price effects between groups: $\gamma_{i,j} = \gamma_{j,i}$. We checked the validity of these restrictions based on a Wald test. The test rejected additivity of price effects for none of the analyzed consumption categories at the 5-percent level. Joint symmetry of the cross-price effects could not be uphold for alcoholic beverages, clothing and communication (see the last two column of Table A3 in the Appendix). Furthermore, the sum of budget effects taken over all the twelve expenditure groups was not significantly different from zero according to this test (p-value: 0.510).

Since homogeneity in prices is required for the prediction of the price effects, we nevertheless imposed the conditions of additivity and symmetry by means of restrictions on the estimated coefficients (at the cost of considerably low R^2 values for some consumption categories). After the estimation of the restricted model, all but three consumption categories showed negative compensated own-price elasticities, as it should be expected from the law of demand. The $\gamma_{i,i}$s of communication (6), recreation and culture (9), and restaurants and hotels (10) were indeed positive but not significantly different from zero. Restricting them to zero did not have a significant impact on the explained variance of the model – the related Wald test lead a p-value of 0.397. The compensated price effects and budget effects estimated on the basis of the final model are shown in Table A2. The cells contain the $\gamma_{i,j}$ coefficient estimated by the model in the upper part and the resulting price elasticities of demand, calculated at mean expenditure shares, in the lower part. Food and leisure are identified as complementary goods. The same applies to alcoholic beverages and tobacco and restaurants and hotels. Clothing is substituted for alcoholic beverages and hotels and restaurants, communication is substituted for 'other' goods and services, when their relative prices increase. As in the micro-level regressions, food, alcoholic beverages and housing have been approved to be necessities.

We use the estimators of the compensated price effects from Table A3 and the budget effects from Table A2 for the calculation of the Konüs index (7).[11] The real income, now inflated by the Konüs index taking into account behavorial response, is typically higher after

[11] We constructed each coefficient of the last consumption category by summing up the other categories' coefficients.

than before the adjustment of consumption. As a consequence, the savings and consumption effect is likely to be revised. We repeated the simulation of the savings and consumption adjustment several times until the change in the cost-of-living index became very small.

3.3 Modeling Work Incentive and Labor Supply Effects

The first- and second-round effects modeled above yield the net household income changes from y_0 before the reform to $y_1 = y_0 - \Delta VAT + \Delta SSC/P_K$ after the reform. We use our behavioral microsimulation model STSM to simulate the work incentive and labor supply effects of the VAT/SSC reform, *given its second-round effects on net household incomes*. STSM includes all relevant components of the German tax and transfer system. Labor supply effects at the level of individual households, both at the extensive (participation) and the intensive margin (working hours), are modeled on the basis of a microeonometric discrete choice model (Steiner, Haan and Wrohlich 2005). The current version of STSM is based on data from the 2004 wave of the German Socio Economic Panel (SOEP) and maps the fiscal year 2003. The SOEP is a representative sample of private households living in Germany with detailed information on household incomes, hours worked and household structure.[12] However, the SOEP contains no information on the structure of private consumption and can thus not be used to derive the second-order effects of the VAT/SSC reform on net household incomes. We therefore merge the relevant information derived from the estimates of the second-round income effects from the EVS to the SOEP. We match the real income effect derived for each household on a basis of a simple regression linear model. The percentage change in the level of real net household income is the dependent variable, and net household income, working time of both spouses, number of children, and region of residence are the explanatory variables. We then take the conditional expectation from this regression and adjust individual net household income in the SOEP. Thus given an estimate of the real income effect of the VAT/SSC reform we can simulate its labor supply effects on the basis of the STSM under the assumption that preferences for income and leisure are not affected by the reform, which seems a fairly innocent assumption here. [13]

We simulate the changes in working hours and labor market employment on the basis of a discrete choice labor supply model. The main advantage of the discrete choice approach compared to continuous specifications of labor supply derives from the possibility to model

---

[12] A description of the SOEP can be downloaded from www.diw.de/soep; see also Haisken-DeNew and Frick (2001).

[13] A recent study by Schneider and Bonin (2005) which simulates the effect of the introduction of a basic allowance for social security contributions (akin to the basic allowance in the income tax system) financed by an increase in VAT follows a similar approach but do not account for second-round effects related to the adjustment of households savings and consumption decisions.

nonlinearities in budget constraints. Furthermore by specifying a joint labor supply model for couples, the method makes it possible to asses the labor supply responses allowing both partners in couples to vary their labor input. A detailed specification of the model can be found in the Appendix. We estimate the model on a restricted sample of individuals, aged between 20 and 59, not retired, not in education not in maternity leave and not self employed. The analysis is conducted separately for five groups: for single men (732 observations), single women (903), "mixed" couples with fixed labor supply of, respectively, the wife (498) and the husband (699), and for couples under the assumption that both spouses (3387) can vary their labor supply in a flexible way.

Using the microsimulation model (STSM) combined with the second round income effects taken from the EVS; we simulate the net household income for the current legislation and for the hypothetical reform scenario at the defined discrete hours points. The net household income together with the leisure terms associated to each hours point are the crucial variables for the labor supply estimation. Based on the labor supply estimates, we simulate for each household the probabilities of choosing each discrete working point for the status quo scenario, the fiscal legislation in 2003, and the VAT/SSC reform.

In the following three sub-sections we present and discuss our simulation results for the distributional and behavioral effects of the VAT/SSC reform derived from the microsimulation modeling described above. We start with the presentation of the first-round and second-round distribution effects of the reform; in the subsequent sub-sections we look at behavioral effects of consumers and the work incentive and labor supply effects of the reform.

4 Simulation Results

In the following three sub-sections we present and discuss our simulation results for the distributional and behavioral effects of the VAT/SSC reform derived from the microsimulation modeling described above. We start with the presentation of the first-round and second-round distribution effects of the reform; in the subsequent sub-sections we look at behavioral effects of consumers and the work incentive and labor supply effects of the reform.

4.1 Distributional effects

Table 2 summarizes our main simulation results of the fiscal impact and the distributional effects of the VAT/SSC reform for private households. Compared to the 25 billion Euro announced by the government the additional VAT revenue from private households is estimated here to be 16.6 billion Euro without and 15.0 billion Euro with behavioral response of savings and consumption patterns. First of all, the discrepancy to the 25 billion Euro stems from pub-

lic consumption (current cost of the administration and public investment) since the government authorities just as the private household have to bear the higher VAT. Furthermore real investment of industries that supply tax exempted goods and services such as tenancy, medical services, financial services or aviation transport also bears the increased VAT. All in all, these components of the VAT base not covering current private consumption amount to approximately 30 % of the entire tax base. Moreover, it should be stressed that the simulation analysis presented in the following is based upon the 2003 survey data, whereas the government revenue estimation of the reform refers to the year 2007 when the reform is announced to be effective. However, due to slight economic growth and stagnation of mass income since 2003 the observed household structures might have been changed very little. Hence, the relative changes in tax burden or household behavior we present here should be still valid at present.

The impact of the behavioral response of income and consumption patterns is substantial. Additional revenues are 1.6 billion Euro (10 %) below the expected amount without taking behavioral adjustments into account. The reason for this are the relative strong income and substitution effects that favor goods and services taxed at reduced rates or exempted which are not or less affected by the reform (for details see below, section 4.2).

The second part of the table shows the percentage change in real household expenditures across the income distribution, assuming constant behavior in the first column and adjustments in savings rates and consumption behavior in the second column. In the first column this change is simply given by the Laspeyres price index, in the second column by the Konüs cost-of-living index (see section 3.1 and 3.2, respectively), both divided by the households' pre-reform disposable household income. Here and in the following sections, we define income deciles in terms of net equivalent household income to account for household composition effects. The use of income rather than current consumption expenditure as the basis to rank households implies a short-run distributional perspective rather than a life-cycle view, which seems more appropriate regarding our basically static approach in the calculation of behavioral responses of consumers and workers.[14] The lower part of the table contains various summary inequality measures, such as the Gini and Theil coefficients and the Atkinson inequality index, which differ in their sensitivity to changes in different parts of the income distribution (see, e.g., Cowell 1995).

[14] For the use of current consumption expenditures as a proxy for lifetime income in the analysis of the distributional impact of indirect taxes see, e.g., Porterba (1989) and Metcalf (1994). Bach (2005a) shows that the first-round distributional effects of the VAT/SSC reform would be fairly proportional if measured relative to current household consumption.

Table 2
Distributional effects of the VAT/SSC reform by income decile without and with behavioral adjustment of savings and consumption

Deciles net equivalent household income[1], inequality measures	VAT reform		VAT/SSC reform	
	without behavioral adjustment of savings and consumption	with behavioral adjustment of savings and consumption	without behavioral adjustment of savings and consumption	with behavioral adjustment of savings and consumption
	Effect on tax revenue			
bill. Euro	16 623	14 972	5 460	3 808
% GDP	0.77	0.69	0.25	0.18
	Change in tax burden relative to disposable household income[2] in percentage points			
1st decile	1.68	1.51	1.27	1.10
2nd decile	1.51	1.36	0.78	0.63
3rd decile	1.45	1.30	0.55	0.40
4th decile	1.39	1.25	0.43	0.28
5th decile	1.38	1.23	0.42	0.28
6th decile	1.33	1.20	0.34	0.21
7th decile	1.29	1.16	0.29	0.17
8th decile	1.25	1.13	0.25	0.13
9th decile	1.19	1.07	0.29	0.17
10th decile	0.97	0.88	0.35	0.25
Total	1.26	1.13	0.41	0.29
	Change of inequality measures of net household equivalent income[1] in %			
Gini coefficient	0.38	0.32	0.32	0.28
Theil measures				
Entropy measure	0.81	0.69	0.52	0.43
Mean log deviation measure	1.39	1.28	1.30	0.66
Atkinson measure				
ε = 0,5	0.80	0.69	0.65	0.53
ε = 1	1.30	1.20	1.22	0.62
ε = 2	0.58	0.58	0.51	- 0.88

1) Equivalence scale: square root of the number of household members.- 2) Net household income plus other earnings (e.g. from household production, from refunds on purchases, from daily allowances).
Source: German Income and Consumption Survey (EVS) 2003; own calculations.

Not accounting for any behavioral response of consumers to the VAT/SSC reform, we find that the combined VAT/SSC reform increases the tax burden on households, on average, by roughly 0.4 percentage points, compared to about 1.3 percent when only the VAT increase is considered. As shown by the various summary inequality measures reported in the lower part of the table, the VAT/SSC reform has only a rather modest effect on overall inequality, and this effect is only marginally larger if only the increase in VAT is considered. However, these summary measures disguise various important differences across the income distribution. The increase in the tax burden is declining from about 1.3 percentage point in the first decile of the

income distribution to about 0.4 percentage points at median net equivalent household income, and remains fairly constant across the upper half of the income distribution. Due to differences in the savings rate across the income distribution, the impact of the increase in VAT alone on the tax burden is declining over the whole income distribution, from 1.7 in the lowest to about 1 percentage point in the highest decile. The smaller relative decline of the tax burden in this case is related to the fact that in the lower part of the income distribution people gain little from the reduction of SSC because they are typically not covered by the social security system. This group of people includes the unemployed, those working in "marginal jobs" not subject to SSC, pensioners, and people with small incomes from self-employment (see below).

Accounting for adjustments in households' savings and consumption behavior, reduces the additional tax burden of the VAT/SSC reform slightly, and also results in a somewhat smaller increase in the summary inequality measures, but does not change the effects on the additional tax burden across the income distribution in relative terms, on average. Tables 3 and 4 provide a more detailed picture about the distributional impact of the VAT/SSC reform by household composition and occupational status of the head of household. Here we focus on the distributional effects accounting for behavioral response regarding changes in the savings rate and consumption patterns at the household level. It is often argued that a higher VAT has particularly adverse effects on families with children because they spend a large share of their income on current consumption. The VAT/SSC reform might also have differential effects on the various types of households. For example, since the employment rate of lone mothers is below average in Germany and because they often work in "marginal" jobs which are exempted from SSC ("mini-jobs"), they are likely to be compensated less by a reduction in SSC. Likewise, pensioners, civil servants, and the self-employed will not profit from the reduction in the contribution rate to the public unemployment insurance scheme, simply because they are not covered by it in Germany. Some self-employed are also hit by the rising pension contributions since they are insured in the public pension system on a mandatory or voluntary basis.

Table 3
Distributional effects of the VAT/SSC reform by income decile and household type with behavioral adjustment of savings and consumption

Deciles net equivalent household income[1)]	Single house-holds	Single parents		Married and unmarried couples				Other house-holds	Private house-holds total
		with 1 child	with 2 and more children	without children	with 1 child	with 2 children	with 3 and more children		
	Shift in tax burden relative to disposable household income[2)] in percentage points								
1st decile	1.18	0.89	1.03	1.19	0.96	0.72	0.73	1.22	1.10
2nd decile	0.72	0.38	0.42	1.01	0.06	0.13	0.33	1.04	0.63
3rd decile	0.43	0.15	0.48	0.86	0.11	- 0.08	- 0.01	0.83	0.40
4th decile	0.26	0.00	0.13	0.81	- 0.14	- 0.08	0.01	0.54	0.28
5th decile	0.20	- 0.03	0.40	0.78	- 0.09	- 0.13	0.12	0.36	0.28
6th decile	0.22	0.17	0.11	0.61	- 0.17	- 0.12	- 0.01	0.44	0.21
7th decile	0.25	- 0.13	0.28	0.42	- 0.15	- 0.06	0.04	0.27	0.17
8th decile	0.25	0.01	0.43	0.33	- 0.17	- 0.11	0.12	0.23	0.13
9th decile	0.30	0.28	0.52	0.30	- 0.10	- 0.01	0.27	0.15	0.17
10th decile	0.38	0.57	0.66	0.23	0.11	0.20	0.39	0.28	0.25
Total	0.44	0.31	0.48	0.47	- 0.04	- 0.01	0.16	0.36	0.29
	For information: private households in 1 000								
Total	14 034	1 382	673	11 200	4 098	3 820	1 383	1 520	38 110

1) Equivalence scale: square root of the number of household members.- 2) Net household income plus other earnings (e.g. from household production, from refunds on purchases, from daily allowances).
Source: German Income and Consumption Survey (EVS) 2003; own calculations.

The results in Table 3 show that, contrary to popular belief, the VAT/SSC reform has no disproportionately strong negative impact on families with children (also see Table A4 in the Appendix, where effects for the isolated increase in VAT are shown). Since the distribution effects of VAT/SSC reform depends on occupational status, as shown in Table 4, and families with children often live from wage income liable to SSC, they are at least partly compensated for the increase in VAT by a reduction in SSC. In contrast, single mothers do not profit from reduced SSC. because they often live from private or public transfers or are employed in "mini-jobs" which are not covered by the social security system.

Table 4 shows the expected outcome of the reform for the different occupational characteristics: households with no or little income subject to SSC and therefore paying no or little SSC to the public unemployment insurance have to fear reductions in real income due to higher VAT burden. In relation to current income the additional burden decreases with increasing income – according to the pre-reform VAT burden described above. These are the households of self employed, unemployed, pensioners, other non-employed as well as the civil servants. The constant reduced rate eases this effect at best modestly. The winners of the reform are the employees subject to social security contribution whose extra VAT burden is overcompensated by the reduced SSC. Across the income deciles, employees with higher income in particular benefit from the lower SSC. In contrast, low-income employee households

tend to be adversely affected by the reform. These households might rely stronger on public transfers or "minijobs" not liable to SSC. Within the employees with higher income other income sources as well as the threshold on SSC play a more dominant role thus confining the relief of the tax reform.

Table 4
Distributional effects of the VAT/SSC reform by income decile and occupational status of the principal earner with behavioral adjustment of savings and consumption

Deciles net equivalent household income[1)]	Self-empoyed	Civil servant	White-collar employee	Blue-collar employee	Unem-ployed	Pensio-ner	Other non-employed	Private house-holds total
	Shift in tax burden relative to disposable household income[2)] in percentage points							
1st decile	2.31	1.78	0.10	- 0.04	1.36	1.32	1.61	1.10
2nd decile	1.49	1.33	- 0.26	- 0.25	1.20	1.27	1.43	0.63
3rd decile	1.47	1.23	- 0.44	- 0.30	1.18	1.23	1.36	0.40
4th decile	1.23	1.20	- 0.52	- 0.28	1.09	1.19	1.07	0.28
5th decile	1.30	1.15	- 0.52	- 0.31	1.02	1.20	1.23	0.28
6th decile	1.18	0.99	- 0.57	- 0.37	0.88	1.22	1.09	0.21
7th decile	1.15	0.96	- 0.49	- 0.37	0.83	1.13	1.30	0.17
8th decile	0.97	0.97	- 0.55	- 0.45	0.98	1.18	0.97	0.13
9th decile	0.97	0.87	- 0.55	- 0.49	0.70	1.07	1.20	0.17
10th decile	0.81	0.76	- 0.44	- 0.17	0.61	0.88	1.07	0.25
Total	1.00	0.89	- 0.48	- 0.34	1.14	1.13	1.40	0.29
	For information: private households in 1 000							
Total	2 218	1 635	11 222	6 498	2 071	12 645	1 821	38 110

1) Equivalence scale: square root of the number of household members.- 2) Net household income plus other earnings (e.g. from household production, from refunds on purchases, from daily allowances).
Source: German Income and Consumption Survey (EVS) 2003; own calculations.

4.2 Consumers' response to the reform

Table 5 gives an overview on the changes in (nominal) disposable income and its use for consumption and savings, as well as highlights the effects on VAT base and VAT burden. Table 6 lists the changes in real consumption by the 12 consumption categories we used for the estimation of consumption behavior.

Nominal disposable income increase by about 1 %, on average, due to the reduced SSC, however depending on the household's occupational status (see Table 4 above). In contrast, real income declines since consumer prices rise by 1.64 % reflecting the higher VAT. This is consistent with the result of Table 3 and 4 above, showing an average 0.3 increase in overall tax burden relative to disposable income. Savings decline by 1 % which implies a reduction in the overall savings rate of 0.1 percentage points. As a result of the higher nominal income and the slight reduction in savings, nominal consumption expenditures expand by 1.4 %. Taking

into account the inflationary impulse real consumption expenditure declines by 0.24 % (Table 6).

Table 5
Change in the use of disposable income of private households, VAT base and VAT burden induced by the reform by income decile

Deciles net equivalent household income[1]	Dispo-sable income[2]	Private consump-tion ex-penditure	Other expen-diture[3]	Saving[4]	Consumption expenditure liable to VAT				VAT burden
					Taxed at normal rate		Taxed at reduced rate	Total	
					Total	thereof: exempted			
1st decile	0.56	1.47	0.00	6.72	- 1.94	- 0.58	3.38	- 0.74	14.66
2nd decile	0.86	1.41	0.00	14.03	- 1.98	- 0.53	3.69	- 0.76	14.51
3rd decile	1.03	1.41	0.00	- 21.09	- 2.01	- 0.49	3.99	- 0.77	14.55
4th decile	1.10	1.41	0.00	- 1.88	- 2.00	- 0.48	4.08	- 0.79	14.54
5th decile	1.08	1.38	0.00	- 1.45	- 1.99	- 0.52	4.26	- 0.80	14.54
6th decile	1.11	1.43	0.00	- 0.45	- 1.94	- 0.49	4.47	- 0.78	14.72
7th decile	1.11	1.45	0.00	- 0.02	- 1.89	- 0.49	4.51	- 0.76	14.78
8th decile	1.11	1.47	0.00	0.21	- 1.84	- 0.50	4.76	- 0.75	14.94
9th decile	1.01	1.45	0.00	0.02	- 1.85	- 0.57	4.86	- 0.78	14.97
10th decile	0.72	1.35	0.00	- 0.18	- 1.88	- 0.78	5.19	- 0.86	14.97
Total	0.96	1.42	0.00	- 1.02	- 1.92	- 0.56	4.39	- 0.79	14.76

1) Equivalence scale: square root of the number of household members.- 2) Net household income plus other earnings (e.g. from household production, from refunds on purchases, daily allowances).- 3) Voluntary SSC and other insurance premium expenditure, other taxes (e.g. motor vehicle tax, inheritance and gift tax), interest payment on bank loans, other transfers payed.- 4) Including statistical difference (defined residually).
Source: German Income and Consumption Survey (EVS) 2003; own calculations.

A striking result of our research is the remarkable decrease in the VAT base by 0.8 % (normal rate tax base deteriorates by 1.9 %) although nominal consumption expenditure increases slightly. Looking at the changes in consumption patterns sheds more light on these findings. As a consequence of the reduction in standard of living induced by the reform the demand for necessities, like food and housing has increased at the expense of the demand for luxury goods like furniture, transport, education and other goods and services, as well as health (see the lower part of Table 6). Some consumption items are taxed at reduced rates. Especially the prices for food will change at a much lower rate than the average, which will even further foster the demand for food (from 4.2 to 5.2 % of the demand before the reform) according to our simulation. We predict a strong negative price effect for clothing (10.0 %), which is taxed at the normal rate and thus increases at the maximum rate. As our estimations identified alcoholic beverages and clothing as being substitutes, the price increase for clothing is linked with a parallel increase of the demand for alcoholic beverages (7.2 % of the pre-reform value). The effect on the latter group, however, is not so strong in absolute terms, since alcoholic beverages make up for less than 2 percent of the overall expenditure. Furthermore, we find a posi-

tive price effect for recreation and culture, which will be taxed at comparatively rates.[15] This pronounced shift in consumption patterns leads to a significant decline in additional revenue (see Table 2 above). Instead of 16.6 billion Euro additional revenue without taking into account responses in savings and consumption patterns only 15.0 billion Euro will feed the cash-strapped public budget.

Table 6
Change in household consumption expenditure induced by the reform by consumption category and income decile

Deciles net equivalent household income[1)]	Private consumption expenditure												
	Food and non-alcoholic beverages	Alcoholic beverages, tobacco	Clothing and footwear	Housing	Electricity, gas, fuels, water	Health	Fuels for personal transport equipment	Communication	Recreation and culture	Restaurants and hotels	Insurance and financial services	Other expenditure[2)]	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
	Total effect (income and substitution effect) in %												
1st decile	3.79	4.25	- 12.59	1.28	0.46	- 3.61	- 0.63	0.56	1.92	- 1.49	- 1.55	- 4.18	- 0.05
2nd decile	4.17	6.03	- 11.81	1.34	0.73	- 4.14	- 0.28	1.12	1.88	- 1.94	- 1.30	- 5.05	- 0.15
3rd decile	4.54	6.32	- 11.58	1.43	0.95	- 4.02	- 0.06	1.29	1.98	- 1.85	- 1.20	- 5.25	- 0.18
4th decile	4.73	7.01	- 11.12	1.37	1.11	- 3.78	0.12	1.47	1.87	- 1.99	- 1.11	- 5.59	- 0.21
5th decile	4.96	8.01	- 10.80	1.34	1.23	- 3.98	0.20	1.56	1.97	- 1.93	- 1.19	- 5.32	- 0.23
6th decile	5.20	8.27	- 10.66	1.42	1.36	- 4.01	0.29	1.68	2.00	- 1.72	- 1.00	- 5.21	- 0.21
7th decile	5.37	8.51	- 10.24	1.40	1.41	- 3.40	0.51	1.81	2.07	- 1.68	- 1.05	- 5.13	- 0.20
8th decile	5.67	9.78	- 10.40	1.46	1.53	- 3.38	0.61	1.93	2.06	- 1.54	- 1.06	- 4.91	- 0.20
9th decile	6.02	10.17	- 10.05	1.50	1.64	- 2.87	0.69	2.02	2.07	- 1.64	- 1.12	- 4.80	- 0.24
10th decile	6.86	11.19	- 10.39	1.49	1.75	- 2.07	0.98	1.90	1.88	- 1.33	- 1.13	- 4.92	- 0.34
Total	5.21	8.16	- 10.78	1.42	1.26	- 3.08	0.36	1.55	1.97	- 1.65	- 1.14	- 5.03	- 0.22
	Only income effect (Engel curves) in %												
1st decile	2.97	- 0.04	- 0.87	1.20	0.38	- 2.99	- 0.72	0.19	- 1.37	- 1.69	- 1.63	- 4.23	- 0.08
2nd decile	3.34	0.35	- 0.83	1.28	0.68	- 3.54	- 0.34	0.50	- 1.00	- 1.63	- 1.38	- 4.88	- 0.17
3rd decile	3.61	0.53	- 0.79	1.37	0.90	- 3.50	- 0.12	0.66	- 0.90	- 1.59	- 1.26	- 4.97	- 0.20
4th decile	3.84	0.81	- 0.76	1.32	1.06	- 3.26	0.08	0.73	- 0.87	- 1.56	- 1.16	- 5.33	- 0.23
5th decile	4.02	0.94	- 0.75	1.29	1.19	- 3.46	0.16	0.85	- 0.82	- 1.57	- 1.23	- 4.97	- 0.26
6th decile	4.24	1.07	- 0.68	1.37	1.31	- 3.48	0.25	0.98	- 0.81	- 1.46	- 1.08	- 4.87	- 0.23
7th decile	4.41	1.12	- 0.63	1.36	1.38	- 2.90	0.47	1.05	- 0.74	- 1.33	- 1.10	- 4.76	- 0.22
8th decile	4.63	1.41	- 0.60	1.43	1.50	- 2.93	0.57	1.15	- 0.75	- 1.28	- 1.11	- 4.56	- 0.22
9th decile	4.88	1.39	- 0.64	1.47	1.61	- 2.54	0.66	1.18	- 0.75	- 1.30	- 1.16	- 4.44	- 0.26
10th decile	5.49	1.53	- 0.81	1.45	1.71	- 1.85	0.94	1.40	- 0.85	- 1.31	- 1.20	- 4.50	- 0.36
Total	4.21	0.96	- 0.73	1.37	1.21	- 2.68	0.32	0.89	- 0.85	- 1.42	- 1.19	- 4.71	- 0.24
	Stone Price Index based on pre-reform quantities in %												
Total	0.25	2.58	2.59	1.49	2.59	1.05	2.59	2.48	1.25	2.42	1.63	2.07	1.64
	For information: pre-reform budget shares structure in %												
Total	12.06	1.84	5.16	27.39	5.47	3.95	3.75	3.11	12.00	4.61	1.01	19.64	100.00

1) Equivalence scale: square root of the number of household members.- 2) Furnishings, household equipment and routine household maintenance, transport equipment, public transport services, education, miscellaneous goods and services.
Source: German Income and Consumption Survey (EVS) 2003; own calculations.

4.3 Work incentive and labor supply effects

The expected number of hours worked as well as the labor force participation rates are calculated at the level of real household incomes prevailing for the VAT/SCC reform and at the

15 The predicted effects of the relative price change on the other consumption categories is rather weak. This is partially due to the difficulty to estimate the long-run price effects for housing, electricity, gas, water, fuels for transport and financial services satisfactorily on the basis of our system of demand equations.

income level after the reform, where the latter takes into account the second-round effects as given in the previous section. For both the base and the reform scenario expected labor force participation rates and average working hours are derived using the "calibration method", as described in the Appendix. The difference between simulated participation rates and total working hours before and after the reform yields the estimated labor supply effects of the VAT/SSC reform. These effects combine the impact of both the change in net real household incomes resulting from the reform and the size of the labor supply response of a particular household type to a given percentage change of net household income. We are assuming here that households can freely choose their working hours and are not restricted by labor demand constraints.

Population-weighted estimates of the labor supply effects of the VAT/SSC reform are given in Table 7 which shows, in addition to the overall effects at the bottom of the table, also their distribution across income deciles.[16] Because labor supply behavior is known to differ by gender, we report our simulation results separately for women and men. Following the method suggested by McDonald and Moffit (1980), the total hours effect can be decomposed into an hours effect and a participation effect. The former gives the change in working hours of people already employed before the reform, whereas the latter effect measures to the additional hours worked by additionally employed people.

Table 7
Labor supply effect of the VAT/SSC reform by income deciles
in 1 000

Deciles net equivalent household income[1)]	Women				Men			
	New Participation	Working hours as full time equivalents[2)]			New Participation	Working hours as full time equivalents[2)]		
		Total	New Participants	Working Population		Total	New Participants	Working Population
1st decile	14.1	15.4	13.1	2.3	12.3	13.9	13.3	0.6
2nd decile	8.8	11.2	7.2	3.9	7.0	8.9	7.6	1.3
3rd decile	7.1	8.1	6.1	2.0	1.8	3.8	2.0	1.8
4th decile	6.7	7.5	5.5	2.0	1.5	3.7	1.5	2.2
5th decile	3.4	6.5	3.1	3.5	0.7	2.4	0.8	1.6
6th decile	3.4	5.5	3.1	2.4	0.1	1.7	0.1	1.5
7th decile	3.2	5.3	2.7	2.5	0.1	1.6	0.2	1.5
8th decile	2.2	5.8	1.9	3.9	0.2	1.6	0.2	1.3
9th decile	2.4	4.1	1.9	2.2	0.0	0.5	0.0	0.5
10th decile	- 0.5	1.4	0.7	0.7	0.2	0.3	0.3	0.0
Total	50.8	70.7	45.3	25.4	24.0	38.4	26.1	12.3

1) Equivalence scale: square root of the number of household members.- 2) Defined by 40 weekly hours.
Source: German Socio Economic Panel (GSOEP) 2004; own calculations.

16 As in previous sub-sections, we use net equivalent household incomes to sort households into income deciles.

Our simulation results show that the VAT/SSC reform can be expected to increase labor force participation by a total of about 75 thousand people (about 50 thousand women and 25 thousand men). In terms of full-time equivalents, the total labor supply effect amounts to roughly 110 thousand people (70 thousand women and 40 men). In other words, about two thirds of the additional hours are supplied by persons who have not been participating in the labor market before the VAT/SSC reform, and this differs little by gender.[17]

The magnitude of these simulated effects seems plausible, given the size of empirical labor supply elasticities for Germany (Bargain et al. 2005, Haan 2006, Haan and Steiner 2006), and the implied average change in net household incomes across the various hours categories induced by the reform. As expected, labor supply effects of the VAT/SSC reform are not uniform across the income distribution. The strongest effects occur at the bottom end of the income distribution, especially in the lowest decile where labor force participation increases by about 14 thousand women and 12 thousand men. There is very little change in male labor force participation above the median income, and the effect of the reform on working hours of men with net household equivalence incomes above the median is also extremely weak. Although the numbers are fairly small, the reform seems to affect labor supply at the intensive margin in the middle of the income distribution as well. This would be compatible with the larger labor elasticities of women, especially married women, compared to men.

Finally, it may also be instructive to look at the labor supply effects of a VAT increase without a (partially) compensating reduction in SSC. As Table A5 in the Appendix shows, an isolated increase in VAT by 3 percentage points would *reduce* overall labor force participation by about 70 thousand people and total working hours by about 120 thousand full-time equivalent workers. That is, the substitution effect clearly dominates the income effect for both men and women, and the net effect has a stronger impact on working hours than on labor force participation. Negative effects of a (hypothetical) VAT increase of a similar magnitude were also found by Schneider and Bonin (2005) in their study cited above.

5 Summary and Concluding Discussion

We have analyzed the distribution and allocation effects of the increase of the VAT rate by 3 percentage points accompanied by a reduction of the overall rate of social security contributions by 1.6 percentage points, which will become effective in Germany at the beginning of 2007, on the basis of integrated behavioral microsimulation models accounting for the adjustment of individual households' consumption and labor supply behavior. We use the theory

[17] Bootstrapped confidence intervals for the simulated effects will be provided in a revised version of this paper.

of exact aggregation of consumer demand systems to link own-price and cross-price effects of the demand for goods estimated on macro time-series data to income effects at the level of individual households estimated on pooled cross-section household budget surveys. By way of a statistical matching technique, we link these "second-round" effects to our behavioral tax-benefit microsimulation model STSM which includes a structural labor supply model estimated on the German Socio Economic Panel. On the basis of this model we have also simulated the work incentive and labor supply effects of the reform.

Not accounting for any behavioral response of consumers to the VAT/SSC reform, we find that the combined VAT/SSC reform reduces, on average, net household incomes by roughly 0.4 percentage points, compared to about 1.3 percent when only the increase in VAT is considered. The VAT/SSC reform has only a rather modest effect on overall inequality, and this effect is only marginally larger if the increase in VAT is considered in isolation from the reduction in social security contributions. However, these summary measures disguise that the increase in the tax burden is strongly declining below median net equivalent household income due to the VAT/SSC reform. The relatively strong negative real income effect in the lower part of the income distribution is related to the fact that people with low household incomes, among them the unemployed, those working in "marginal jobs" not subject to SSC, pensioners, and people with small incomes from self-employment, gain little or not at all from the reduction of SSC because they are typically not covered by the social security system.

Accounting for adjustments in households' savings and consumption behavior, reduces the additional tax burden of the VAT/SSC reform slightly, and also results in a somewhat smaller increase in the summary inequality measures, but does not significantly change the effects on the additional tax burden across the income distribution in relative terms. The winners of the reform are employees subject to SSC, in particular those in the upper part of the income distribution, whose extra VAT burden is overcompensated by the reduced SSC. In the lower part of the income distribution, employees might rely stronger on public transfers or "mini-jobs" not liable to SSC. Contrary to popular belief, we do not find that the VAT/SSC reform has particularly adverse effects on families with children in general, although single parents in the lowest income decile face a relatively large income loss due to the reform. However, this is basically related to the employment situation especially among single mothers rather than to a disproportionally large VAT burden on the consumption of this group.

According to simulation results from our behavioral labor supply model, the second-round income effects induced by the VAT/SSC reform can be expected to increase labor force participation by a total of about 75 thousand people (about 50 thousand women and 25 thousand men). This we consider to be the upper bound of the possible employment effect of the

reform since the labor supply effects are derived under the assumption of given market wages and no demand-side rationing. Given the relatively small estimated labor supply effects this assumption seems unlikely to be violated in case of the analyzed reform. In terms of full-time equivalents, the total labor supply effect amounts to roughly 110 thousand people (70 thousand women and 40 thousand men). That is, about two thirds of the additional hours are supplied by persons who have not been participating in the labor market before the VAT/SSC reform, and this differs little by gender. However, labor supply effects are not uniform across the income distribution; the strongest effects occur at the bottom end of the income distribution, whereas there is very little change in labor force participation above median income. The VAT increase without partially compensating reduction of SSC would *reduce* overall labor force participation by about 70 thousand people and total working hours by about 120 thousand full-time equivalent workers.

Overall, we expect the VAT/SSC reform to have only modest labor supply and employment effects which have to be evaluated against a modest increase in overall income inequality. If this can be considered as an improvement relative to the pre-reform situation can only be evaluated on a normative basis, which is beyond the scope of the current paper. However, these results have to be interpreted with several qualifications in mind. First, since part of the VAT increase is not re-distributed back to the private sector but used to finance the budget deficit, we may overestimate the negative distribution effects of the reform depending on the alternative way of financing the budget deficits. Second, since we do not analyze the general equilibrium effects of the reform we had to make a number of incidence assumptions, which might be questionable especially in the short-run. Last not least, here we have focused on the short-term distributional effects of the reform on the basis of current income, although a long-term perspective using permanent income or, as a proxy, current consumption as reference measure might be more appropriate. We plan to pursue some of these issues in future research.

References

Bach, S, G. Corneo and V. Steiner (2005): Top Incomes and Top Taxes in Germany. German Institute for Economic Research. DIW Discussion Paper 532, Berlin.

Bach, S. (2005a): Koalitionsvertrag: Belastungen durch Mehrwertsteuererhöhung werden nur zum Teil durch Senkung der Sozialbeiträge kompensiert. DIW Wochenbericht 47/2005.

Bach, S. (2005b): Mehrwertsteuerbelastung der privaten Haushalte. Dokumentation des Mehrwertsteuer-Moduls des Konsumsteuer-Mikrosimulationsmodells des DIW Berlin auf Grundlage der Einkommens- und Verbrauchsstichprobe. Data Documentation 10, DIW Berlin.

Bargain, O., M. Caliendo, P. Haan and K. Orsini (2005): 'Making work pay' in a rationed labour market. The Mini-Job reform in Germany. DIW Discussion Papers 536, Berlin.

Blundell, R., A. Duncan, J. McCrae and C. Meghir (2000): The labour market impact of the Working Families' Tax Credit. Fiscal Studies 21, 75-104.

Böhringer, C., S. Boeters und M. Feil (2005): Taxation and Unemployment: An Applied General Equilibrium Approach for Germany. Economic Modelling 22, 81-108.

Buscher, H., H. Buslei, K. Göggelmann, H. Koschel, T.F.N. Schmidt, V. Steiner and P. Winker (2001): Empirical macromodels under test – a comparative simulation study of the employment effects of a revenue neutral cut in social security contributions. Economic Modelling 18, 455-474.

Caspersen, E. and G. Metcalf (1994): Is a Value Added Tax Regressive? Annual Versus Lifetime Incidence Measures. National Tax Journal 47, 731-746.

Cowell, F. (1995): Measuring Inequality (2nd ed.). London.

Creedy, J. and A. Duncan (2002): Behavioural Microsimulation with Labour Supply Responses. Journal of Economic Surveys 16.

Deaton, A. and J. Muellbauer (1980a): An Almost Ideal Demand System. American Economic Review 70, 312-326.

Deaton, A. and J. Muellbauer (1980b)*:* Economics and Consumer Behavior. Cambridge, Cambridge University Press.

Feenberg, D.R., A. W. Mitrusi and J. M. Poterba (1997): Distributional effects of adopting a national retail sales tax. In: J.M. Potera (ed.), Tax Policy and the Economy. Vol. 11, 49-89, MIT Press.

Feil, M. and G. Zika (2006): Less contributions, more employment? What will cutting social-security contributions accomplish? In: C. Dreger, H.-P. Galler, U. Walwei (eds.), Determinants of employment – the macroeconomic view. Schriften des Instituts für Wirtschaftsforschung Halle, Band 22, 123-153, Nomos.

Fritzsche, B., R. Kambeck and H. D. von Loeffelholz et al. (2003): Empirische Analyse der effektiven Inzidenz des deutschen Steuersystems. Untersuchungen des Rheinisch-Westfälischen Instituts für Wirtschaftsforschung 42. Essen.

Fullerton, D., G. E. Metcalf (2002): Tax incidence, in: A. J. Auerbach, M. Feldstein (eds.), Handbook of Public Economics, Vol. 4, Chapter 26, North Holland.

Haan, P. (2006): Much Ado About Nothing: Conditional Logit versus Random Coefficient Models for Estimating Labor Supply Elasticities, forthcoming in: Applied Economics Letters.

Haan, P. and V. Steiner (2006): Labor Market Effects of the German Tax Reform. DIW Discussion Papers 472, Berlin. In: Dreger, C., Galler, H.P., Walwei, U. (eds): Determinants of employment - the macroeconomic view, Nomos, Baden-Baden.

Haisken-DeNew, J. and J. Frick (2001): Desktop Compendium to The German Socio-Economic Panel Study (SOEP). DIW Berlin.

McDonald, J. and R. Moffitt (1980): The use of tobit analysis. Review of Economics and Statistics 62, 318-321.

McFadden, D. (1974): Conditional Logit Analysis of Qualitative Choice Behavior. In: P. Zarembka (ed.), Frontiers in Econometrics, Academic Press.

Metcalf, G. (1994): Life cycle versus annual perspectives of the incidence of the value added tax. In: J. M. Poterba (ed.), Tax Policy and the Economy, Vol. 8, 45-64, Cambridge, Mass.

Moschini, G. (1995): Units of Measurement and the Stone Index in Demand System Equations. American Journal of Agricultural Economics 77, 63-68.

Nichèle, V. and J.-M. Robin (1995): Simulation of Indirect Tax Reforms Using Pooled Micro and Macro French Data. Journal of Public Economics 56, 225-244.

Poterba, J. M. (1989): Lifetime incidence and the distributional burden of excise taxes. American Economic Review, 78, PaP, 325-330.

Schmähl, W. (1998): Financing social security in Germany: Proposals for changing its structure and some possible effects. In: S. Black (ed.), Globalization, Technological Change, and the Welfare State, Chapter 8, 179-211, Kluwer Academic Publishers.

Schneider, H. and H. Bonin (2005): Wohlfahrts- und Verteilungseffekte eines allgemeinen Freibetrags bei den Sozialgaben. IZA Discussion Paper 1490, Bonn.

Steiner, V. (2002): Beschäftigungseffekte einer Subventionierung der Sozialbeiträge von Geringverdienern. In: W. Schmähl (Hrsg.), Wechselwirkungen zwischen Arbeitsmarkt und sozialer Sicherung, Schriftenreihe des Vereins für Socialpolitik, Duncker-Humblot, Berlin.

Steiner, V. (2003): Employment and wage effects of social security financing. In: John A. Addison and Paul J. Welfens, Labour Markets and Social Security (2nd edition), Chapter L, 319-344; Springer.

Steiner, V. and K. Wrohlich (2005): Work incentives and labor supply effects of the 'mini-jobs reform' in Germany. Empirica 32, 91-116.

Steiner, V., P. Haan and K. Wrohlich (2005): Dokumentation des Steuer-Transfer-Mikrosimulationsmodells STSM 1999 – 2002. Data Documentation 9, DIW Berlin.

Van Soest, A. (1995): Structural Models of Family Labor Supply: A Discrete Choice Approach. Journal of Human Resources 30, 63-88.

Appendix

Discrete Choice Labor Supply Estimation

Discrete-choice models of labor supply are based on the assumption that a household can choose among a finite number J+1 of working hours (J positive hours points and non-employment); each hour j=0,…,J corresponds to a given level of net household income y_{ij} and each discrete bundle of leisure and income provides a different level of utility.[18] Following van Soest (1995), we specify a household utility function depending on the leisure time of the household members and net household income. We assume that the household's utility index for a particular hours category *k* can be modeled by the following quadratic utility function:

$$(A1) \quad U_k(x_k) = x_k' A x_k + \beta' x_k + \varepsilon_k$$

where $x = (y, l_m, l_f)'$. The components of *x* are net household income (*y*), leisure of the husband (l_m) and leisure of the wife (l_f). These components enter the utility function in linear, quadratic and cross terms. The matrix *A*, with elements α_{ij}, $i,j = (1,2,3)$, contains the coefficient of the quadratic and the cross terms, the vector β_j, $j = (1,2,3)$, the coefficients of the linear terms. ε_k is a stochastic error term accounting for unobserved factors that affect household utility.

Given the assumption of joint maximization of household utility, the household will choose hours category *k* if, in probability terms, the associated utility index, U_k, exceeds the utility index in any other possible alternative *l*, i.e.:

$$(A2) \quad P(U_k > U_l) = P\left[\left(x_k' A x_k + \beta' x_k\right) - \left(x_l' A x_l + \beta' x_l\right) > \varepsilon_l - \varepsilon_k\right].$$

Assuming that ε_k is distributed identically across all hours categories according to an extreme-value distribution, the difference of the utility index between any two hours categories follows a logistic distribution. Under this distributional assumption the probability of choosing alternative *k* relative to alternative *l* is given by a conditional logit model introduced by McFadden (1973):

$$(A3) \quad P(U_k > U_l) = \frac{\exp(x_k' A x_k + \beta' x_k)}{\sum_{m=1}^{J} \exp(x_m' A x_m + \beta' x_m)}, \forall l \neq k,$$

[18] We assume that working hours can be described by a distribution with 6 discrete points. We define on hours intervals (0, [0,12], [12,20], [20,34], [34,40], >40) according to the empirical distribution in the data (GSOEP 2003). The empirical mean of the distribution describes the discrete hours points. For couples we assume a joint labour supply model and specify 6x6 discrete points. For more details, see Bargain et al. (2005).

where the summation sign is defined over all possible alternatives, i.e. hours categories. We control for observed heterogeneity in household preferences by including as control variables age and health status of both spouses, number and age of children in the household, region of residence (east or west Germany), and nationality. Because variables with no variation across alternatives drop out of the estimation in the conditional logit model, the household-specific variables are interacted with the leisure terms in the utility function (1). [19]

The likelihood for a sample of observed choices can be derived from the probabilities given by equation (3) and maximized to estimate the parameters of the utility function. We assume a quadratic specification of the utility function as in Blundell et al. (2000). In the present non-linear model labor supply effects need to be derived numerically. Instead of the `aggregated frequencies´ technique, that is aggregating the expected individual hour supply over the whole sample, we follow the calibration method which is consistent with the probabilistic nature of the model at the individual level (Creedy and Duncan 2002). It consists of drawing for each household a set of J+1 random terms from the Extreme Value distribution until a vector of random terms is found that generates a perfect match between predicted and observed hour supply. In a second step, the draws are used for predicting labor supply responses to a tax reform, and averaging them over a large number of draws provides robust transition matrices.

19 In the estimation we do not consider potential effects of unobserved heterogeneity which implies that the independence of irrelevant alternatives (IIA) property holds. However, Haan (2006) has shown that labor supply elasticities, estimated on the same data as in the present study, do not differ significantly when unobserved heterogeneity is introduced.

Table A1
Estimation of savings rate effects with cross-section micro data

	Coefficient	t-value
Income effect	0.3627	3.84
1 child	-0.0854	-1.66
2 children	-0.0755	-1.31
3 children	-0.1291	-1.59
4 children and more	-0.1180	-1.20
Self employed	0.4588	1.71
Civil servant	0.0761	1.09
White-collar worker	0.1063	0.88
Pensioner	-0.1055	-0.51
Unemployed	-0.0025	-0.01
Students and others	1.0572	1.17
Full-time single	0.3267	0.96
Part-time single	-0.0644	-1.90
Marginally empl. single	0.0150	0.23
Not-employed single	0.1269	0.51
Full-time / full-time	-0.0438	-1.74
Full-time / part-time	0.0081	0.25
Full-time / marginal	0.0738	1.80
Part-time / part-time	-0.0947	-1.60
Part-time /marginal	-0.0925	-0.85
Part-time / not-empl.	0.2586	1.06
Marginal / marginal	-0.0127	-0.07
Marginal / not-empl.	0.3211	0.92
Not empl. / not-empl.	-0.0170	-0.09
Foreign nationality	-0.2208	-1.86
Mortgage	-0.1788	-2.10
Car purchase	-0.6907	-1.56
Expenditure car purchase	-0.6267	3.38
Furniture purchase	-0.3314	-1.88
Expenditure furniture purchase	-0.0477	1.98

Effects of interaction terms are evaluated at sample means.
Source: German Income and Consumption Survey (EVS) 1998 and 2003 (pooled); own calculations.

Table A2
Estimation of budget effects with cross-section micro data

	Food, non-alcoholic beverages	Alcoholic beverages, tobacco	Clothing and footwear	Housing	Water, electricity, gas, fuels	Health
	1	2	3	4	5	6
Budget effect	-0.071 ***	-0.018 ***	-0.002	-0.063 ***	-0.026 ***	0.009 ***
Elasticity	0.495	0.047	0.959	0.781	0.590	1.292
1 child	-0.016 ***	0.001 *	-0.005 ***	0.000	-0.003 ***	0.003 *
2 children	-0.021 ***	0.003 ***	-0.006 ***	0.000	-0.004 ***	0.000
3 children	-0.022 ***	0.006 ***	-0.005 ***	-0.005	-0.004 ***	0.005
4 children and more	-0.023 ***	0.006 ***	-0.003	0.002	-0.004 *	0.003
Younger than 26	0.028 ***	0.005 **	-0.004 *	0.001	0.012 ***	-0.003
35 - 44 years	-0.005 ***	-0.003 ***	0.006 ***	-0.008 ***	-0.002 ***	0.004 ***
45 - 54 years	-0.003 *	-0.001	0.007 ***	-0.020 ***	-0.004 ***	0.006 ***
55 - 64 years	-0.003 *	0.003 **	0.002 **	-0.019 ***	-0.002 ***	0.006 ***
65 and older	-0.003	0.008 ***	0.006 ***	-0.023 ***	0.000	0.006 **
Self employed	0.026 ***	0.007 ***	-0.001	-0.006	0.007 ***	-0.002
Civil servant	0.011 ***	0.006 ***	-0.007 ***	-0.005	0.006 ***	0.033 ***
White-collar worker	0.008 ***	0.004 ***	-0.003 ***	0.000	0.004 ***	0.002 *
Pensioner	0.005	0.003	-0.009 ***	-0.002	0.001	0.025 ***
Unemployed	0.007	-0.001	-0.003	-0.017 **	-0.003	-0.001
Students and others	0.010 **	0.009 ***	-0.005 *	0.004	0.007 ***	0.003
Full-time single	0.023 ***	0.001	0.005 ***	-0.008 **	0.003 ***	0.006 **
Part-time single	0.020 ***	0.003 *	0.011 ***	-0.010	0.001	-0.003
Marginally empl. single	0.046 ***	-0.014	-0.005	-0.014	0.007	-0.011
Not-employed single	0.005	0.000	0.015 ***	0.002	0.000	0.006
Full-time / full-time	0.004 **	0.003 ***	-0.005 ***	-0.006	0.002 **	-0.004 *
Full-time / part-time	0.001	0.004 ***	-0.006 ***	-0.006 *	0.001 *	-0.009 ***
Full-time / marginal	-0.006	0.004	-0.003	-0.006	0.000	-0.006 *
Part-time / part-time	0.002	0.002	-0.006 *	-0.002	0.002	-0.002
Part-time /marginal	0.000	-0.003	-0.015	0.013	-0.007	0.013
Part-time / not-empl.	-0.007 **	0.000	0.004 *	0.000	0.000	-0.003
Marginal / marginal	0.056 ***	0.034 ***	-0.028	0.125 *	0.048	-0.027 ***
Marginal / not-empl.	-0.001	0.001	0.006	0.008	-0.002	0.005
Not empl. / not-empl.	-0.010 ***	0.001	0.005 **	0.002	0.000	0.005
Female	0.000	0.007 ***	-0.009 ***	-0.006 ***	-0.003 ***	-0.001
Foreign nationality	-0.009 **	0.004	0.000	-0.001	-0.001	-0.003
Eastern Germany	-0.004 ***	0.002 **	-0.005 ***	0.013 ***	-0.002 ***	-0.015 ***
R^2	0.374	0.068	0.059	0.161	0.161	0.132
No. of observations	42,744	42,744	92,464	92,464	92,464	92,464

*** Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level

Table A1 continued

	Fuels and lubricants for transport	Communi-cation	Recreation and culture	Restaurants and hotels	Insurance, financial services	Others[1]	Adding up (t-value)
	7	8	9	10	11	12	
Budget effect	-0.025***	-0.022***	0.009***	-0.001	0.003***	0.209***	0.411
Elasticity	0.408	0.399	1.080	0.983	1.305	2.238	
1 child	0.001	0.001***	0.000	-0.001	0.000	0.018***	0.202
2 children	0.003***	0.005***	0.005**	0.000	0.000	0.017***	0.335
3 children	0.003***	0.005***	0.002	0.004***	-0.001	0.019***	0.585
4 children and more	0.002	0.004***	0.018***	0.004	0.006**	-0.006	0.390
Younger than 26	0.008***	0.006***	-0.002	-0.009***	-0.001	-0.045***	-0.240
35 - 44 years	0.005***	0.004***	0.008***	0.005***	0.000	-0.011***	0.077
45 - 54 years	0.008***	0.008***	0.014***	0.011***	0.001	-0.024***	0.184
55 - 64 years	0.008***	0.011***	0.011***	0.010***	0.002**	-0.030***	-0.003
65 and older	0.009***	0.013***	0.014***	0.011***	0.002***	-0.043***	0.055
Self employed	-0.002	0.001	-0.002	-0.006***	0.002	-0.019**	0.240
Civil servant	-0.003***	0.001**	-0.018***	-0.013***	-0.002**	-0.013**	-0.321
White-collar worker	-0.002*	0.001	-0.002	-0.005***	0.000	-0.010***	-0.248
Pensioner	0.004***	0.000	-0.003	-0.003	-0.002	-0.015	0.211
Unemployed	0.010***	0.004***	0.013**	0.005	0.001	-0.012	0.193
Students and others	0.010***	0.004***	0.004	-0.003	-0.002	-0.037***	0.291
Full-time single	0.005***	0.002***	0.000	-0.010***	0.000	-0.031***	-0.187
Part-time single	0.012***	0.001	0.010**	-0.007***	0.001	-0.038***	0.038
Marginally empl. single	0.009	-0.001	0.052**	-0.008	0.000	-0.047	0.228
Not-employed single	0.013***	-0.001	0.010*	-0.003	0.003	-0.056***	-0.429
Full-time / full-time	-0.004***	0.003***	-0.006**	-0.007***	-0.001	0.022***	0.141
Full-time / part-time	-0.002***	0.001	-0.005	-0.005***	-0.001	0.026***	-0.010
Full-time / marginal	0.000	0.002	-0.003	0.004*	-0.003**	0.013	-0.319
Part-time / part-time	-0.003	-0.001	-0.016*	-0.013***	0.002	0.034*	-0.014
Part-time /marginal	0.011	-0.004	-0.014	-0.011	0.003	0.013	-0.004
Part-time / not-empl.	0.002	0.000	0.005	0.002	0.000	-0.007	-0.424
Marginal / marginal	0.016	0.016	-0.003	-0.037***	-0.003**	-0.161***	0.347
Marginal / not-empl.	0.005*	-0.003	0.015	0.002	0.003	-0.037*	0.090
Not empl. / not-empl.	0.005***	0.001	0.008	0.004*	0.000	-0.027***	-0.358
Female	0.006***	0.000	0.005***	0.010***	0.001***	-0.008***	0.797
Foreign nationality	0.008***	-0.004***	0.012***	0.002	0.000	-0.008	-0.013
Eastern Germany	0.000	-0.001**	-0.005***	-0.002***	-0.002***	0.024***	0.636
R^2	0.190	0.201	0.029	0.077	0.013	0.300	
No. of observations	92,464	92,464	92,464	92,464	92,464	92,464	

[1] Furnishings, household equipment, transport, education, miscellaneous goods and services.

Table A3

Estimation of price and income effects with time-series macro data

	Compensated price effects												Budget			Adding	Sym-
	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	p11	p12	effect	R^2	DW	up	metry
1	0.004	-0.014	0.038	/	/	0.006	/	0.001	-0.032 *	-0.003	/	0.000	-0.058 **	0.163	1.954	0.089	0.162
	-0.086	-0.113	0.313			0.049		0.006	-0.267	-0.024		0.000	0.523				
2		-0.020 *	0.060 ***	/	/	0.000	/	0.008	0.000	-0.021 **	/	-0.012	-0.023 *	-0.049	2.192	0.054	0.000
		-0.583	1.600			-0.010		0.203	-0.007	-0.567		-0.310	0.389				
3			-0.120 ***	/	/	-0.001	/	-0.011	0.030	0.046 **	/	-0.042	0.093 ***	0.511	1.997	0.641	0.007
			-1.904			-0.020		-0.173	0.460	0.707		-0.643	2.436				
4				/	/	/	/	/	/	/	/	/	-0.151 ***	0.341	1.537	/	/
													0.195				
5					/	/	/	/	/	/	/	/	0.003	0.001	2.203	/	/
													1.068				
6						/	/	-0.004	-0.007	0.004	/	0.003	0.000	0.028	1.928	0.732	0.633
								-0.113	-0.191	0.108		0.086	1.008				
7							/	/	/	/	/	/	0.000	0.003	2.090	/	/
													1.015				
8								-0.012 **	-0.008	-0.002	/	0.029 *	-0.001	-0.033	2.146	0.511	0.006
								-0.568	-0.347	-0.066		1.276	0.95				
9									/	0.018	/	0.000	0.000	0.039	1.953	0.354	0.084
										0.193		-0.005	1.001				
10										/	/	-0.043	-0.042 ***	0.312	1.493	0.948	0.236
												-0.768	0.25				
11											/	/	-0.023	0.020	1.779	/	/
													0.642				

Upper numbers: Estimated coefficients; lower numbers: price elasticity of demand calculated at mean expenditure shares.

*** Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level

Table A4

Distributional effects of the increased VAT normal rate by income decile and household type with behavioral adjustment of savings and consumption

Deciles net equivalent household income[1)]	Single house-holds	Single parents		Married and unmarried couples				Other house-holds	Private house-holds total
		with 1 child	with 2 and more children	without children	with 1 child	with 2 children	with 3 and more children		
	Shift in tax burden relative to disposable household income[2)] in percentage points								
1st decile	1.49	1.49	1.42	1.49	1.71	1.78	1.52	1.52	1.51
2nd decile	1.32	1.42	1.25	1.38	1.42	1.39	1.28	1.45	1.36
3rd decile	1.30	1.32	1.32	1.27	1.40	1.28	1.18	1.34	1.30
4th decile	1.24	1.26	1.17	1.25	1.30	1.27	1.20	1.15	1.25
5th decile	1.21	1.19	1.28	1.28	1.31	1.17	1.14	1.19	1.23
6th decile	1.20	1.39	1.20	1.26	1.19	1.12	1.09	1.29	1.20
7th decile	1.12	1.11	1.07	1.21	1.19	1.12	1.09	1.18	1.16
8th decile	1.11	1.06	1.07	1.23	1.09	1.04	0.99	1.18	1.13
9th decile	1.08	1.08	1.09	1.12	1.08	1.00	1.02	1.03	1.07
10th decile	0.83	0.81	0.85	0.90	0.88	0.86	0.82	0.93	0.88
Total	1.16	1.25	1.21	1.14	1.13	1.09	1.06	1.14	1.13
	For information: private households in 1 000								
Total	14 034	1 382	673	11 200	4 098	3 820	1 383	1 520	38 110

1) Equivalence scale: square root of the number of household members.- 2) Net household income plus other earnings (e.g. from household production, from refunds on purchases, from daily allowances).
Source: German Income and Consumption Survey (EVS) 2003; own calculations.

Table A5

Labor supply effect of the increased VAT normal rate by income deciles
in 1 000

Deciles net equivalent household income[1)]	Women				Men			
	New Participation	Working hours as full time equivalents[2)]			New Participation	Working hours as full time equivalents[2)]		
		Total	New Participants	Working Population		Total	New Participants	Working Population
1st decile	1.3	- 0.4	0.5	- 0.9	0.3	0.0	0.1	- 0.1
2nd decile	- 3.9	- 7.0	0.4	- 7.4	- 3.0	- 3.9	0.0	- 3.9
3rd decile	- 6.1	- 10.8	0.5	- 11.3	- 5.2	- 6.6	0.0	- 6.6
4th decile	- 5.6	- 7.1	0.5	- 7.7	- 5.5	- 7.3	0.0	- 7.3
5th decile	- 5.8	- 9.0	0.1	- 9.1	- 6.0	- 8.7	0.0	- 8.7
6th decile	- 3.3	- 6.9	0.1	- 7.0	- 5.6	- 8.0	0.0	- 8.0
7th decile	- 4.8	- 8.3	0.1	- 8.4	- 5.3	- 8.2	0.0	- 8.2
8th decile	- 5.2	- 7.3	0.1	- 7.4	- 3.4	- 6.1	0.0	- 6.1
9th decile	- 2.8	- 5.0	0.2	- 5.2	- 1.9	- 3.9	0.0	- 3.9
10th decile	- 0.2	- 1.8	0.5	- 2.3	- 0.9	- 1.7	0.0	- 1.7
Total	- 36.4	- 63.5	3.1	- 66.6	- 36.6	- 54.3	0.1	- 54.4

1) Equivalence scale: square root of the number of household members.- 2) Defined by 40 weekly hours.
Source: German Socio Economic Panel (GSOEP) 2004; own calculations.