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Revenue and Welfare Effects of Financial Sector VAT Exemption

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Abstract:

This paper provides an analysis of revenue and welfare effects associated with a VAT exemption of financial services, which is common among OECD countries. We follow a general equilibrium approach which takes account of the input-output structure of the economy. This allows us to discuss the various effects of repealing the VAT exemption not only on consumer demand and intermediate-input demand but also on labor supply. We derive formal expressions for revenue and welfare effects, which can be quantified with a minimum of information about behavioral effects. Using VAT statistics as well as national accounts we compute the effects of repealing the VAT exemption in Germany. Our baseline estimate indicates that tax revenues would increase by some €1.2 billion or 0.9% of VAT revenues (excluding import turnover tax). If the revenue gains are used to finance a reduction in the distortive labor tax, however, our results point at a modest welfare gain of €0.675 Billion.

Keywords: VAT; Financial Services; Exemption; General Equilibrium; Deadweight Loss; Input-Output Analysis

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Kommunikation

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1 Introduction

The recent time has seen various policy proposals to change the tax system in order to determine "*a fair and substantial contribution by the financial sector.*" (IMF, 2010). Some of the recent proposals may be little more than a political reflex to the financial crisis that forced governments in many developed countries into providing large rescue packages for financial institutions. However, as a matter of fact, in many countries financial institutions are largely exempt from the value-added-tax (VAT). Given the relative size of the financial industry in some countries, repealing the VAT exemption of the financial industry might result in substantial revenue gains. For instance, according to the HMRC's overview of tax expenditures and structural reliefs, in the UK, the largest single VAT exemption is that of finance and insurance which amounts to no less than £9.1 Billion or, according to own calculations, 11.4% of total VAT receipts (see also Mirrlees *et al.*, 2011).

However, a large share of financial services is taxed already since it is used as input into production rather than being purchased by the consumer. Table 1 reports the use-structure of financial sectors in Germany, the UK, France and Italy. It shows that the share of business to business (B2B) transactions is two to three times higher than the fraction of business to costumer (B2C) transactions except for the UK, where the shares are almost equal. Another reason, why revenue gains need to be qualified, relates to unrecoverable input taxes. Though the financial sector is tax exempt for VAT purposes, it contributes indirectly to VAT revenues since taxable goods serve as inputs in the production of financial services where taxes are not refunded. Therefore, removing the exemption on financial services might even result in revenue losses.

Aside from revenue effects, another questionable aspect of the tax exemption of financial services is associated with the distortion of relative prices. Based on a theoretical analysis, Auerbach and Gordon (2002) show that for reasons of allocative efficiency, VAT should be levied on resources devoted to financial services in the same manner as it is levied on resources used by other sectors.

Table 1: Demand for Financial Services among Selected Countries (2007 figures in Billion Euros)

	Germany	UK	France	Italy
Total demand	118.389	155.741	100.959	77.174
B2B	76.869	59.961	73.905	52.309
B2C	35.630	58.212	22.260	19.978
Exports	5.890	37.467	4.794	4.888

Figures report financial intermediation services, except insurance and pension funding services. Source: European Commission (ESA 95 Supply Use and Input-Output tables)

Several distortions are discussed in the literature (*e.g.*, Huizinga, 2002, Mirrlees *et al.*, 2011). Due to the exemption, private consumption of financial services enjoys a tax-advantage whereas productive uses face a tax-disadvantage. Moreover, under exemption, inputs used by the financial industry tend to be more costly than self production. This favors in-sourcing of production and tends to boost the size of the financial sector. From this perspective, taxing financial activities might help to enhancing allocative efficiency. However, as in the case of revenue effects, the empirical importance of the allocative effects depends on the input-output-structure of the economy.[1]

Despite recent proposals, the empirical estimation of revenue and welfare effects of removing the VAT exemption of financial services is rarely discussed in the literature. Using data for Germany, Genser and Winker (1998) estimate the tax revenue gains from repealing the exemption at about 8.3% of total VAT revenues. Huizinga (2002) finds a more modest revenue increase of 4.7% of total VAT revenues for the European Union in 1998. Regarding welfare effects, Huizinga (2002) presents some evidence for modest welfare gains. However, both papers use data from national accounts according to ESV95 where the value added of financial services was only accounted for to a limited extent. In difference to the old system of national accounts, the revised system of European National Accounts available since 2004/2005 provides detailed information on the value added of the financial sector. This raises the issue as to whether the large revenue gains reported in previous studies can be confirmed using the more recent data. In a recent study, Lockwood

[1]In an international context, differences in VAT rates across countries may cause further distortions which are neglected in the following.

(2011) considers revenue implications for 26 EU countries based on data for 2007 and finds revenue losses in an amount of 0.058% of total VAT revenues.

This paper reconsiders the revenue effects and explores also the welfare effects associated with VAT exemption of financial services. In difference, to the previous literature, we follow a general equilibrium approach which takes account of pre-existing distortions associated with the tax system as well as of the input-output structure of the economy. This allows us to determine the effects of repealing the VAT exemption not only on consumer demand and intermediate-input demand but also on labor supply. Making use of general equilibrium relationships we derive formal expressions for revenue and welfare effects, which can be quantified with a minimum of information about behavioral effects of commodity taxation. To facilitate the empirical analysis we treat the final consumption of financial services like any other consumer good. While this enables us to link the theoretical model with the national accounts, the literature has argued that financial services do not generate utility and should be treated like an input (*e.g.*, Grubert and Mackie, 1999). However, our approach allows for a substitutive relationship between leisure and consumer demand for financial services and, thus, takes account of possible distortions which arise if taxation of financial services exerts a disincentive for labor supply.

Using VAT statistics and national-accounts statistics we compute the effects of repealing the VAT exemption in Germany. Our results point at the importance of the deductibility of input taxes. If the exempted part of the financial sector cannot deduct any input taxes under the current system, repealing the exemption would result in revenue losses. This finding critically hinges on the amount of unrecoverable input taxes. Based on a realistic estimate of the extent to which the financial sector is able to deduct input taxes that are associated with the exempted part of the financial sector, we find that repealing the exemption would result into a revenue gain of about €1.2 Billion or 0.9% of total VAT revenues in the base year (exclusive of import turnover tax). Regarding welfare effects, our results indicate that a revenue neutral decrease in the distortive labor tax should result in a modest welfare gain, amounting to €0.675 Billion. At any rate, the revenue and welfare effects of repealing the VAT exemption of financial services turn out to be much less promising than indicated by previous research.

The next section provides a formal discussion of revenue effects in an economy with n sectors and a single primary input. Section 3 is concerned with the conceptualization of welfare effects. Section 4 provides a brief discussion of data and institutions, before Section 5 presents our quantitative results. Section 6 concludes.

2 Revenue Effects

To study revenue effects associated with a VAT exemption, we start by developing a general equilibrium model under perfect competition. The model takes account of sector-specific tax rates and sector-specific exemptions. Using this framework, we then consider a case where only one sector is exempt and discuss the consequences for quantities and prices of removing this exemption.

Consider an economy with n sectors. Each sector receives inputs from the others and from the own sector. The intermediate input linkage is captured by technical input coefficients a_{ij} which determine how many units from sector i are used in the production of one unit in sector j. The tax revenue is generated from taxing the value of output p_iX_i less the recoverable taxes on inputs plus the tax on labor earnings, with τ_L denoting the labor income tax rate. Labor serves as numeraire in this analysis and the wage rate is set to unity. Adding the contribution of the sectors to VAT and the labor tax, we can define total tax revenue

$$\begin{aligned} T \quad &\equiv \quad \tau_1 p_1 X_1 - \left(\tau_1 p_1 a_{11} X_1 + \tau_2 p_2 a_{21} X_1 + ... + \tau_n p_n a_{n1} X_1\right) I_1 \\ &+ \quad ... \\ &+ \quad \tau_f p_f X_f - \left(\tau_1 p_1 a_{1f} X_f + \tau_2 p_2 a_{2f} X_f + ... + \tau_n p_n a_{nf} X_f\right) I_f \end{aligned}$$

$$
\begin{aligned}
&+ \quad ... \\
&+ \quad \tau_n p_n X_n - \left(\tau_1 p_1 a_{1n} X_n + \tau_2 p_2 a_{2n} X_n + ... + \tau_n p_n a_{nn} X_n\right) I_n \\
&- \quad \alpha \left(\tau_1 p_1 a_{1n} X_n + \tau_2 p_2 a_{2n} X_n + ... + \tau_n p_n a_{nn} X_n\right) \left(I_f - I_n\right) \\
&+ \quad \tau_L \left(L_1 + L_2 + ... + L_n\right),
\end{aligned}
$$

where $I_i = 1$ if sector i is taxed or zero-rated, and $I_i = 0$ if the sector is exempt. L_i is the labor input in sector i. In the analysis below we will focus on the (partial) exemption of the financial sector. For this purpose we distinguish the financial sector in two subsectors, one of which, subsector f, is already subject to taxation and receives a refund of taxes on inputs, while the other subsector n may enjoy exemption without refund of input taxes. The above definition of tax revenues already takes account of possibilities of the exempted part of the financial sector n to shift some share α of input taxes to the taxed part of the financial sector, indexed with f. Thus, even if sector n is exempted such that $I_n = 0$, the tax revenue equation takes account of the possibility that some part of the hidden input tax associated with the exempted part of the financial sector might be deductible in practice. Defining consumer demand as $x_i \equiv X_i - \sum_j^n a_{ij} X_j$, and rearranging terms we obtain

$$
\begin{aligned}
T \equiv \sum_{i=1}^{n} \tau_i p_i x_i \quad &+ \quad \sum_{j=1}^{n} \sum_{i=1}^{n} \tau_j p_j \left(1 - I_i\right) a_{ji} X_i + \tau_L L \\
&- \quad \alpha \sum_{j=1}^{n} \tau_j p_j a_{jn} X_n \left(I_f - I_n\right);
\end{aligned}
$$

where L is total employment. Accordingly, if no sector is exempt $I_j = 1 \; \forall j$, VAT is equivalent to a tax on final demand. If the sector n, a subsector of the financial sector, is exempted, $I_n = 0$ and $\tau_n = 0$. In this case, as the last term shows, if some of the taxes on inputs can be shifted to the taxed part of the financial sector and deducted there, the total tax revenue declines.

To simplify later interpretation and quantification, we rearrange the equation for the tax revenue using the difference between the sector-specific tax rate and the standard VAT rate. Moreover, since household expenditures on goods including indirect taxes are equal to labor income after taxes, we can express the labor tax in a way that includes the regular VAT tax burden. Inserting the budget constraint of the household, we arrive at

$$
\begin{aligned}
T \equiv \sum_{i=1}^{n} \widetilde{\tau}_i p_i x_i \quad &+ \quad \sum_{j=1}^{n}\sum_{i=1}^{n} \tau_j p_j \left(1 - I_i\right) a_{ji} X_i + \widetilde{\tau}_L L \\
&- \quad \alpha \sum_{j=1}^{n} \tau_j p_j a_{jn} X_n \left(I_f - I_n\right),
\end{aligned}
\tag{1}
$$

where $\widetilde{\tau}_i = \frac{\tau_i - \tau}{1+\tau}$ and $\widetilde{\tau}_L \equiv \frac{\tau_L + \tau}{1+\tau}$. Note that the main part of the indirect tax is now captured by $\widetilde{\tau}_L$ which is the total tax on labor income including regular VAT. More specifically, if all sectors are equally subject to VAT and only sector n is exempted, we have a simpler expression

$$
T = \widetilde{\tau}_n p_n x_n + (1-\alpha) \sum_{j=1}^{n} \tau_j p_j a_{jn} X_n + \widetilde{\tau}_L L.
$$

Accordingly, tax revenue originates from the non-deductible input taxes paid by the customers of sector n and from the taxation of labor. With $\widetilde{\tau}_n < 0$, the first term is a tax revenue loss from the implicit subsidization of the exempted sector.

Let us consider the revenue effects of repealing sector n's exemption. Of course, one argument for exempting the financial sector from VAT payments is that there are technical difficulties of levying VAT on the value added by financial institutions. More precisely, the technical problem is to define the tax base, because there is no explicit price for services like granting loans or taking deposits. In order to charge VAT, however, the tax authority usually builds on an invoice with a reported price. The basic idea how to solve this problem is to use the difference between the deposit and the loan interest rate compared to a benchmark interest rate to determine the value added in the financial sector. The concepts of cash-flow taxation and tax calculation accounts (TCA) are based on this approach (Mirrlees *et al.*, 2011). Also the national accounts follow this approach in order to compute the value added of the financial sector.[2]

[2]The statistical office uses the interbank lending rate as a benchmark to calculate the price for loan and deposit

Supposing that administrative issues can be solved in a satisfactory way, and the exemption is abolished, the output of sector n will be taxed at rate $\tau_n' = \tau$, and $\tilde{\tau}_n' = 0$. As a consequence, we will have a change in sector n's tax rate in an amount of $d\tilde{\tau}_n = \tilde{\tau}_n' - \tilde{\tau}_n = \frac{\tau}{1+\tau}$. A second consequence is that VAT on inputs used in sector n is refunded, formally $dI_n = 1$. The various consequences for the tax system are summarized by Table 2.

Table 2: Parameters With & Without Financial Sector Exemption

		Exemption	No Exemption	Repealing Exemption
$\tau_i = \tau$	$\forall i \neq n$	$\tau_n = 0$	$\tau_n' = \tau$	$d\tau_n = \tau$
$\tilde{\tau}_i = 0$	$\forall i \neq n$	$\tilde{\tau}_n = \frac{-\tau}{1+\tau}$	$\tilde{\tau}_n' = 0$	$d\tilde{\tau}_n = \frac{\tau}{1+\tau}$
$I_i = 1$	$\forall i = 1 \neq n$	$I_n = 0$	$I_n' = 1$	$dI_n = 1$

We obtain the revenue effects by evaluation of the tax-revenue equation (1) with and without exemption. Inserting the parameters for repealing the VAT exemption, the revenue change is

$$\Delta T \equiv T' - T = (p_n x_n)\frac{\tau}{1+\tau} - (1-\alpha)\left(\sum_{j=1}^{n} \tau_j p_j a_{jn} X_n\right) - \tilde{\tau}_L \Delta l. \tag{2}$$

This expression suggests that the revenue effects of repealing the exemption can be distinguished into three components. The first component is a direct revenue effect from the taxation of value added in sector n. The second term captures the revenue loss due to unrecoverable or *hidden* taxes on inputs. Note that these terms are evaluated at pre-reform producer prices. The last term captures the change in employment which might result from a change in labor supply. In order to determine this effect it is important to take account not only of the direct effect on the consumer price of sector n. Repealing the exemption of the n-th sector might also affect the producer prices. This would also affect the labor market depending on the elasticity of labor supply. As discussed in the Appendix, the producer price effects are determined by the input-output matrix and the fraction α of input taxes that are shifted to the taxed part of the financial sector.

services using the FISIM (Financial Intermediation Services, Indirectly Measured) approach.

3 Welfare Effects

Having discussed the revenue effects of the exemption at least from a conceptual point of view, let us consider possible welfare gains or losses. Corresponding to the n-sector model discussed above we consider a representative household with utility

$$u\left(x_1, x_2, ..., x_n, l\right),$$

where l is leisure, and x_i is consumption of good i. The consumer's budget constraint is

$$\sum_{i=1}^{n} q_i x_i + g = (1-\tau_L)(\mathcal{T}-l),$$

where $q_i = (1+\tau_i)\, p_i$ is the consumer price for good i, $\mathcal{T}$ is the total time endowment of the household, l is the demand for leisure, and g is a lump-sum transfer. The latter term is useful in order to consider tax-reforms, where the revenue change is distributed back to the household. Note that we distinguish final demand x_i and total demand $X_i \equiv x_i + \sum_j X_{ij}$.

Denoting the lagrangian multiplier with λ the first order conditions for maximum utility are $\frac{\partial u}{\partial x_i} = q_i\lambda$ and $\frac{\partial u}{\partial l} = (1-\tau_L)\,\lambda$. Profit maximization of the firm implies $p_i F_{iL} = 1$ and $p_i F_{ij} = p_j \; i \neq n$. In the exempted sector, the optimal intermediate input depends also on the tax rate, at least if the VAT is not fully deductible. Formally, $p_n F_{nj} = (1 + (1-\alpha)(1-I_n)\,\tau_j)\, p_j$.

The marginal deadweight loss associated with repealing the exemption is found by the impact on utility expressed in terms of the numeraire. Taking a total differential of the utility function and making use of the first-order conditions

$$\frac{1}{\lambda} du = \sum_i q_i dx_i + (1-\tau_L)\, dl. \tag{3}$$

As the appendix shows, taking account of the first-order conditions for input demand and employment as well as of the labor market equilibrium condition allows us to reformulate this expression to obtain

$$\frac{1}{\lambda}du = \sum_i p_i \tau_i dx_i - \tau_L dl + (1-\alpha)(1-I_n)\sum_j \tau_j p_j dX_{jn}. \tag{4}$$

Welfare decreases to the extent that the household demand for taxed goods declines and the demand for leisure increases. In addition, demand changes associated with the intermediate inputs matter, if some tax revenue originates in unrecoverable input taxes ($\alpha < 1$).

3.1 Household Demand for Financial Services and for Leisure

Let us start with effects on household demand that originate in the change in the consumer price of the taxed good at given producer prices. In this case, the marginal utility effect from equation (4) is equal to

$$\frac{1}{\lambda}du = \sum_i p_i \tau_i dx_i - \tau_L dl.$$

Building on the assumption that tax rate changes are small, we use the Hicksian demands $dx_i = \frac{\partial h_i}{\partial q_n} p_n$ and $dl = \frac{\partial h_{n+1}}{\partial q_n} p_n$ in order to derive the final demand and labor supply effects, where h_i is the Hicksian demand for good i and h_{n+1} is the Hicksian demand for leisure. Separating out sector n and invoking the above reinterpretation of taxation of sector i in terms of a deviation from the standard VAT rate on consumption, we have

$$\frac{1}{\lambda}du = \widetilde{\tau}_n p_n \left(\frac{\partial h_n}{\partial q_n}\right) p_n d\widetilde{\tau}_n + \sum_i^{n-1} \widetilde{\tau}_i p_i \left(\frac{\partial h_i}{\partial q_n}\right) p_n d\widetilde{\tau}_n - \tau_L \frac{\partial h_{n+1}}{\partial q_n} p_n d\widetilde{\tau}_n. \tag{5}$$

Obviously, this expression involves not only the own price effect in sector n but a large number of cross-price effects. At first sight, this makes it extremely difficult if not hopeless to come up with a quantification. However, the cross-price effects for the individual goods demand are weighted by the tax rate-differential with regard to the standard tax-rate τ. As is well known in the literature (*e.g.*, Hines, 1999), the analysis of the welfare effect of taxation needs to focus only on spillovers into markets that are subject to distortions. With the assumption that the crucial exemption is that of sector n, as a first approximation, we have $\widetilde{\tau}_i = 0, \forall i \neq n$, and can ignore the cross price effects. Of course, if there were another important exemption, say for sector k, it is no problem, at least conceptually, to augment the quantification approach – provided a reasonable estimate of the cross-price elasticity exists. However, the cross-price effects with labor/leisure cannot be ignored, since the labor tax is substantial. Leaving out the cross-price effects regarding all other consumption goods we get

$$\frac{1}{\lambda} du = \widetilde{\tau}_n p_n \frac{\partial h_n}{\partial q_n} p_n d\widetilde{\tau}_n - \widetilde{\tau}_L \frac{\partial h_{n+1}}{\partial q_n} p_n d\widetilde{\tau}_n. \tag{6}$$

Since this expression still involves a cross-price effect between consumption of labor and good n, we follow Goulder and Williams (2003) and substitute the compensated elasticity of labor supply into this equation. As we show in the Appendix, making use of Slutsky symmetry, we can specify the labor supply effect as

$$-\frac{\partial h_{n+1}}{\partial q_n} = -\epsilon_L L \frac{h_n}{y} \left[1 + \theta_n\right], \tag{7}$$

where $\epsilon_L \equiv \frac{\partial L}{\partial(1-\tau_L)} \frac{(1-\tau_L)}{L}$ is the labor supply elasticity and $\theta_n = \frac{\epsilon_{n,n+1}}{\sum_{i=1}^{n} \sigma_i \epsilon_{i,n+1}} - 1$ is an indicator of the degree to which good n is a substitute to leisure – relative to all other goods.[3] Substituting this expression into equation (6) we arrive at

$$\frac{1}{\lambda} du = \frac{\widetilde{\tau}_n}{1 + \widetilde{\tau}_n} p_n h_n \epsilon_{nn} d\widetilde{\tau}_n - \widetilde{\tau}_L s_n \epsilon_L L [1 + \theta_n] d\widetilde{\tau}_n, \tag{8}$$

where $s_n \equiv \frac{p_n h_n}{y}$ denotes the net-of-tax share of consumer spending on good n in relation to the total household income (net of labor taxes) y. The first term captures the direct effect of the tax on

[3] $\sigma_i \equiv \frac{q_i h_i}{y}$ denotes the (gross of commodity taxes) share of demand for good i in relation to total household income.

the consumer price of good n and the second term captures the indirect effect on the labor/leisure decision. Though we are considering an ad-valorem tax, this expression is very similar to Goulder and Williams (2003) who consider the welfare cost associated with a unit tax.

To get a formula for the welfare loss arising through the tax induced change in the consumer price, we need to integrate over the change in the tax rate associated with repealing the exemption.

$$DWL_{CP} \equiv -\int_{\frac{-\tau}{1+\tau}}^{0} \frac{1}{\lambda}\frac{du}{d\widetilde{\tau}_n} d\widetilde{\tau}_n \quad = \quad -\left[\frac{1}{2}\frac{\widetilde{\tau}_n^2}{1+\widetilde{\tau}_n} p_n h_n \epsilon_{nn} - \widetilde{\tau}_n \widetilde{\tau}_L s_n \epsilon_L L \left[1+\theta_n\right]\right]_{\frac{-\tau}{1+\tau}}^{0} .$$

Evaluating this expression yields

$$DWL_{CP} = s_n y \frac{1}{2}\left(\frac{\tau^2}{1+\tau}\right)\epsilon_{nn} + \frac{\tau}{1+\tau}\widetilde{\tau}_L L s_n \epsilon_L \left[1+\theta_n\right]. \tag{9}$$

The first term of this expression is negative. This relates to the fact that, initially, with exemption, sector n actually receives a subsidy. The second term is positive. It captures possible adverse consequences of taxing consumption for labor supply.[4] Note that the expression for the welfare loss implicitly takes account of the immediate revenue gains associated with extending VAT to financial services. Also the indirect revenue effects associated with taxation of labor are taken into account.

Having derived the consumer price effects, we now turn to the producer price effects on the final demand for the tax good and for the demand for leisure. To capture these effects we need to derive a computable measure of the effects of producer-price changes on the deadweight loss. Note that

[4] Some reader might find it disturbing that the first term is negative. But this is simply the consequence of the consideration of a negative tax $\widetilde{\tau}_n$. Consider an increase in the tax τ_n from a level of τ to $\overline{\tau}_n$. In this case we have

$$DWL = -\int_{0}^{\frac{\overline{\tau}_n-\tau}{1+\tau}} \frac{1}{\lambda}\frac{du}{d\widetilde{\tau}_n} d\widetilde{\tau}_n \quad = \quad -\left[\frac{1}{2} p_n \widetilde{\tau}_n^2 h_n \frac{1}{1+\widetilde{\tau}_n}\epsilon_{nn} - \widetilde{\tau}_n \widetilde{\tau}_L L s_n \epsilon_L \left[1+\theta_n\right]\right]_{0}^{\frac{\overline{\tau}_n-\tau}{1+\tau}} .$$

We would end up with

$$DWL = -p_n h_n \frac{1}{2}\left(\frac{\overline{\tau}_n-\tau}{1+\tau}\right)\left(\frac{\overline{\tau}_n-\tau}{1+\overline{\tau}_n}\right)\epsilon_{nn} + \frac{\overline{\tau}_n-\tau}{1+\tau}\widetilde{\tau}_L L s_n \epsilon_L \left(1+\theta_n\right),$$

where the first term and the second term are positive.

changes in producer prices affect final consumption of good n by

$$dx_n = \sum_j \frac{\partial h_n}{\partial q_j} (1 + \widetilde{\tau}_j)\, dp_j$$

and demand for leisure by

$$dl = \sum_j \frac{\partial h_{n+1}}{\partial q_j} (1 + \widetilde{\tau}_j)\, dp_j.$$

To keep the analysis tractable, let us assume that only sector n experiences noticeable producer price effects. Then, using (7) from above, the welfare effect of (4) can be written as

$$\frac{1}{\lambda} du = p_n \widetilde{\tau}_n \frac{\partial h_n}{\partial q_n} (1 + \widetilde{\tau}_n)\, dp_n - \widetilde{\tau}_L \epsilon_L L \frac{h_n}{y} [1 + \theta_n] (1 + \widetilde{\tau}_n)\, dp_n.$$

Integrating the utility effect over the price change gives us an approximation for the deadweight loss associated with the producer price effect (PP) on consumer demand for financial services and labor supply. Because the producer price for financial services is decreasing, we compute the utility effect as a difference between the utility effect of the initial price and the post-reform price.

$$DWL_{PP} \equiv \int_0^{p_n} \left(\frac{1}{\lambda} \frac{du}{dp_n} \right) dp_n - \int_0^{p_n'} \left(\frac{1}{\lambda} \frac{du}{dp_n} \right) dp_n = \int_{p_n'}^{p_n} \left(\frac{1}{\lambda} \frac{du}{dp_n} \right) dp_n$$

$$DWL_{PP} = \left[\frac{1}{2} p_n h_n \widetilde{\tau}_n \epsilon_{nn} - p_n \widetilde{\tau}_L \epsilon_L L \frac{h_n}{y} [1 + \theta_n] (1 + \widetilde{\tau}_n) \right]_{p_n'}^{p_n}.$$

Evaluating this expression yields

$$DWL_{PP} = -\widehat{p}_n s_n y \frac{1}{2} \widetilde{\tau}_n \epsilon_{nn} + \widehat{p}_n (1 + \widetilde{\tau}_n) \widetilde{\tau}_L L s_n \epsilon_L [1 + \theta_n], \tag{10}$$

where $\widehat{p}_n \equiv \left(\frac{p_n' - p_n}{p_n} \right)$. Suppose, the producer price change would be positive and we have a positive tax rate $\widetilde{\tau}_n$. Then, the first term and the second term would both be positive, indicating that there is a welfare loss. Intuitively, a higher producer price would result in lower demand and depress labor supply. In our case, while the producer price declines, we have no welfare gain since the tax rate $\widetilde{\tau}_n$ is negative. Thus, the first term is positive and indicates a welfare loss. The second term captures the indirect effect of a change of the producer price in the labor market. In case of a price increase, the second term would be positive since labor supply and, hence, tax revenue from labor supply would be affected adversely. However, with a price decrease, the effect is negative – we have a welfare gain.

3.2 Effects on Intermediate Input Demand

The above expression (4) for the marginal utility effect suggests that there is a separate effect of changes in the demand for intermediate inputs on welfare. This term captures the consequences of the change in intermediate input demands by the exempted sector n, which is subject to input taxes. The analysis in the previous section has assumed that intermediate input demand is unchanged $dX_{jn} = 0$. However, with $\alpha < 1$, this is not to be expected.

In order to determine $\sum_{j=1}^{n-1} p_j dX_{jn}$ we note that the first order condition for X_{jn} implies that the marginal product is equal to the input price

$$p_n F_{nj}\left(X_{1n}, ...X_{jn}, ...X_{nn}, L_n\right) = \left(1 + \left(1 - \alpha\right)\tau\right) p_j,\ j \neq n.$$

Let us assume for simplicity that the output elasticity of F_n with regard to X_{jn} is equal to $\eta_{j,n}$. Then, the demand for input j in sector n

$$X_{j,n} = \frac{p_n \eta_{j,n} X_n}{\left(1 + \left(1 - \alpha\right)\tau\right) p_j}$$

has unit output and price elasticities. Moreover, the value-based input coefficient

$$\widetilde{a}_{jn} = \frac{p_j X_{j,n}}{p_n X_n} = \frac{\eta_{j,n}}{\left(1 + \left(1 - \alpha\right)\tau\right)},$$

is independent of prices. With this result, in order to determine the change in intermediate input demands, we just need to quantify the following expression

$$\sum_{j=1}^{n-1} p_j dX_{jn} = d\left(p_n X_n\right) \sum_{j=1}^{n-1} \widetilde{a}_{jn} - p_n X_n \sum_{j=1}^{n-1} \widetilde{a}_{jn} \widehat{p}_j .$$

This expression indicates that the change in intermediate input demand is a linear function of changes in the value of output of sector n and of the price changes. Focusing on the tax effect on the producer price of sector n, the welfare effect associated with changes in the demand for intermediate inputs becomes

$$DWL_{IID} = -\left(1-\alpha\right)\tau \left[\left(p'_n X'_n - p_n X_n\right) \sum_{j=1}^{n-1} \widetilde{a}_{jn}\right]. \tag{11}$$

To determine the value of the gross output change $(p'_n X'_n - p_n X_n)$ in sector n, we note that the vector of output changes in the economy can be traced back to changes in final and intermediate inputs. The Appendix shows how the gross-output change in the financial industry can be determined using the input-output matrix and the vector of cross-price demand elasticities $\epsilon_{n,1}, \epsilon_{n,2}, \ldots\epsilon_{n,n}$.

3.3 Revenue Neutral Change of Labor Income Taxes

In the above derivation of welfare effects, based on the simplifying premise that revenue gains or losses are passed on to consumers by means of lump-sum transfers, revenue implications are already taken into account. However, if the revenue changes are used to finance a change in another distortive tax such as the labor income tax in our model rather than lump-sum transfers to households, further welfare effects result.

Assuming that the tax reform would result into a revenue gain of dT, what would be the budget balancing reduction in $\widetilde{\tau}_L$? Starting from the budget constraint

$$-dT = d\widetilde{\tau}_L L + \widetilde{\tau}_L \frac{\partial L}{\partial \widetilde{\tau}_L} d\widetilde{\tau}_L$$

we have

$$d\widetilde{\tau}_L = -\frac{1}{L}\left[1 - \epsilon_L \frac{\widetilde{\tau}_L}{1-\widetilde{\tau}_L}\right]^{-1} dT. \tag{12}$$

Based on the assumption that there is no exemption such that $\widetilde{\tau}_i = 0\ \forall i$, from equation (4) the welfare effect is just determined by the change in the demand for leisure.

$$\frac{1}{\lambda} du = -\widetilde{\tau}_L dl.$$

Inserting the effect on the demand for leisure

$$\frac{1}{\lambda} du = \widetilde{\tau}_L \frac{\partial h_{n+1}}{\partial q_{n+1}} d\widetilde{\tau}_L.$$

Integration over $d\widetilde{\tau}_L$ gives us the deadweight loss associated with changes in labor taxes

$$DWL_{\Delta T} = -\int_{\widetilde{\tau}_L}^{\widetilde{\tau}_L'} \frac{1}{\lambda} \frac{du}{d\widetilde{\tau}_L} d\widetilde{\tau}_L = -\left[\frac{1}{2}\widetilde{\tau}_L^2 \frac{\partial h_{n+1}}{\partial q_{n+1}}\right]_{\widetilde{\tau}_L}^{\widetilde{\tau}_L'}.$$

Expressing the labor supply effect in terms of an elasticity we obtain

$$DWL_{\Delta T} = \frac{1}{2}\left(\frac{\widetilde{\tau}_L'^2}{1-\widetilde{\tau}_L'} - \frac{\widetilde{\tau}_L^2}{1-\widetilde{\tau}_L}\right) L\epsilon_L. \tag{13}$$

Accordingly, a reduction in the labor tax results in a welfare gain due to a higher labor supply.

4 Data and Quantification Approach

To quantify the revenue and price effects of the financial sector VAT exemption, we utilize German data. The value added tax is one of the two most important tax revenue sources in Germany. With a volume of about €190 in 2011 – €140 Billion excluding import turnover VAT – it makes up about a third of tax revenues. Similar to other countries, VAT in Germany is subject to reduced rates and to exemptions. Also the German financial sector is subject to several exemptions. More specifically, §4 no. 8 German VAT Act (UStG) determines that among other things provision and intermediation of loans and deposits are exempted from VAT. However, in Germany as well as in other countries of the European Union, in the exempted parts of their business, financial service providers may opt for taxation (De la Feria and Lockwood, 2010). While B2C transactions would remain exempted, financial institutions can opt for a taxation of B2B transactions (§9 I UStG).

To quantify the price effects of a VAT reform that repeals the exemption of financial services, we take account of the input interdependencies between the different sectors using the input-coefficient matrix from the national accounts. The data is taken from the German national accounts (Statistisches Bundesamt, 2010) and the VAT statistics (Statistisches Bundesamt 2009). We use the input-output-table and the input-index-table, where the economy is split into 71 sectors. The base year for the analysis is 2007. We define services of credit institutions (*DL der Kreditinstitute*) as financial sector and separate it into a taxable and a non-taxable part. We work with an artificial classification into 72 sectors, where the financial sector is decomposed into two sectors, with one fully taxed and one exempted part. This decomposition relies on the amount of taxable services in the financial sector from the VAT statistics. According to this statistic, in 2011 €37.638 Billion of financial services were subjected to VAT. Relating this amount of taxable services to the total output of the financial sector results in a fraction of 33.03 % (=€37.638 Billion/€113.950 Billion) for the "taxed financial sector". Hence, the non-taxed part of the financial sector accounts for about 67 % of the total output amounting to some €76.311 Billion. In the following, this exempted part of the financial sector makes up the financial sector n. An underlying assumption is that the share of inputs used by the exempted part is proportional to the output share – even if the input taxes are shifted.

The average VAT rate for each sector is obtained from the VAT statistics by dividing the amount of paid VAT (for goods and services) with the amount of taxable supply of goods and services.[5] For the n sectors the tax rate average ranges from 0 % (services of public administration and defense, services of social security, services of private households) and 3.34 % (services of health care, veterinary sector and welfare) up to 24.23 % (services of finance and insurance related businesses).[6] This indicates that there are other exempted sectors and sectors with reduced rates. However, the mean tax rate average still amounts to 13.59 %.

5 Quantitative Results

The above analysis has provided us with formal expressions for revenue and welfare effects of repealing the exemption in a general equilibrium setting. As we have seen, these expressions rest on a couple of simplifying assumptions. One such simplification is the assumption that producer price effects are more or less confined to the exempted sector. Based on the above formula for computing the price effects, according to our results, this assumption seems reasonable in the current empirical setting. If there is no shifting of input taxes to the taxed part of the financial sector in the current system, the relative price change in the financial sector would be -5.59%, in the other sectors it is between 0 and -0.62 %. If input taxes are shifted, as is assumed in our baseline scenario, the relative price change in the financial sector would be -1.51%, in the other sectors it is between 0 and -0.17 % – on average, the price effect in the financial sector is larger by a factor of twenty.

[5]Intra-EU purchases and imports from third countries are excluded.

[6]Whereas tax rates below the normal rate of 19 % reflect the presence of sales subject to reduced rates of 7 % or exempted sales, a figure above 19% reflect statistical discrepancies.

5.1 Revenue Effects

Using equation (2) we first analyze the change in tax revenues due to repealing the VAT exemption in the financial sector n. Let us repeat this expression here, for convenience.

$$\Delta T = (p_n x_n)\,\frac{\tau}{1+\tau} - (1-\alpha)\left(\sum_{j=1}^{n} \tau_j \widetilde{a}_{jn} p_n X_n\right) - \widetilde{\tau_L}\Delta l$$

τ is the regular VAT rate, actually 19 %, and τ_j is the value added tax rate average for sector j. Parameter α might vary between zero and unity. To compute our baseline estimate, we use a figure of $\alpha = 0.585$ which we consider to be the best estimate for German case (see box on next page). To see how this estimate compares with the existing literature, note that our figure implies that unrecovered input taxes amount to some 28% $\simeq \frac{1.955}{2.325+4.715}$ of all input taxes paid by the financial sector as a whole, including exempted as well as taxed activities. Using data on a group of European financial institutions Huizinga (2002) reports a total share of unrecovered input taxes relative to all taxes on inputs of about 18.8%. From this perspective, when we base the calculations below on our estimate for α we are operating with a relatively modest estimate for the current tax shifting potential of the financial sector. Though Huizinga's estimate for unrecoverable input taxes is based on survey data which depict individual firms precisely, it is not obvious to which extent these figures are representative. Based on national accounts statistics that should represent all rather than a selected group of banks, Lockwood (2011) comes to a different result. Distinguishing intra-EU sales of financial services from exports of services to the rest of the world, his findings point at an average recovery rate between 0% and 10% and a fraction of irrecoverable input taxes between 90% to 100 %.[7] Our approach to compute α differs from previous papers, because we utilize statistics on the actual VAT payments and input taxes recovered by the financial sector. Another possible source for differing estimates may be that we focus on Germany. While the

[7] This recovery rate is not directly comparable to our rate, because Lockwood (2011) excludes large exempted sectors (education, medical care, public administration and financial intermediation services themselves) from the calculation of unrecoverable input taxes (our recovery rate already takes these exemptions into account). Lockwood also notes that the activity classification does not cleanly divide the financial services sector into subsectors subject to VAT and exempt from VAT.

European VAT Directive includes an optional clause, which allows all member states to legislate for opting for taxation of financial services, Germany is one of the member states where it is possible to opt for taxation of B2B transactions in the financial sector (de la Feria and Lockwood, 2010). This might provide the financial sector in Germany with more leeway to shift input taxes than is available in other countries.

The second element in the above expression sums the taxes on the inputs used by the exempted sector. These are the unrecoverable or hidden input taxes. This term is calculated by multiplying every input quantity that is purchased by the financial sector with the sector-specific VAT rate.[8] Summing terms, we obtain the total amount of taxes that are not deductible for the financial sector. Shifting of input taxes is taken into account by premultiplying $1-\alpha$, where α is the share of input taxes shifted to the taxed part of the financial sector.

The labor supply response depends on the effects of the reform on the consumer prices inclusive of VAT. As in the above analysis, the computation critically hinges on which sector's producer prices are affected by the reform. Not only sector n's prices may change, but also the prices of all sectors' products. However, as we have noted above, the VAT exemption of financial services has only limited effects on prices of other sectors. As an approximation, we will stick with the assumption that only sector n's producer price changes. This allows us to use the above derivation to determine the labor supply effect. Using Equation (7), we can calculate the change in the supply of labor $dL = -dl = -\epsilon_L L s_n \widehat{q}_n$. Total labor supply is assumed to be equal to the total domestic employees' income from the primary input matrix, hence L=€ 1180.43 Billion. Dividing the final demand for non-taxed financial services by total final demand for all sectors, we obtain $s_n = 1.8\%$ (= € 23.54 Billion/ € 1306.34 Billion). The total consumer price change can be specified as

$$\widehat{q}_n \equiv \frac{q_n' - q_n}{q_n} = \frac{(1+\tau)\, p_n' - p_n}{p_n} = (1+\tau)\,\widehat{p}_n + \tau.$$

[8]To obtain the input coefficient $\tilde{a}_{fn}$ of exempted financial services in the non-taxed part of the financial sector, we assume that inputs are demanded proportional to the relative output size. $\tilde{a}_{fn} = 33\% a_{(f+n)(f+n)} \simeq \frac{37639}{113590} a_{(f+n)(f+n)}$. Similarly $\tilde{a}_{nn} = 67\% a_{(f+n)(f+n)}$.

How Much Input Taxes are Unrecovered?

While the financial sector is generally exempt from paying VAT, there are some services that are not exempt. Due to this fact, the literature wonders to what extent the financial sector may be able to deduct some parts of the cost of inputs purchased to produce exempted services from the taxes paid on the taxed part of their output (Huizinga, 2002, Lockwood, 2011). However, to come up with reliable figures has proved to be difficult. We provide some own empirical estimate based on the German VAT statistics and the national accounts for the year 2007.

The VAT statistics report taxable output of the financial sector in an amount of €37.639 Billion. The total output of the financial sector from the national accounts is €113.950 Billion. Accordingly, the output of the exempted financial sector amounts to €76.311 Billion. From the VAT statistics we know, that the VAT input tax, that is currently recovered by the financial sector, is €5.085 Billion. This amount will cover both input taxes associated with the taxed and the exempted parts of the financial sector. Following the above notation $5.085 = \alpha \sum \tau_j \tilde{a}_{jn} X_n p_n + \sum \tau_j \tilde{a}_{jf} X_f p_f$. Rearranging, yields the share of shifted input taxes:

$$\alpha = \frac{5.085 - \sum \tau_j \tilde{a}_{jf} X_f p_f}{\sum \tau_j \tilde{a}_{jn} X_n p_n}.$$

Based on the assumption that input coefficients are the same for both parts of the financial sector, and noting that $X_f p_f = 37.639$, $X_n p_n = 76.311$ and $\sum \tau_j \tilde{a}_{jf} = \sum \tau_j \tilde{a}_{jn} = 0.0618$, we have

$$\alpha = \frac{5.085 - 2.325}{4.715} = \frac{2.760}{4.715} = 0.585$$

Accordingly, some 58.5% of the taxes on inputs used in the production of the exempted part are shifted to the taxed part of the financial sector. This amounts to €2.760 Billion of recoverable input taxes associated with the exempted sector; €1.955 Billion (=4.715-2.760) hidden input taxes are unrecovered.

Imposing a VAT of 19% results in a consumer price increase of 17.2% ($= -(1+0.19)*0.015+0.19$). For the compensated labor supply elasticity, we use the average elasticity reported by Keane (2011) of $\epsilon_L = 0.31$. Now, we are able to calculate the change in compensated labor supply evaluated at the current wage rate: dL= -€1.133 Billion (=-0.31*€1180.43 Billion*0.018*0.172). For the labor tax rate we use $\widetilde{\tau}_L = 0.53$. This is calculated using OECD data for Germany capturing the marginal rate of the income tax plus employee contributions less transfers for a married one-earner couple with two children. This marginal tax rate is $\tau_L = 43.8\%$ (OECD, 2008). To compute $\widetilde{\tau}_L$, we sum the marginal labor income tax rate and the standard VAT rate of 19% and divide it by 1 plus the standard VAT rate of 19 %.

Equipped with an estimate of the labor supply response we are in a position to compute the total revenue effect as captured by equation (2). The figures for each of the three terms are as follows:

1. The first term on the right-hand side is the change in VAT revenue due to giving up the implicit subsidization of final demand for the financial sector. According to our calculations this revenue gain amounts to €3.758 Billion or about 2.9% of total VAT revenues in the base year (exclusive of import turnover tax).

2. The second term represents the unrecovered or hidden input taxes. If no input taxes of the exempted part can be shifted to the taxed part ($\alpha = 0$), repealing the exemption would cause a loss in VAT from taxed inputs by €4.714 Billion[9] or about 3.7% of total VAT revenues in the base year (exclusive of import turnover tax). With the more realistic estimate of $\alpha = 0.585$, the associated revenue loss is much lower amounting to some €1.955 Billion or about 1.5% of total VAT revenues in the base year (exclusive of import turnover tax).

3. The last term reports the change in tax revenues due to a change in labor supply. It amounts to a loss of €0.600 Billion.

[9]This figure of unrecoverable input taxes is very similar to the number of €4.846 Billion of hidden input taxes for 2006 in Germany calculated by de la Feria and Lockwood (2010). However, based on their differing estimate of the share of unrecoverable input taxes, they argue that tax shifting is not important.

The sum of these three effects leads to the total revenue effect of the VAT reform in the financial sector. Based on our estimate for the fraction of taxes on inputs already deducted from the VAT on the taxed part of the financial sector of 58.5%, we come up with a total **tax revenue increase by €1.203 Billion or 0.89% of total VAT revenues** in the base year (exclusive of import turnover tax).

Of course, this result depends on the value chosen for α. If the financial sector would currently pay taxes on all inputs associated with the exempted part ($\alpha = 0$), the total tax revenue would decrease by €1.556 Billion or -1.1% of total VAT revenues in the base year (exclusive of import turnover tax). In the other extreme, where the financial sector would somehow manage to deduct all input taxes from the taxes imposed on the sales of the taxed part of its activities ($\alpha = 1$), no hidden input taxes would be lost, and the producer prices would not be affected by the reform. This implies that the first term, pointing at a revenue increase of €3.758 Billion, still matters. The second term disappears, because there were no unrecoverable input taxes, that could be lost. The tax loss of the last term increases due to a reduced labor supply. The associated revenue loss is estimated to be about 0.600 Billion. Summing these effects, we would obtain a total tax revenue gain of €3.158 Billion or 2.3% of total VAT revenues in the base year (exclusive of import turnover tax).

5.2 Welfare Effects

Regarding welfare effects, we first consider the deadweight loss due to a tax induced change in the consumer demand for financial services and for labor. As above, let us first focus on the consumer price effects. For convenience, we repeat equation (9) from above.

$$DWL_{CP} = s_n y \frac{1}{2} \left(\frac{\tau^2}{1+\tau} \right) \epsilon_{nn} + \frac{\tau}{1+\tau} \widetilde{\tau}_L L s_n \epsilon_L \left[1 + \theta_n \right].$$

The first term on the right-hand side captures the welfare effect from raising the tax on final consumption of financial services. The relative change in final demand for financial services is calculated using the own price elasticity of financial services ϵ_{nn}. Lacking empirical studies we use a figure of -0.547, which is reported by Chen (1999) for Germany in the group of consumption n.e.c.[10] Since the initial situation is that of a subsidy, extending the VAT to cover financial services implies a reduction of a subsidy and results in a welfare gain in an amount of €0.195 Billion. The deadweight loss caused by the reaction in labor supply is represented by the second term. This term depends on θ_n, indicating whether financial services are a close substitute to leisure relative to other consumer goods. Assuming that financial services show the same degree of substitutability with leisure as other goods $\theta_n = 0$. With this assumption, and based on the same parameter values as in the computation of the revenue effects, the second term turns out to represent a welfare loss of €0.557 Billion. Taking the two effects together, the increase in the VAT rate on the consumption of the financial sector generates a **welfare loss of €0.362 Billion**. Of course, θ_n would be larger than zero if financial services are a strong substitute for leisure relative to other consumer goods. Lockwood (2012) argues that financial transactions associated with consumption activities require household time, and that the purpose of financial services is to save this time for the household. From that perspective it seems likely that financial services are a relatively strong substitute for leisure. In this case, $\theta_n > 0$ and the labor market distortion of repealing the tax exemption would be aggravated.

Next, we consider the welfare implications of the effect of a change in the producer price on the household demand for financial services and leisure. We use equation (10) from above.

$$DWL_{PP} = -\widehat{p}_n p_n h_n \frac{1}{2} \widetilde{\tau}_n \epsilon_{nn} + \widehat{p}_n \widetilde{\tau}_L \epsilon_L L s_n \left[1 + \theta_n\right] \left(1 + \widetilde{\tau}_n\right).$$

According to our computations, the producer price of financial services $\widehat{p}_n$ decreases by 1.5% ($\widehat{p}_n \simeq -0.015$).

[10]Following the literature, we use elasticity estimates for compensated demand.

Table 3: Effects Associated with Intermediate Input Demand (in Billion Euros)

$\epsilon_{ni} \forall i \neq n$	$d(p_n X_n)$	DWL_{IID}
0	-0.551	+0.019
0.25	0.433	-0.015
0.5	1.418	-0.049
1	3.387	-0.117

The first term on the right-hand side amounts to a welfare loss of €0.016 Billion. Even though the producer price of sector n declines, a welfare loss is obtained because in the initial situation the financial sector enjoys a subsidy relative to all other consumption goods. The second term, however, yields a negative figure indicating that the labor supply response to the producer price change is positive. According to our calculations the associated welfare gain is €0.044 Billion. The net effect induced by the change in the producer price is a **welfare gain of €0.028 Billion**.

The welfare effect associated with changes in intermediate input demand can be determined using equation (11) from above

$$DWL_{IID} = -\left(1 - \alpha\right) \tau \left[(p_n' X_n' - p_n X_n) \sum_{j=1}^{n-1} \widetilde{a}_{jn} \right].$$

In order to quantify this expression we have to make assumptions about the cross-price elasticities ϵ_{ni}, $\forall i \neq n$. This is problematic, since we have no information as to how large those cross-price effects are. Table 3 provides some calculations for the change in total output of sector n and welfare effects associated with changes in intermediate input demands – assuming that all cross-price elasticities are the same. For the own-price elasticity we use $\epsilon_{nn} = -0.547$. The other parameters are: $\alpha = 0.585$, $\sum \tilde{a}_{jn} = 0.437$ and $\tau = 0.19$. As the table shows, if there were no cross-price effects we would have a small **welfare loss of about €0.019 Billion**, the intuition being that a decline in the value added of the exempted sector results in lower intermediate input taxes. While our baseline estimate employs the assumption that cross-price effects are zero, if cross-price elasticities were positive, the associated welfare effect turns into a welfare gain, which is, however, small.

A further welfare effect, which should be considered in order to give a comprehensive picture, is associated with the revenue implications of the reform. The basic premise of the welfare analysis is that the revenue changes are distributed back to households in a lump-sum fashion. However, if the distortive labor income tax is used to feed back the revenue changes, additional welfare effects would result. We evaluate this effect by computing the welfare change associated with a balancing change in the tax rate on labor. In other words, we calculate the welfare effect by assuming that changes in revenues are not distributed back to the households but used to finance a budget-balancing change in the labor tax rate. In order to do so, we compute the necessary balancing change in the labor tax rate using equation (12). Of course, sign and size of the revenue change depend on the amount of unrecoverable input taxes. If a share $\alpha = 0.585$ of input taxes is already deducted from the VAT payments currently associated with the financial sector, we have seen above that revenues are increasing. In this case, $\widetilde{\tau}_L$ could decrease by 0.16 percentage points.

To compute the associated welfare effect, we use equation (13) derived above.

$$DWL_{\Delta T} = \frac{1}{2}\left(\frac{\widetilde{\tau}_L'^2}{1-\widetilde{\tau}_L'} - \frac{\widetilde{\tau}_L^2}{1-\widetilde{\tau}_L}\right)\epsilon_L L.$$

Using our baseline estimates, we arrive at a **welfare gain of €1.028 Billion**.

Taken together, repealing the VAT exemption turns out to be associated with a slight increase in the excess burden of taxation. The additional distortion of labor supply, through the increase in the consumer price level, outweights beneficial effects for the consumer through lower producer prices. The net welfare effect amounts to a welfare loss in the amount of €0.353 Billion. However, if we would use the revenue gains in order to lower the tax rate on labor, the resulting total welfare gain amounts to €0.675 Billion.

6 Concluding Remarks

Applying a general equilibrium approach to compute revenue and welfare effects of repealing the VAT exemption of the financial sector in the case of Germany, we find that the results critically hinge on the amount of unrecoverable input taxes as well as on the labor market consequences. In a scenario where no input taxes associated with the production of financial services are refunded, our analysis points at revenue losses of about €1.556 Billion or -1.1% of total VAT revenues in the base year (exclusive of import turnover tax). These losses partly reflect the unrecoverable input taxes but also the disincentive for work effort associated with taxing financial services. If financial services are a relatively strong substitute for leisure, the adverse revenue effect might even be larger. However, since the financial industry can already deduct input taxes associated with exempted services, the expected revenue losses associated with non-deductible taxes on inputs are much lower. In an extreme case, where the financial sector is assumed to be able to fully deduct even those input taxes that are associated with the exempted part of the financial sector, repealing the exemption would result in a revenue gain of about €3.158 Billion or 2.3% of total VAT revenues in the base year. If only some fraction of input taxes can already be recovered, and our consideration of the available empirical data for Germany suggests that this fraction is about 58.5%, repealing the VAT exemption would result in a more modest revenue gain of about €1.203 Billion or 0.89% of VAT revenues.

A welfare assessment indicates that repealing the exemption is associated with an increase of the excess burden of taxation regardless of whether or not input taxes can already be recovered by the financial sector. If input taxes can be fully recovered, producer prices are largely unaffected, and the welfare cost of repealing the exemption is estimated to be €0.362 Billion. Taking into account that the producer price of the exempted part of the financial sector is reduced, the welfare costs are somewhat lower. Our preferred estimate, which builds on a share of recovered input taxes of 58.5% among all input taxes of the exempted sector, is a welfare loss of €0.353 Billion. While this figure is based on the assumption that revenue changes are transferred in a lump-sum fashion to households, a different conclusion obtains when considering a revenue neutral decrease in the distortive labor tax. In the preferred estimation where the revenue gains from repealing the exemption amount to €1.203 Billion, we arrive at a total welfare gain amounting to €0.675 Billion.

While the ultimate assessment would have to take account of the technical difficulties of implementing a VAT on financial services, this welfare gain seems not to be very encouraging for attempts to repeal financial sector VAT exemption. Yet this figure is derived on the assumption that consumer demand for financial services is no close substitute with leisure. If, however, the main purpose of consuming financial services is to save time for the household, this assumption would not hold. In this case, the adverse consequences on labor supply would be larger, and the welfare and revenue gains would have to be further qualified.

7 Appendix

7.1 Producer Price Effects of Removing the VAT Exemption

With perfect competition, the producer price equals unit cost and obeys

$$p_i = \sum_{j=1}^{n} a_{ji}(1 + (1 - I_i)\,\tau_j)p_j + b_i,$$

where $I_i = 1$ if the sector i is subject to tax, or zero-rated, and $I_i = 0$ if the sector is exempt. Therefore, the producer price of a sector depends on the input prices p_i and input coefficients a_{ij} as well as on the tax rates τ_i and the input tax refund. b_i is the per-unit labor input in sector i – the wage rate is set to unity.

Obviously, a direct effect of taxes on the price of a sector is only obtained if the sector is exempted ($I_i = 0$). In case of business to business (B2B) transactions, the customer pays a higher price than without exemption due to the hidden input tax, which is not refunded. In case of a business to consumer (B2C) transaction, of course, the customer pays a lower tax under exemption, because there is no taxation of the value added of the sector – only the non-deductable VAT on inputs is charged for the exempted good.

To determine the effect of repealing the exemption of sector n on producer prices consider the total differential of the system of n price equations

$$\begin{aligned}
\widehat{p}_1 &= \sum_{i=1}^{n} \widetilde{a}_{i1}\widehat{p}_i \\
&\vdots \\
\widehat{p}_{n-1} &= \sum_{i=1}^{n} \widetilde{a}_{i,n-1}\widehat{p}_i \\
\widehat{p}_n &= \sum_{i=1}^{n-1} \widetilde{a}_{in}(1+\tau_i)\widehat{p}_i + \widetilde{a}_{nn}\widehat{p}_n + \widetilde{a}_{nn}d\tau_n - (1-\alpha)\sum_{i=1}^{n-1} \widetilde{a}_{in}\tau_i dI_n.
\end{aligned}$$

According to the Envelope theorem, the changes in the input quantities sum up to zero, *i.e.* the changes in the technical input coefficients for intermediate inputs and for labor can be disregarded for small price changes. Note that the formulation of the price change is in terms of value-based input coefficients – obtained by multiplication of the technical input coefficients with the ratio of

p_i (input price) to p_j (price of receiving sector):

$$\widetilde{a}_{ij} = \left[\frac{a_{ij}p_i}{p_j}\right],$$

which expresses the value of inputs of good i in production of one unit of good j as a share of the unit price of good j.

With the transpose of the input-coefficient-matrix (excluding row n and column n)

$$\widetilde{\mathsf{A}}^T_{n-1\times n-1} = \begin{bmatrix} \widetilde{a}_{1,1} & \widetilde{a}_{2,1} & \cdots & \widetilde{a}_{n-1,1} \\ \widetilde{a}_{1,2} & & & \\ \vdots & \ddots & & \vdots \\ \widetilde{a}_{1,n-1} & \widetilde{a}_{2,n-1} & \cdots & \widetilde{a}_{n-1,n-1} \end{bmatrix}$$

we can solve for the vector of the relative price changes. Rewriting the system of equations of relative price changes for n sectors in vector notation:

$$\begin{aligned} \left[\mathsf{I}_{n-1\times n-1} - \widetilde{\mathsf{A}}^T_{n-1\times n-1}\right] \begin{bmatrix} \widehat{p}_1 \\ \vdots \\ \widehat{p}_{n-1} \end{bmatrix} - \begin{bmatrix} \widetilde{a}_{n,1} \\ \vdots \\ \widetilde{a}_{n,n-1} \end{bmatrix} \widehat{p}_n &= 0 \\ [-\widetilde{a}_{1n}(1+\tau_1), \ldots, -\widetilde{a}_{n-1,n}(1+\tau_{n-1}), 1-\widetilde{a}_{nn}] \begin{bmatrix} \widehat{p}_1 \\ \vdots \\ \widehat{p}_n \end{bmatrix} &= \widetilde{a}_{nn} d\tau_n - (1-\alpha)\sum_{i=1}^{n-1} \widetilde{a}_{i,n}\tau_i \end{aligned}$$

where $\mathsf{I}_{i\times j}$ is a i times j identity matrix. Note that the first set of equations represent rows 1 to n-1 of the above system – the last equation represents row n. Solving for the vector of relative price changes:

$$\Leftrightarrow \underbrace{\begin{bmatrix} \mathsf{I}_{n-1\times n-1} - \widetilde{\mathsf{A}}^T_{n-1\times n-1} & & & -\widetilde{a}_{n,1} \\ & & & \vdots \\ & & & -\widetilde{a}_{n,n-1} \\ -\widetilde{a}_{1,n}(1+\tau_1) & \cdots & -\widetilde{a}_{n-1,n}(1+\tau_{n-1}) & 1-\widetilde{a}_{n,n} \end{bmatrix}}_{\widetilde{\mathsf{A}}^T_{n\times n}} \begin{bmatrix} \widehat{p}_1 \\ \vdots \\ \widehat{p}_n \end{bmatrix} = \begin{bmatrix} 0 \\ \vdots \\ 0 \\ \widetilde{a}_{nn} d\tau_n - (1-\alpha)\sum_{i=1}^{n-1} \widetilde{a}_{i,n}\tau_i \end{bmatrix}$$

$$\Leftrightarrow \begin{bmatrix} \widehat{p}_1 \\ \vdots \\ \widehat{p}_n \end{bmatrix} = (I_{n\times n} - \widetilde{A}^T_{n\times n})^{-1} \begin{bmatrix} 0 \\ \vdots \\ 0 \\ \widetilde{a}_{nn} d\tau_n - (1-\alpha)\sum_{i=1}^{n-1} \widetilde{a}_{i,n}\tau_i \end{bmatrix}$$

Note that every element of matrix $\widetilde{\mathsf{A}}^T_{n\times n}$ in row n is multiplied by $(1+\tau_i)$, except for the last element $\widetilde{a}_{nn}$, because of the hidden input taxes.

7.2 Derivation of Equation (4)

For each commodity we have

$$dx_i = dX_i - \sum_j dX_{ij},$$

which implies

$$dx_i = F_{iL} dL_i + \sum_j F_{ij} dX_{ji} - \sum_j dX_{ij}.$$

Multiplying with p_i and substituting the first-order conditions for profit maximization

$$p_i dx_i = dL_i + \sum_j p_j dX_{ji} - \sum_j p_i dX_{ij}, \forall i \neq n.$$

In the exempted sector, the change in final output obeys

$$p_n dx_n = dL_n + \sum_j (1 + (1-\alpha)(1-I_n)\tau_j) p_j dX_{jn} - \sum_j p_n dX_{nj}.$$

The sum of all changes in employment will have to be equal to changes in labor supply. Therefore, $\sum_i dL_i = -dl$, and

$$\sum_i p_i dx_i = -dl + (1-\alpha)(1-I_n)\sum_j \tau_j p_j dX_{jn} + \sum_i \sum_j p_j dX_{ji} - \sum_i \sum_j p_i dX_{ij}.$$

Note that the last two terms cancel each other. Hence, the major part of the intermediate input effects washes out and we obtain

$$\sum_i p_i dx_i = -dl + (1-\alpha)(1-I_n)\sum_j \tau_j p_j dX_{jn}.$$

Inserting in equation (3) gives equation (4).

7.3 Derivation of Equation (7)

Note that the marginal change in the consumption of leisure will be matched by the sum of the marginal changes in expenditures

$$\sum_{i=1}^{n} \frac{\partial h_i}{\partial q_{n+1}} q_i + q_{n+1} \frac{\partial h_{n+1}}{\partial q_{n+1}} = 0,$$

where h_{n+1} denotes the Hicksian demand for leisure. Noting that $q_{n+1} = (1 - \widetilde{\tau_L})$ we have

$$\sum_{i=1}^{n} \frac{\partial h_i}{\partial q_{n+1}} \frac{q_i}{(1 - \widetilde{\tau_L})} = -\frac{\partial h_{n+1}}{\partial q_{n+1}}. \tag{14}$$

Making use of the Slutsky symmetry, the second order derivatives of the expenditure function obey

$$\frac{\partial h_i}{\partial q_{n+1}} = E_{i,n+1} = E_{n+1,i} = \frac{\partial h_{n+1}}{\partial q_i}. \tag{15}$$

Replacing $\frac{\partial h_i}{\partial q_{n+1}}$ by $\frac{\partial h_{n+1}}{\partial q_i}$ in equation (14) gives

$$\sum_{i=1}^{n} \frac{\partial h_{n+1}}{\partial q_i} \frac{q_i}{(1 - \widetilde{\tau_L})} = -\frac{\partial h_{n+1}}{\partial q_{n+1}}. \tag{16}$$

Dividing (15) by (16) we arrive at

$$\begin{aligned}
\frac{\frac{\partial h_i}{\partial q_{n+1}}}{\sum_{i=1}^{n} \frac{\partial h_i}{\partial q_{n+1}} \frac{q_i}{(1-\widetilde{\tau_L})}} &= -\frac{\frac{\partial h_{n+1}}{\partial q_i}}{\frac{\partial h_{n+1}}{\partial q_{n+1}}} \\
\Leftrightarrow -\frac{\partial h_{n+1}}{\partial q_i} &= \frac{\partial h_{n+1}}{\partial q_{n+1}} \left[\frac{\frac{\partial h_i}{\partial q_{n+1}}}{\sum_{i=1}^{n} \frac{\partial h_i}{\partial q_{n+1}} \frac{q_i}{(1-\widetilde{\tau_L})}} \right] \\
\Leftrightarrow -\frac{\partial h_{n+1}}{\partial q_i} &= \frac{\partial h_{n+1}}{\partial q_{n+1}} \frac{(1 - \widetilde{\tau_L})}{y} \left[\frac{h_i \frac{\partial h_i}{\partial q_{n+1}} \frac{q_{n+1}}{h_i}}{\sum_{i=1}^{n} \frac{\partial h_i}{\partial q_{n+1}} \frac{q_{n+1}}{h_i} \frac{q_i h_i}{y}} \right].
\end{aligned}$$

Inserting elasticities as well as $\sigma_i \equiv \frac{q_i h_i}{y}$ for the (gross of commodity taxes) share of demand for good i in relation to the total household income (net of labor taxes) y, we can obtain an expression for a change in the price of sector n

$$-\frac{\partial h_{n+1}}{\partial q_n} = \frac{\partial h_{n+1}}{\partial q_{n+1}} q_{n+1} \frac{h_n}{y} \left[\frac{\epsilon_{n,n+1}}{\sum_{i=1}^{n} \sigma_i \epsilon_{i,n+1}} \right].$$

Noting that $\frac{\partial h_{n+1}}{\partial q_{n+1}} = -\frac{\partial L}{\partial(1-\tau_L)}$,

$$-\frac{\partial h_{n+1}}{\partial q_n} = -\frac{\partial L}{\partial\left(1-\tau_L\right)}\left(1-\tau_L\right)\frac{h_n}{y}\left[\frac{\epsilon_{n,n+1}}{\sum_{i=1}^{n}\sigma_i\epsilon_{i,n+1}}\right].$$

With the labor supply elasticity $\epsilon_L \equiv \frac{\partial L}{\partial(1-\tau_L)}\frac{(1-\tau_L)}{L}$ and $\theta_n = \frac{\epsilon_{n,n+1}}{\sum_{i=1}^{n}\sigma_i\epsilon_{i,n+1}} - 1$ as an indicator of the degree to which good n is a substitute to leisure – relative to all other goods, we get

$$-\frac{\partial h_{n+1}}{\partial q_n} = -\epsilon_L L\frac{h_n}{y}\left[1+\theta_n\right].$$

7.4 Determination of Total Output Change in the Financial Industry

Keeping the assumption of unit price- and output elasticities of intermediate input demand, the value based input coefficients remain unchanged and we can focus on the value of output changes. Using value based input coefficients

$$\left[I-\widetilde{A}\right]\begin{bmatrix} d\left(p_1X_1\right) \\ \vdots \\ d\left(p_nX_n\right)\end{bmatrix} = \begin{bmatrix} d\left(p_1x_1\right) \\ \vdots \\ d\left(p_nx_n\right)\end{bmatrix}.$$

If we follow the above assumption that substantial price effects are only obtained with regard to sector n, we have

$$\begin{bmatrix} d\left(p_1X_1\right) \\ \vdots \\ d\left(p_nX_n\right)\end{bmatrix} = \left[I-\widetilde{A}\right]^{-1}\begin{bmatrix} p_1\frac{\partial h_1}{\partial q_n}dq_n \\ \vdots \\ h_ndp_n + p_n\frac{\partial h_n}{\partial q_n}dq_n\end{bmatrix}.$$

Using Slutsky symmetry

$$\begin{bmatrix} d\left(p_1X_1\right) \\ \vdots \\ d\left(p_nX_n\right)\end{bmatrix} = \left[I-\widetilde{A}\right]^{-1}\begin{bmatrix} p_1\frac{\partial h_n}{\partial q_1}dq_n \\ \vdots \\ h_ndp_n + p_n\frac{\partial h_n}{\partial q_n}dq_n\end{bmatrix}.$$

Rearranging terms we see that the output changes are linear functions of the price changes.

$$\begin{bmatrix} d\left(p_1X_1\right) \\ \vdots \\ d\left(p_nX_n\right) \end{bmatrix} = \left[I-\widetilde{A}\right]^{-1} \begin{bmatrix} \left(\frac{h_n}{1+\tau_1}\right)\epsilon_{n,1}dq_n \\ \vdots \\ h_n dp_n + \left(\frac{h_n}{1+\tau_n}\right)\epsilon_{n,n}dq_n \end{bmatrix}.$$

In the case where all taxes are equal $\tau_i = \tau, \forall i < n$, except for $\tau_n = 0$, introducing a tax in the amount of $\tau_n = \tau$ we obtain the changes in the value of gross outputs

$$\begin{bmatrix} d\left(p_1X_1\right) \\ \vdots \\ d\left(p_nX_n\right) \end{bmatrix} = p_nh_n\left[I-\widetilde{A}\right]^{-1} \begin{bmatrix} \left(\frac{\epsilon_{n,1}}{1+\tau}\right)\left(\widehat{p}_n+\tau\right) \\ \vdots \\ \widehat{p}_n + \epsilon_{n,n}\left(\widehat{p}_n+\tau\right) \end{bmatrix}.$$

The last element of this vector gives the output change in the exempted sector evaluated at pre-tax prices.

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