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FAT or VAT?
The Financial Activities Tax as a Substitute
to Imposing Value Added Tax on Financial Services

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Abstract:

This paper analyzes revenue and welfare effects of implementing a FAT both from a theoretical and a quantitative perspective. The theoretical analysis allows us to derive expressions for the revenue effects and the deadweight loss in a general equilibrium setting, which can be quantified with a minimum of information about the economy and key elasticities. Using data for Germany, the empirical quantification suggests that introducing a modest FAT with a rate of 3% results in a revenue gain of about €1.312 bn. If this revenue gain is used to reduce distorting labor taxes, the results point at a welfare gain of €1.092 bn. Comparing these results with Buettner and Erbe (2012), we find that the introduction of a FAT of 3% would generate similar revenue and welfare effects as a repeal of the financial sector VAT exemption (with a 19% VAT rate). However, taxing financial services through FAT may exert adverse location effects on financial service production.

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

JEL Classification: H24; H25

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1 Introduction

In the aftermath of the financial crises, interest in the taxation of the financial sector has been renewed. One issue that has continuously attracted the attention of scholars in public finance is the VAT exemption for financial services, which is widely applied. The empirical literature has pointed at substantial revenue gains that a repeal of the VAT exemption might generate (Genser and Winker, 1998, Huizinga, 2002) and also the recent Mirrlees report notes the revenue potential (Mirrlees, *et al.*, 2011). Other papers have reconsidered the empirical evidence and found weaker revenue gains (Buettner and Erbe, 2012) or even revenue losses (Lockwood, 2011). Besides of revenue gains, also possible distortions of the VAT exemption for financial services are discussed in the literature. From a theoretical point of view, Auerbach and Gordon (2002) have argued that it is desirable to integrate financial services into the VAT base. Others have argued that consumption of financial services should not be treated like any other consumer good (*e.g.*, Grubert and Mackie, 1999, Lockwood, 2012). Assuming that consumption of financial services does not show a particularly large degree of substitution with leisure, Buettner and Erbe (2012) provide an analysis of the welfare effects and find small welfare gains of a revenue neutral repeal of the VAT exemption of financial services.

But there are important practical concerns regarding VAT on financial services. A large part of financial services is paid implicitly through differences in the rate of interest paid on loans and deposits. In those cases no invoice exists which would allow banks to charge VAT. While administrative solutions may exist,¹ to the best of our knowledge, there is no country that imposes VAT on financial services.² Perhaps, the practical concerns are the reason why the current policy debate has moved on and discusses other means to raise taxes from the financial sector. Key proposals for the taxation of the financial sector are the Financial Transaction Tax (FTT) (Euro-

¹For instance cash-flow taxation and tax calculation accounts, which are approaches using the accounts and balance sheets of the credit institution to calculate a difference between the interest rate for loans and deposits. Another solution may be zero taxation of B2B transactions, see Mirrlees, *et al.*, 2011.

²New Zealand taxes insurance services with a cash flow approach, see Cnossen (2012).

pean Commission, 2011) and the Financial Activities Tax (FAT) (IMF, 2010). The latter is more close to VAT and its introduction might serve as a substitute to repealing financial sector VAT exemption (Keen, 2011). More specifically, a FAT imposed on wages and profits may cause an increase in the price of financial services, which would offset the implicit subsidization of financial services under VAT exemption. Since a price increase in financial services creates an incentive to outsource production to other sectors, a FAT might also offset the dis-incentive for in-house production associated with VAT exemption (IMF 2010). Against this background, the current paper analyzes revenue and welfare effects of implementing a FAT both from a theoretical and quantitative perspective, where we illustrate the effects using data for Germany.

The IMF (2010) calculates a revenue gain of €0.830 bn for Germany in 2006 by levying a FAT rate of 1%. Our estimate for this modest tax rate is much lower and points to a revenue gain of €0.447 bn for Germany in 2007, even if we include profits into the tax base. We also compare our results with the results of Buettner and Erbe (2012), who consider repealing the VAT exemption of financial services. A VAT reform (with a VAT rate of 19%) would increase total tax revenues by €1.203 bn. The quantification in this paper suggests that introducing a FAT rate of 3% would yield a similar revenue gain. If this revenue gain is used to lower the distorting taxes on labor, a welfare gain would result in an amount of €1.092 bn. However, as we note in the conclusion, a critical assumption made in order to produce these figures is that the tax burden is fully shifted to the consumer. With international competition in the banking sector the outlook would be less optimistic.

The paper proceeds as follows. In Section 2 we derive a model which provides a theoretical basis for the analysis of the FAT. Section 3 presents the quantitative results for Germany. In Section 4 we compare our results with those obtained for repealing VAT exemption and Section 5 concludes.

2 Modeling Revenue and Welfare Effects of the FAT

To assess revenue and welfare effects of imposing a FAT we adapt the approach of Buettner and Erbe (2012). While the theoretical model is, basically, the same, we do not consider a tax reform which repeals the VAT exemption of financial services but a reform which imposes a tax on the labor input purchased by the financial sector. The following subsection is concerned with the revenue effects, before we turn to the consequences for welfare.

2.1 Revenue Effects

To calculate the change in tax revenues caused by an implementation of a FAT, we compare before- and after-reform revenues. Following Buettner and Erbe (2012), the VAT is treated as a tax on primary inputs, *i.e.* labor. Only the treatment of the financial sector is allowed to differ from the standard VAT. To simplify matters we ignore the existence of unrecoverable input taxes arising under VAT exemption of financial services. While views differ regarding the extent to which unrecoverable input taxes are significant, Buettner and Erbe (2012) provide estimates according to which most of the input taxes can actually be shifted to the taxed part of the financial sector. Since unrecoverable input taxes are of secondary importance in our setting, we simplify the subsequent analysis by assuming that all input taxes are deductible. Noting that all private consumption inclusive of taxes is financed by labor income after taxes and assuming that all VAT rates are equal to the standard VAT rate τ , except for the tax on financial services, we can define tax revenues as

$$T = \tilde{\tau}_n p_n x_n + \tilde{\tau}_L L, \quad (1)$$

where x_n is the final consumption of financial services, priced with p_n . With the wage rate set to unity, L is labor income. $\tilde{\tau}_n = \frac{\tau_n - \tau}{1 + \tau}$ captures the difference between the tax on the final

consumption of financial services and the standard VAT rate τ , and $\tilde{\tau}_L = \frac{\tau_L + \tau}{1 + \tau}$ is the total tax on labor, inclusive of both VAT and labor income taxes. The first term in (1) is negative and represents the implicit subsidy of the financial sector according to the VAT exemption.

Using a prime to denote post-reform values, we can specify the tax revenue after introducing the financial activities tax τ_{FAT} levied on labor inputs used by the financial sector.

$$T' = \tilde{\tau}_n p'_n x'_n + \tilde{\tau}_L L' + \tau_{FAT} L'_n.$$

Subtracting equation (1) gives the revenue change:

$$dT = T' - T = \tilde{\tau}_n (p'_n x'_n - p_n x_n) + \tilde{\tau}_L dL + \tau_{FAT} L'_n.$$

The revenue change is composed by three terms. If the value of the final output of financial services declines, the implicit subsidy associated with the VAT exemption of financial services is reduced. As a consequence, the first term becomes positive, and we have a revenue gain. The second term represents the change in labor taxes due to the reform. The third term shows the revenue associated with the financial activities tax evaluated at post reform conditions, where $L'_n = L_n + dL_n$. The change in the labor input used by the financial sector is determined as follows. We employ a Cobb-Douglas production function, where $\frac{\partial F_n}{\partial L_n} = \alpha \frac{F_n}{L_n}$, where α is the output elasticity of employment. Inserting this expression into the first-order condition for employment in the financial sector yields:

$$p_n \alpha \frac{F_n}{L_n} = 1 + \tau_{FAT}.$$

Taking the total differential, noting that $\alpha = \frac{L_n}{X_n p_n}$ in the absence of FAT, and rearranging terms, we obtain for the introduction of FAT at rate τ_{FAT} :

$$dL_n = \hat{p}_n L_n + \hat{X}_n L_n - \tau_{FAT} L_n.$$

where a hat denotes relative changes. Hence, employment in the financial sector varies proportional to the value of output except for the adverse effect of higher labor cost, which works towards a decline in employment.

2.2 Welfare effects

To determine the welfare effects, we start with a representative household's utility function and the corresponding budget constraint:

$$u(x_1, x_2, \dots, x_n, l),$$

where l is leisure, and x_i is final consumption of good i .

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

$q_i = (1 + \tilde{\tau}_i)p_i$ is the (modified) 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. Maximizing utility yields the first-order conditions $\frac{\partial u}{\partial x_i} = q_i \lambda$ and $\frac{\partial u}{\partial L} = -(1 - \tilde{\tau}_L)\lambda$. With F_i denoting the production function in sector i and X_{ji} denoting the input purchased by sector i from sector j , the first-order conditions for profit maximization of the firm are $p_i \frac{\partial F_i}{\partial X_{ji}} = p_j$ and $p_i \frac{\partial F_i}{\partial L_i} = 1$, $\forall i \neq n$, and for sector n : $p_n \frac{\partial F_n}{\partial L_n} = 1 + \tau_{FAT}$. Taking the total differential of the utility function gives:

$$\frac{1}{\lambda} du = \sum_{i=1}^n q_i dx_i - (1 - \tilde{\tau}_L) dL,$$

where $dL = -dl$ is the change in labor supply. With $q_i = (1 + \tilde{\tau}_i)p_i$ and $\tilde{\tau}_i = 0$, $\forall i \neq n$, we can reformulate the welfare effect using producer prices

$$\frac{1}{\lambda} du = \sum_{i=1}^n p_i dx_i + \tilde{\tau}_n p_n dx_n - (1 - \tilde{\tau}_L) dL. \quad (2)$$

Inserting marginal products, each sector's final output changes can be expressed as

$$dx_i = \frac{\partial F_i}{\partial L_i} dL_i + \sum_{j=1}^n \frac{\partial F_i}{\partial X_{ji}} dX_{ji} - \sum_{j=1}^n dX_{ij}.$$

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

$$\begin{aligned} p_i dx_i &= dL_i + \sum_{j=1}^n p_j dX_{ji} - p_i \sum_{j=1}^n dX_{ij} \quad \forall i \neq n \\ p_n dx_n &= (1 + \tau_{FAT}) dL_n + \sum_{j=1}^n p_j dX_{jn} - p_n \sum_{j=1}^n dX_{nj} \end{aligned}$$

Summing over all changes in final demand

$$\sum_{i=1}^n p_i dx_i = \sum_{i=1}^{n-1} dL_i + (1 + \tau_{FAT}) dL_n + \sum_{i=1}^n \sum_{j=1}^n p_j dX_{ji} - \sum_{i=1}^n \sum_{j=1}^n p_i dX_{ij}$$

and noting that changes in intermediate inputs wash out, we obtain

$$\sum_{i=1}^n p_i dx_i = \sum_{i=1}^{n-1} dL_i + (1 + \tau_{FAT}) dL_n. \quad (3)$$

Inserting (3) into (2) and using $\sum_{i=1}^n dL_i = dL$ allows us to reformulate the welfare effect as

$$\frac{1}{\lambda} du = \tau_{FAT} dL_n + \tilde{\tau}_n p_n dx_n + \tilde{\tau}_L dL. \quad (4)$$

Since the financial activities tax is a tax on producers – not on consumers, we have only indirect welfare effects through the changes in distorted markets. The first term on the right-hand side captures the welfare consequence of employment effects in the financial sector. It vanishes in an initial situation where no FAT pre-exists. The second and third terms show the indirect effects on final consumption and on employment.

Expression (4) allows us to calculate the deadweight loss associated with introducing a FAT, provided the tax revenue is redistributed in a lump-sum fashion to the household. Of course, we need to determine how total employment as well as employment in the financial services sector n are affected and we need to specify the impact on the demand for financial services. Another consideration that may be important, is to consider “recycling” the tax revenues through a revenue-neutral change in the VAT; we will come back to this issue below.

Deadweight Loss Associated with Introducing FAT Using the Hicksian demands $dx_n = \frac{\partial h_n}{\partial q_n} dq_n$ and $dl = \frac{\partial h_{n+1}}{\partial q_n} dq_n$, we can relate the change in the demand for leisure and in the demand for financial services to price changes. Noting that in a situation where, initially, no FAT is imposed, $\tau_{FAT} = 0$, and we have

$$\frac{1}{\lambda} du = \tilde{\tau}_n p_n \frac{\partial h_n}{\partial q_n} dq_n - \tilde{\tau}_L \frac{\partial h_{n+1}}{\partial q_n} dq_n. \quad (5)$$

To substitute the cross-price effect between consumption of leisure and good n , we follow Buettner and Erbe (2012) who utilize the discussion in Goulder and Williams (2003). With the labor supply elasticity $\epsilon_L \equiv \frac{\partial L}{\partial(1-\tau_L)} \frac{(1-\tau_L)}{L_n}$ 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 can specify the impact on the demand for leisure as

$$-\frac{\partial h_{n+1}}{\partial q_n} = -\epsilon_L L \frac{h_n}{y} [1 + \theta_n]. \quad (6)$$

Substituting this expression into equation (5) and inserting ϵ_{nn} for the own-price elasticity of the demand for financial services we arrive at

$$\frac{1}{\lambda} du = \frac{\tilde{\tau}_n}{1 + \tilde{\tau}_n} h_n \epsilon_{nn} dq_n - \tilde{\tau}_L \epsilon_L L \frac{h_n}{y} [1 + \theta_n] dq_n. \quad (7)$$

To evaluate the deadweight loss, we integrate over the tax induced change in consumer prices:

$$DWL_1 = \int_0^{q_n} \frac{1}{\lambda} \frac{du}{dq_n} dq_n - \int_0^{q'_n} \frac{1}{\lambda} \frac{du}{dq_n} dq_n = - \int_{q_n}^{q'_n} \frac{1}{\lambda} \frac{du}{dq_n} dq_n.$$

Using $s_n = \frac{h_n q_n}{y}$ we obtain:

$$DWL_1 = - \frac{\tilde{\tau}_n}{1 + \tilde{\tau}_n} q_n h_n \epsilon_{nm} \hat{q}_n + \tilde{\tau}_L \epsilon_L L s_n [1 + \theta_n] \hat{q}_n. \quad (8)$$

Provided, we have an empirical estimate of the consumer price effect of introducing FAT, $\hat{q}_n \equiv \frac{q'_n - q_n}{q_n}$, as well as estimates of the elasticities and parameters, we can use this formula to compute the deadweight loss.

Welfare Gain of a Revenue Neutral Change of Labor Income Taxes The above expression for the deadweight loss rests on the assumption that revenue gains are distributed back to the household in a lump-sum fashion. An alternative way to use the funds is to reduce the distortive tax on labor income. This can be integrated in the above analysis by adding a welfare effect associated with the corresponding tax reduction. Following Buettner and Erbe (2012), we focus on the distortion associated with labor taxation, and approximate this welfare loss as

$$DWL_2 = \frac{1}{2} \left(\frac{\tilde{\tau}'_L{}^2}{1 - \tilde{\tau}'_L} - \frac{\tilde{\tau}_L^2}{1 - \tilde{\tau}_L} \right) L \epsilon_L. \quad (9)$$

3 Quantification using German Data

To quantify the effects of the implementation of a FAT, we use data from the German national accounts for 2007. We first calculate the relative changes in the consumer price. Then, we compute the revenue and welfare effects. The policy experiment first discussed is the implementation of a FAT with a rate of 19%, which is the standard VAT rate in the German system. Later, we

calculate the effects of an implementation of a FAT for different tax rates.

For the calculation of the price change we make use of the input-output table (see appendix 6.1). The value of labor relative to total output is the position *compensation of employees*, which amounts to €37.299 bn divided by the total *output produced by the financial sector* (€113.950 bn). Of course, while our theoretical model focuses on labor as the sole primary factor, a more comprehensive analysis would have to take account of remuneration for other primary inputs, notably profits. This would imply to add the *net operating surplus* to the tax base, which amounts to €10.260 bn.³ Adding the capital input to the tax base, the question arises how this input will respond to the tax reform. Since the financial industry could substitute capital with inputs from other sectors in the same way as labor, in the calculations below, we apply the same elasticity of input demand to both labor and capital inputs.

The FAT changes from zero, before the reform, to 19%, after the reform. The quantitative results indicate that

- The price for financial intermediation services would increase by 7.66%.
- The price increases in the other sectors are small, in all cases they are less than 1%. The average price increase across all non-financial sectors amounts to 0.14%.

With the estimation of the price changes due to the implementation of the FAT, we can calculate the consequences for the tax revenue. For this purpose we use equation (2):

$$dT = \tilde{\tau}_n(\hat{p}_n\hat{x}_n + \hat{p}_n + \hat{x}_n)x_n p_n + \tilde{\tau}_L dL + \tau_{FAT} L'_n.$$

In equation (2) the first term is the change in tax revenue due to a change in the value of final demand at producer prices, which is calculated with €-0.177 bn (for the calculation, see appendix

³Statistisches Bundesamt (2010), Table 1.3.

6.2). This means that the implicit subsidy of financial services is extended, because the positive price change is larger than the demand reduction. Hence, the first term is a tax revenue loss. The second term is the effect of the change in tax revenue due to a change in aggregated labor supply. The change in labor supply caused by the price change of financial services is: $dL = -dl = -\epsilon_L L s_n \hat{p}_n = -0.31 * \text{€}1180.43 \text{ bn} * 0.018 * 0.07655 = -\text{€}0.504 \text{ bn}^4$. With $\tilde{\tau}_L = 0.53\%$ (OECD 2008) and $dL = -\text{€}0.504 \text{ bn}$, it is estimated with $-\text{€}0.267 \text{ bn} = 0.53 * (-\text{€}0.504 \text{ bn})$. The third term gives the taxation of labor inputs and profits. Assuming that employment of all primary factors is equally affected by the reform, we arrive a direct revenue effect of $\text{€}7.319 \text{ bn}$. Hence the total revenue change with a FAT rate of 19 % would be a revenue gain of $\text{€}6.876 \text{ bn}$.

With equations (8) and (9) we can calculate the welfare effects.

$$\begin{aligned}
 DWL_1 &= -\frac{\tilde{\tau}_n}{1 + \tilde{\tau}_n} h_n q_n \epsilon_{nn} \hat{q}_n + \tilde{\tau}_L \epsilon_L L s_n [1 + \theta_n] \hat{q}_n \\
 DWL_2 &= \frac{1}{2} \left(\frac{\tilde{\tau}_L^2}{1 - \tilde{\tau}_L} - \frac{\tilde{\tau}_L^2}{1 - \tilde{\tau}_L} \right) L \epsilon_L
 \end{aligned}$$

The two terms associated with DWL_1 capture the welfare effects of a change in the consumer price of financial services. These effects amount to a small welfare loss of $\text{€}0.032 \text{ bn}$. Note that this estimate is obtained under the assumption, that consumption of financial services is no close substitute to leisure. More specifically, we have set $\theta_n = 0$. θ_n denotes the extent to which financial services are a substitute to leisure. If financial services would help the household to saving time for leisure, θ_n might be larger than zero. In this case, the welfare loss would be stronger due to more intense reactions on the labor market. DWL_2 is the effect of a compensating, revenue neutral decline in labor taxation. According to our calculations the labor tax rate can be reduced by 0.896% to balance the tax revenue gains. Abstracting from minor pre-existing distortions associated with VAT exemption and FAT, this would yield a welfare gain of $\text{€}5.640 \text{ bn}$. Summing up DWL_1 and DWL_2 , the total welfare effect is a gain of $\text{€}5.608 \text{ bn}$.

⁴With the parameters $L = \text{€}1180.43 \text{ bn}$, $s_n = 1.8\%$, $\epsilon_L = 0.31$ (average labor supply elasticity reported by Keane (2011))

Table 1: Effects of an Implementation of a FAT vs Repealing VAT in the Financial Sector.

Change in ...	FAT (19%)	FAT (3%)	VAT (19%)
Price	PP: +7.66% CP: +7.66%	PP: +1.21% CP: +1.21%	PP: -1.51% CP: +17.2%
Revenue	€ 7.655 bn	€ 1.312 bn	€ 1.203 bn
Welfare*	€ 5.608 bn	€ 1.092 bn	€ 0.675 bn

Source: FAT results: own computations, VAT results obtained from Buettner and Erbe (2012).
*Welfare effect is based on the assumption that revenues are used to lower labor taxes.

While the above figures are obtained by setting the FAT rate to 19%, Figure 2 shows results for tax revenue and welfare effects for a range of FAT rates between 1 and 20% (see appendix 6.3 for numerical results). Figure 1 depicts the associated producer price increases. The figure also shows that the price changes in the other sectors are always very small. This supports our simplifying assumption, that only the producer price of financial services is affected by the reform.

4 Comparison with a VAT Reform

Finally, we compare the effects of an implementation of a FAT with the alternative policy of repealing the financial sector VAT exemption as discussed in Erbe and Buettner (2012). According to this study, repealing the VAT exemption results in a price change of the producer prices of financial services by -1.51%, whereas the consumer price changes by +17.2%. The total tax revenue increases by €1.203 bn and the welfare effect obtained with a revenue neutral reduction in labor taxes is estimated with €-0.675 bn.

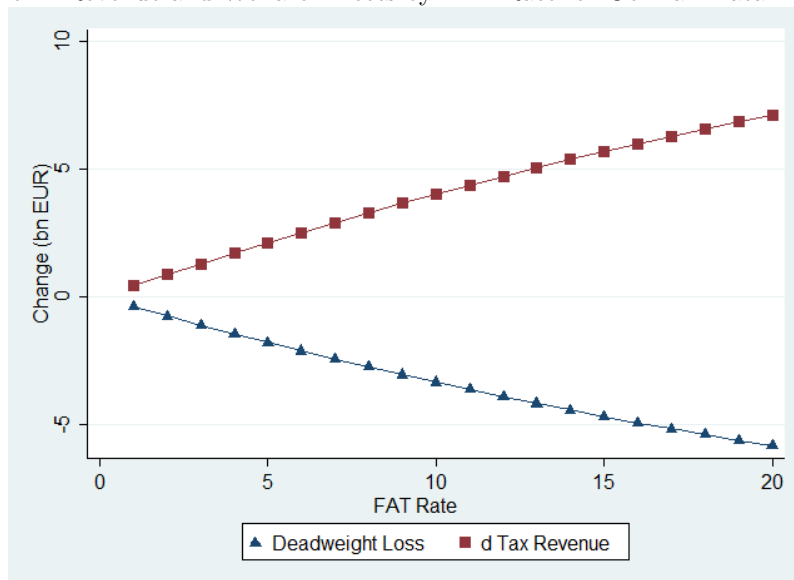
Table 1 gives an overview on the comparison of the estimated effects of an implementation of a FAT at 19% and at a more modest rate of 3% and a repeal of the VAT exemption of financial services, implying that the standard VAT rate of 19% is applied to the financial sector.

The implementation of a financial activities tax at a rate of 19% might be regarded as unrealistic. From table 1 we can see, that a FAT rate of 3% would generate similar results for revenue and

Figure 1: Price Effects of Different FAT Rates for German Data in 2007.



Figure 2: Revenue and Welfare Effects by FAT Rate for German Data in 2007.



welfare as repealing the VAT exemption at a VAT rate of 19%. The different signs of the changes in producer prices caused by the implementation of the two kinds of taxes highlight the different natures of VAT and FAT, which are levied on the final consumption and on primary inputs, respectively. However, both reforms exert positive effects on the consumer price of financial services. This suggests that the FAT may work towards reducing the implicit subsidization of the consumption of financial services, similar as repealing of financial sector VAT exemption.

Since repealing VAT exemption and introducing FAT bear some similarities, it may seem surprising, that similar tax rates of 19% yield vastly differing results. According to our calculations, a FAT would generate a tax revenue gain by €6.876 bn, while a imposing a VAT at the same rate on financial services generates only €1.203 bn. Of course, the tax base differs. FAT is levied on all primary inputs in financial services. In 2007, the labor input in the financial sector amounts to €37.299 bn. Adding the capital input, the tax base amounts to €47.599 bn. At least in Germany, the current exemption regime is not equivalent to zero taxes on final consumption of financial services. According to Buettner and Erbe (2012) a third of all final consumption of financial services is already subjected to VAT. Hence, repealing exemption would increase the tax base only by two thirds of total final consumption of financial services. Hence the increase in the tax base amounts only to two thirds of €35.630 bn or €23.516 bn. Moreover, due to unrecoverable input taxes, the financial sector already pays VAT on inputs, and, hence, repealing VAT exemption is associated with an even weaker revenue gain. Buettner and Erbe (2012) quantify the associated effect with €1.955 bn.

If the tax rate for the FAT is chosen such that the revenue implications are similar to those of repealing VAT exemption, the welfare consequences are different. The basic reason is, again, the different tax base. Since the tax base is smaller, the associated consumer price effect of repealing VAT exemption is much larger than the price effect resulting from the introduction of a FAT. Therefore, the welfare assessment looks more positive in case of the FAT.

Of course, our analysis has been based on the assumption that the increase in the cost of producing financial services associated with the FAT can be shifted to the final consumer in the same way as the VAT would be shifted. This assumption needs to be qualified, however, in an international context where taxing domestic consumers may have very different effects than taxing domestic producers. Repealing the VAT exemption would increase consumer prices of financial services regardless of whether purchased from domestic financial institutions or purchased from a competing institution with location in a country that does not impose VAT. Moreover, producer prices may even be reduced – due to unrecoverable input taxes. Imposing FAT, however, implies to impose a tax burden at the source, *i.e.* at the location of producer. But, if foreign producers of financial services do not face a FAT, it may be difficult to shift the burden of taxes on the consumer.

5 Summary

The current paper has analyzed revenue and welfare effects of implementing a FAT. The analysis has not only dealt with theoretical issues, but has also used the theoretical results in order to provide some quantifications, which illustrate the effects using data for Germany. Following the IMF (2010), we have discussed a rather broad concept of the FAT, which is a tax levied on the sum of wages and profits and which bears some similarity with a tax on the value added of financial services (Keen, 2011).

The IMF (2010) calculates a revenue gain of €0.830 bn for Germany in 2006 by levying a FAT rate of 1%. Our estimate for this modest tax rate is much lower and points to a revenue gain of €0.447 bn for Germany in 2007, even if we include profits into the tax base. We have also compared our results with the results of Buettner and Erbe (2012), who consider repealing the VAT exemption of financial services. Accordingly, a VAT reform (with a VAT rate of 19%) would increase total tax revenues by €1.203 bn. The quantification in this paper suggests that introducing a FAT rate of 3% would yield a similar revenue gain. If this revenue gain is used to lower the distorting taxes

on labor a welfare gain is approximated with €1.092 bn.

A critical assumption made in order to produce these figures is that the tax burden is fully shifted to the consumer. With international competition in the banking sector the outlook would be less optimistic. For Europe, where this concern seems particularly relevant, this suggests to strive for a joint introduction of FAT among EU member states.

6 Appendix

6.1 Price Effects of the Implementation of a FAT

Starting from the general expression for the producer price in sector i (assuming that there are no unrecoverable input taxes in sector n):

$$p_i = \sum_{j=1}^n a_{ji} p_j + b_i.$$

Total differentiation provides us with expressions

$$\begin{aligned} \hat{p}_1 &= \sum_{i=1}^n \tilde{a}_{i1} \hat{p}_i \\ &\vdots \\ \hat{p}_{n-1} &= \sum_{i=1}^n \tilde{a}_{i,n-1} \hat{p}_i \\ \hat{p}_n &= \sum_{i=1}^n \tilde{a}_{in} \hat{p}_i + \tilde{b}_n d\tau_{FAT}. \end{aligned}$$

Hence the prices change due to price changes in the other sectors, and the price in the financial sector is additionally affected by the taxation of the labor input. The relative producer price change is $\hat{p}_i = \frac{dp_i}{p_i}$ and the value based labor input coefficient is defined by $\tilde{b}_n = \frac{b_n w}{p_n}$, where the wage rate is normalized to unity. \tilde{a}_{in} is the value based input coefficient, defined by $\tilde{a}_{in} = a_{in} \frac{p_i}{p_n}$, where a_{in}

denotes the technical input coefficient. Now we can solve this system of equations by using the transpose of the input index matrix $\tilde{A}_{n \times n}^T$:

$$\begin{bmatrix} \hat{p}_1 \\ \vdots \\ \hat{p}_n \end{bmatrix} = (I_{n \times n} - \tilde{A}_{n \times n}^T)^{-1} \begin{bmatrix} 0 \\ \vdots \\ 0 \\ \tilde{b}_n d\tau_{FAT} \end{bmatrix} \quad (10)$$

In this setting the changes in producer and consumer prices are equal, because there is no additional tax on final consumption implemented.

6.2 Output Change of the Financial Sector

In the following we develop an expression for the change in the value of the output $X_n p_n$ of the financial sector. Starting from the value based expression for inputs, produced by the financial sector and used by the other sectors:

$$p_n X_{ni} = p_i \tilde{a}_{ni} X_i$$

Taking the total differential and rearranging yields:

$$\begin{aligned} dp_n X_{ni} + p_n dX_{ni} &= p_i \tilde{a}_{ni} dX_i \\ \Rightarrow p_n \sum_{i=1}^n dX_{ni} &= \sum_{i=1}^n p_i \tilde{a}_{ni} dX_i - \sum_{i=1}^n dp_n X_{ni} \\ p_n (dX_n - dx_n) &= \sum_{i=1}^n p_i \tilde{a}_{ni} dX_i - \sum_{i=1}^n dp_n X_{ni} \\ p_n dX_n &= \sum_{i=1}^n p_i \tilde{a}_{ni} dX_i - \sum_{i=1}^n \hat{p}_n p_n X_{ni} + p_n dx_n. \end{aligned}$$

The first term on the righthand side accounts for changes in input demands by the other sectors for financial services. The second term represents the reduction due to the price change of financial services and the third term shows the change in private demand. Using $p_i dX_i = d(p_i X_i) - dp_i X_i$ and rearranging yields:

$$\begin{aligned} p_n dX_n &= \sum_{i=1}^n \tilde{a}_{ni} (d(p_i X_i) - dp_i X_i) - \sum_{i=1}^n \hat{p}_n \frac{X_{ni} p_n}{X_i p_i} X_i p_i + p_n dx_n \frac{dp_n}{dp_n} \frac{x_n}{x_n} \\ p_n dX_n &= \sum_{i=1}^n \tilde{a}_{ni} d(p_i X_i) - \sum_{i=1}^n \tilde{a}_{ni} \hat{p}_i X_i p_i - \sum_{i=1}^n \hat{p}_n \tilde{a}_{ni} X_i p_i + \epsilon_{nn} \hat{p}_n x_n p_n \end{aligned}$$

With $\hat{p}_i = 0 \quad \forall i \neq n$:

$$p_n dX_n = \sum_{i=1}^n \tilde{a}_{ni} d(p_i X_i) - \tilde{a}_{nn} \hat{p}_n X_n p_n - \sum_{i=1}^n \hat{p}_n \tilde{a}_{ni} X_i p_i + \epsilon_{nn} \hat{p}_n x_n p_n.$$

In this formula most terms can be quantified using available statistics except for the output changes of the different sectors. Accordingly, we derive a quantifiable expression for the vector of output changes. We start by using the $(n \times n)$ value based input index matrix \tilde{A} :

$$[I - \tilde{A}] \begin{bmatrix} d(p_1 X_1) \\ \vdots \\ d(p_n X_n) \end{bmatrix} = \begin{bmatrix} d(p_1 x_1) \\ \vdots \\ d(p_n x_n) \end{bmatrix}$$

Rearranging and using the assumption that only p_n changes results in:

$$\begin{bmatrix} d(p_1 X_1) \\ \vdots \\ d(p_n X_n) \end{bmatrix} = [I - \tilde{A}]^{-1} \begin{bmatrix} p_1 \frac{\partial x_1}{\partial p_n} dp_n \\ \vdots \\ p_{n-1} \frac{\partial x_{n-1}}{\partial p_n} dp_n \\ dp_n x_n + p_n \frac{\partial x_n}{\partial p_n} dp_n \end{bmatrix}$$

Using Slutsky symmetry ($\frac{\partial x_i}{\partial p_n} = \frac{\partial x_n}{\partial p_i}$) and inserting the cross price elasticities for financial services ϵ_{ni} gives a computable expression for the changes in outputs:

$$\begin{bmatrix} d(p_1 X_1) \\ \vdots \\ d(p_n X_n) \end{bmatrix} = [I - \tilde{A}]^{-1} \hat{p}_n x_n p_n \begin{bmatrix} \epsilon_{n1} \\ \vdots \\ \epsilon_{n(n-1)} \\ 1 + \epsilon_{nn} \end{bmatrix}$$

6.3 Quantification of FAT Effects for Different Tax Rates

Table 2 shows the price change in the financial sector, the change in tax revenue and the welfare effect (split up into the two effects) caused by the implementation of a FAT rate between 1 and 20 %.

Table 2: Effects of FAT Implementation at different rates

FAT rate (%)	Price change (%)	Change T	DWL_1	DWL_2	DWL
1	0.403	0.447	0.002	-0.375	-0.373
2	0.806	0.884	0.003	-0.740	-0.737
3	1.209	1.312	0.005	-1.097	-1.092
4	1.612	1.730	0.007	-1.445	-1.438
5	2.015	2.139	0.009	-1.784	-1.776
6	2.418	2.538	0.010	-2.114	-2.104
7	2.820	2.928	0.012	-2.436	-2.424
8	3.223	3.309	0.014	-2.749	-2.735
9	3.626	3.680	0.015	-3.053	-3.038
10	4.029	4.042	0.017	-3.349	-3.332
11	4.432	4.395	0.019	-3.637	-3.618
12	4.835	4.738	0.020	-3.916	-3.895
13	5.238	5.071	0.022	-4.187	-4.165
14	5.641	5.396	0.024	-4.449	-4.425
15	6.043	5.710	0.025	-4.704	-4.678
16	6.446	6.016	0.027	-4.950	-4.923
17	6.850	6.312	0.029	-5.188	-5.159
18	7.252	6.598	0.031	-5.418	-5.388
19	7.655	6.876	0.032	-5.640	-5.608
20	8.058	7.143	0.034	-5.854	-5.820

Source: own computations using German data in 2007 (bn Euro).

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