Moral Hazard, Profits and Taxation of the Financial Sector

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Abstract

Models on the taxation of banks typically analyze the consequences of VAT exemption for the EU and US financial sectors in models which reduce banks to ordinary firms. This paper analyzes the effects of taxes within the Hellman-Murdock-Stiglitz model of bank moral hazard. Our results indicate that full integration of banks into the VAT system rather than the creation of new taxes limits strategic behavior of profit-maximizing banks.

Keywords: tax policy, moral hazard, taxation, financial sector, banks, VAT, Financial Activities Tax

JEL classifications: E62, F21, F30, G10, H20, H30, H50, H60

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1 Introduction

Because of difficulties in determining the value-added of the large majority of their margin-based operations, the financial sector has traditionally - and unlike most other sectors - been exempted from Value-Added Taxation (VAT) in the European Union. Article 135(1) of the EU VAT Directive indeed provides for a compulsory exemption of most financial transactions related to credit, transfer, debt, etc. (European Union, 2006).[1] In the United States, where sales taxes are generally imposed at the level of the States, no State actually imposes a sales tax on any of the financial services that are equivalent to those listed in article 135(1) of EU VAT Directive.

The question of how to tax the financial sector has been the subject of academic debates. Financial services provided in exchange of a fee such as the provision of safes has not led to controversy as there is a consensus that those shall be subject to taxation, notably VAT (Boadway and Keen, 2003). For spread-based financial services however the consensus is absent. The production efficiency theorem of Diamond and Mirrlees (1971) provides a useful starting point. Under the theorem's main assumptions that (*i*) pure profits are taxable at any tax rate, (*ii*) that other tax instruments are available without restriction and, (*iii*) the absence of market imperfections, the efficient tax structure shall not distort production decisions.

The acceptance of all these conditions allows to generate clear-cut policy recommendations. The conclusion is that for financial services provided to

[1] At the same time, article 137 of the same Directive provides that Member States may allow taxable persons a right of option for taxation for some of these operations but this option is not widely used.

businesses the sector shall be allowed to deduct the VAT paid on the related inputs (Boadway and Keen, 2003). Under the EU VAT exemption, however, the European financial sector is not allowed to deduct the VAT paid on most[2] of its inputs (input VAT). This problem is known as the 'irrecoverable VAT' and is perceived by the sector as a hidden cost.[3] In the United States, there is no input tax recovery system in place (PWC, 2012).

Yet, the asymmetric information justifications of financial intermediation and its consequences for tax design appears to not have been addressed in previous literature on public finance. The neglect of this issue may reflect a view that ignores the specificity of banks and basically reduces banks to ordinary firms. There is a fundamental difference between tax design in a perfect information world and a world with externalities created from an asymmetry of information in the banking sector. The existence of externalities violates the axioms of the production efficiency theorem.

The purpose of this paper is to discuss the economic consequences of taxation. We focus on the question whether the effects of tax policy on banking activity can potentially counteract externalities caused by decentralized decision-making of agents on the capital market. The issue here,

[2]The sector is subject to VAT on part of its business such as fee-based operations. In this case, input VAT can be deductible.

[3]PWC (2006) has attempted to estimate the exact share of irrecoverable VAT and found that it varies from 0% to 74% across selected businesses, notably because of differences in the way EU Member States interpret and apply the option to tax. An earlier unpublished case study by the European Commission - reported by Huizinga (2002) - on six banks and three insurance companies gave an equally imprecise range of between 8% and 35.9% with an average of 16.5%. Huizinga (2002) takes the ratio of banking-sector intermediate and capital inputs to total banking sector production and finds a share of irrecoverable VAT to be at 41.7%. Finally, Buettner and Erbe (2014a) recently find a share of 28% for Germany. All in all, these figures are not very precise. This is because financial institutions keep this information asymmetric and confidential to competitors.

however, is not whether a tax is optimally utilized. Rather, we are interested to study how fiscal policy affects capital investment decisions of banks in a competitive economic environment where information is a strategic variable.

The present paper analyzes the issue within the framework of Hellmann, Murdock and Stiglitz (2000), where banks invest the mobilized deposits along with its own capital to strategically maximize long-run cash flow. To keep the information structure simple we consider banks to choose between two forms of investment, a secure one and a risky one. Depositors have no direct access to the risky investment and cannot observe the market price for the risky investment. We allow banks to possess market power on the market for deposits, but assume that all banks are identical. This allows us to restrict attention to symmetric equilibria, in which each bank has the same market share.

Two main cases are considered. First, it is assumed that, in addition to the existing input VAT, the financial sector is also subject to VAT. This is the case a full integration into the VAT system. It turns out that integration of the financial sector into the VAT system reduces the incentives of bank to invest at inefficiently high levels into the risky asset.[4] In the absence of VAT integration we also consider the case of a Financial Activity Tax. This case is particularly interesting in the debate, since this tax finds public support from arguments that rely on the perceived inefficient risk-taking practices

[4]Auerbach and Gordon (2002) use a perfect-information approach to banking. The equivalence between a VAT and labor taxation in their model creates arguments in favor of full VAT integration. The intuition behind their result is that the labor tax is a tax on leisure consumption in their model where banks are modeled just alike ordinary firms. Recently and related to production efficient tax design in Auerbach and Gordon, Lockwood (2014) finds that VAT design strongly depends on the availability of rent (profit) taxation.

by banks during the recent crisis. Surprisingly, our results indicate that the Financial Activity tax does amplify excessive risk-taking behavior by banks.

The intuition behind the results may be summarized as follows. First, full integration of the banking sector into the VAT system reduces the incentives of banks to manipulate the profit maximizing since full integration into the VAT system actually leads to an increase in the profits of banks as integration eliminates the costs cause by the 'irrevocable VAT'. Second, the Financial Activities Tax reduces the profit margin via an increase in costs, thereby creating incentives to increase risky investments.

The remainder of the paper is organized as follow. Section 2 discusses several possible tax policies. Section 3 reviews the effects of exemption. Section 4 introduces the model and section 5 assesses the effects of alternative taxes. Conclusions follow.

2 Alternative tax policies to exemption

Alternative tax policies have been discussed in various contributions (IMF 2010, European Commission 2010a). In the specific case of the European Union, VAT exemption could be repealed and replaced by taxation at zero, reduced or standard VAT rate. The end of exemption would have as direct consequence that the financial sector would be allowed to deduct input VAT. The application of a sales tax would also be relatively straightforward from a technical viewpoint.

The absence of VAT on the financial sector due to the difficulty to compute the value-added on individual transactions has led to the proposal for a Financial Activity Tax (FAT). In its basic form, a FAT is a tax on the sum of the (cash-flow definition of) profits of the sector and the remunerations it pays to its workforce. Indeed, value-added can be seen as the sum of profit and remuneration, allowing to tax at the aggregated firm level what is difficult to tax at the transactions level. A FAT would not repeal the VAT exemption but alleviate the perceived under-taxation. Because input VAT remains non-deductible, a small rate (possibly equivalent to the reduced VAT rate in application) has been proposed.

Finally, bank levies (also called Financial Sector Contributions) are taxed on items of the balance sheets of financial institutions. A classic example would be taxing non-insured liabilities, defined as liabilities after deduction of regulatory capital and insured deposits (typically those covered by a Deposit Guarantee Scheme). The underlying idea is to tax both the size of the bank and a measure of its contribution to systemic risk.

3 Review of the effects of exemption

Several effects have to be taken into consideration. First, the exemption to consumption taxes has revenue consequences. Several empirical studies have looked at the effects of this exemption for VAT collection. A priori, the revenues effects of repealing VAT exemption are ambiguous as the VAT newly collected on final users of financial services shall be large enough to compensate for the new deductibility of input VAT in the sector and take into account the changes in the demand for financial services by intermediate and final users. Genser and Winker (1997) use data for Germany and conclude that the net revenue loss to the German exchequer from exempting bank services for 1994 was DM 10 billion (just over EUR 5 billion). Huizinga (2002) estimates the net VAT revenue gain of applying VAT to the financial sector for thirteen EU Member States in 1998 and found that with varying elasticities of 0, 1 and 2, the estimates are EUR 15, 12.2 and 9.5 billion respectively. The median figure represents about 0.15% of EU GDP. Finally, the UK HM Treasury (2008) provides estimates of the costs of various tax expenditures and exemptions to the UK budget. The estimates are VAT revenue losses due to exemption of financial sector of 4.2 Billion pounds in 2006, 4.5 Billion pounds in 2007 and 4.6 billion pounds in 2008 (i.e. EUR 5.6 billion). Extrapolating this to the EU based on value-added of the sector in each country and assuming that these services would be taxed at the standard VAT rate in each country, this would represent a VAT loss of about EUR 28.7 billion for the EU-27 in 2008 or 0.23% of GDP. More recently, Buettner and Erbe (2014a) use a General Equilibrium Model to compute the effects of repealing the VAT exemption in Germany. They find a more modest revenue increase of 0.07% GDP in 2007. All figures point to potential gains for the exchequers.

The revenue effects of imposing a Financial Activity Tax have mainly been assessed in a static framework. The IMF (2010) finds that imposing a 5% FAT in a selection of OECD countries usually brings revenues of between 0.15 and 0.30% of GDP. Extrapolating this to the EU27, the European Commission (2011, annex 11) calculate EUR 26 billion revenues, equivalent to about 0.2% GDP. In a computation that uses bank-level information, the European Commission (2011, annex 11) offers an alternative figure of EUR

30.3 billion, about 0.26% GDP. Using a general equilibrium framework, Buettner and Erbe (2014b) find that imposing a FAT at a rate of 4% in Germany would yield the same revenues (EUR 1.7 billion) than imposing the standard VAT rate of 19%.

Second, the impact of financial sector taxes on the profits of the sector has been relatively understudied. In a CGEM framework, Chisari et al. (2016) indicate that introducing a 15% VAT or a 10% sales taxes only marginally affect prices (respectively 0.05% and 0.12%) but in the case of mobility of capital, profits in services (including the financial sector) drop faster than in the rest of the economy.

Finally, the financial crisis has stressed the importance of moral hazard and risk in analyzing the sector. To date, to the best of our knowledge, no contribution looks at the potential impact of VAT or sales taxes on these important aspects. Using a structural model to simulate the losses in the financial sector and their contagion, Cannas et al. (2014) compare the potential contribution of bank levies and FAT with their individual contributions to systemic risk. They find high correlations, even though bank levies (better reflecting the size of banks) are outperforming FAT under a contagion scenario.

4 The model

There is a consensus in the economic literature that minimum capital requirements encourage banks to choose investment in prudent assets over gambling. Hellmann et al. (2000) prove that a Pareto dominant solution would be reached provided that additional to the minimum capital requirement, deposit controls are introduced. Deposit controls put an upper limit on the interest rate offered by the banks. The outcome is a decrease in the competition among banks. The decline in the competition increases their franchise value. As a consequence, the higher franchise value is an additional disincentive for the bank to gamble due to the higher potential loss. We extend the Hellmann-Murdock-Stiglitz model to evaluate the effect of VAT exemption, Value Added Tax, Financial Activities Tax, and sales tax on bank's behavior with respect to risk and portfolio decision and on their profit.

4.1 General framework

In this section we set the main building blocks of the model and define the key variables and their relations. The model lasts T periods and consists of $i = 1, \ldots, N$ banks. A bank i is in competition with all other symmetrical banks $-i$, collects deposits D_i, and respectively offers an interest rate per period r_i. The total amount of deposits in bank i is denoted by $D_i(r_i, r_{-i})$, which is increasing in the own interest rate r_i and decreasing in the interest rates offered by competitors r_{-i}.[5] Each bank invests the mobilized deposits along with its own capital to finance investment on a firm level. Consider that the bank faces a moral hazard problem when choosing its investment portfolio. To keep the structure simple we assume that bank i could choose between two investment alternatives, a safe asset L_i offering a return α and a

[5] We make the assumption that depositors are only concerned by the interest rate, e.g. because a system of deposit insurance is in place.

risky asset U_i yielding a high return γ with probability θ and a low return β with probability $(1-\theta)$. The expected return of the prudent asset is higher than the gambling asset's return (i.e. $\alpha > \theta\gamma + (1-\theta)\beta$). If the gambling is successful, the bank's private return γ exceeds the expected return of the prudent asset α. The total invested assets A_i consist of the deposits D_i and the capital $E_i \equiv kD_i(r_i, r_{-i})$ held by bank i. Therefore, the total asset is $A_i = D_i + E_i = (1+k)D_i(r_i, r_{-i})$. Following the point of the Hellmann-Murdock-Stiglitz model, we assume opportunity cost of capital to be larger than the expected return of the prudent asset ($\rho > \alpha$). Additionally, we take into consideration the fact, that bank i has labor costs $w(A_i)$ and physical costs $K(A_i)$, both are increasing in total asset A_i. The government can enforce a set of possible taxes on banks. First, we examine the case of VAT exemption which is currently the default option for European Union and also mimics the situation in the US. Second, we investigate the case where the government charges a Value-Added Tax τ_{VAT}. Third we look at the scenario with Financial Activity Tax τ_{FAT} and at the scenario with a sales tax.[6]

4.2 VAT Exemption

In the default scenario, banks are entitled to VAT exemption (i.e., they do not charge VAT but pay VAT on physical inputs K). It is noteworthy to make a distinction between services under VAT exemption and those entitled to zero-rate VAT. The difference is expressed by the fact that VAT at zero-rate allows the party selling services subject to this rate still to reclaim the

[6] For the sake of the economic analysis we generalize the world practice and examples of VAT exemption, VAT, and FAT. However, the results give the main insights true for the European Union.

VAT on merchant purchases while this is not the case with VAT exemption. (European Commission, 2015)

EU VAT Directive, Article 135(1) instructs that spread-based financial services provided by banks are mandatorily exempted from VAT. Under VAT exemption the bank is in the role of an end consumer, hence, it is unable to reclaim VAT and will therefore pass part of the expenses $\xi \in [0,1]$ to the consumers of financial services. Thus, the rest of the expenses is transformed into the so-called "irrevocable VAT" specified in our model as $(1-\xi)$.

We begin our economic analysis[7] with a definition of the bank's per-period profits. We set the framework conditioned on VAT exemption, which means that bank i neither pays consumption tax on the deposits $D(r_i, r_{-i})$, nor on the full profits $\pi(r_i, r_{-i}, k)$, but only on the physical inputs $K(A_i)$. Bank i makes a decision on investing in the prudent or the gambling asset. Investing in the prudent asset, the profit of bank i is

$$\begin{aligned} \pi_P(r_i, r_{-i}, k) = {} & [\alpha(1+k) - \rho k - r_i]\, D(r_i, r_{-i}) \\ & - w(A_i) - (1 + (1-\xi)\tau_{VAT})K(A_i). \end{aligned} \tag{1}$$

The equation above shows the bank's effective per-period profit, received on each unit of deposit, net of capital, labor, and physical input costs. The decision of the bank to invest in the gambling asset results in per-period

[7] We revisit the model of Hellmann-Murdock-Stiglitz, building our analysis consistent with the main ideas presented in their work "Liberalization, Moral Hazard in Banking, and Prudent regulation: Are Capital Requirements enough?" (2000). We put emphasis on analyzing the effects of taxes in this framework.

profits as follows:

$$\begin{aligned}\pi_G(r_i, r_{-i}, k) = {} & [\theta(\gamma(1+k) - r_i) - \rho k]\, D(r_i, r_{-i}) \\ & - w(A_i) - (1 + (1-\xi)\tau_{VAT})K(A_i).\end{aligned} \tag{2}$$

From this point on, there are two possible scenarios, conditioned on the outcome of the gambling. In the case of successful gambling, the bank acquires high revenues. In the second scenario, a failure in the gamble, a further functioning of bank i is obstructed and determined by the relevant government institutions.

Equation 1 and 2 enable us to determine the value of the bank as the sum of all future profits discounted by the rate δ, $V = \sum_{t=0}^{T} \delta^t \pi_t$. The limit is defined as $T \to \infty$ (Douglas W. Diamond 1989). Further specification of the bank i's value with respect to the type of asset, gives us the value of $V_P = \pi_P(r_i, r_{-i}, k)/(1-\delta)$ for a prudent asset and, respectively, $V_G = \pi_G(r_i, r_{-i}, k)/(1-\theta\delta)$ for gambling.

Starting with the scenario of bank i under VAT exemption, our task in this sub-section is to establish when bank i decides to invest in the prudent or gambling asset. We investigate the conditions under which banks have incentives to prefer safe to risky investment.

The investment process is a sequence of two steps. During the first one, bank i obtains deposits in order to secure the investment funds. Therefore, this step could be named "deposit mobilization". The second consists of the investment itself and for this reason is known as "asset allocation".

At the end of the deposit mobilization stage, bank i is in possession of

$D(r_i, r_{-i})$ units of deposits to invest with costs of the interest rate r_i. During the allocation stage, bank i has to make an investment portfolio and choose between safe and risky investment. It compares the value from the prudent asset $V_p = \pi_G(r_i, r_{-i}, k)/(1-\delta)$ to the value from the gambling asset $V_G = \pi_G(r_i, r_{-i}, k)/(1-\theta\delta)$. Intuitively, bank i will select the option that maximizes its value. Bank i will set for the prudent asset if $V_P(r_i, r_{-i}, k) \geq V_G(r_i, r_{-i}, k)$, and for the gambling asset otherwise.

From the inequality presented above, we derive the no-gambling condition $\pi_G(r, r_i, k) - \pi_P(r, r_i, k) \leq (1-\theta)\delta V_P$. The purpose of this no-gambling condition is to set a threshold: a critical interest rate level $\hat{r}(k)$ above which the bank will choose to gamble. The logic behind is simple: the expected one-period rent, acquired through gambling ($\pi_G - \pi_P$) must be less than the lost franchise value (δV_P) that the bank gives up if the gamble fails (with probability $1-\theta$). If the value of the interest rate r_i and the threshold value $\hat{r}(k)$ are such that $r_i \leq \hat{r}(k)$, the bank would not adopt a gambling investment strategy due to the threat of loosing the franchise value. Under VAT exemption, the threshold has the following specification:

$$\begin{aligned}\hat{r}(k) \leq \delta\left[\alpha(1+k) - \rho k\right] + \frac{1-\delta}{1-\theta}\left(\alpha - \theta\gamma\right)(1+k) \\ - \frac{\delta w(A_i)}{D(r_i, r_{-i})} - \frac{\delta K(A_i)}{D(r_i, r_{-i})}\left(1 + (1-\xi)\tau_{VAT}\right).\end{aligned} \tag{3}$$

Equation 3 demonstrates, that under VAT exemption, the critical interest rate of bank i, $\hat{r}(k)$ decreases in the amount of VAT τ_{VAT} and decreases in the irrevocable costs $1-\xi$. Hence, VAT exemption increases risk-taking compared to a situation of zero-rating.

Until this point, the model conceptualized the process of decision making which bank i faces while constructing its investment portfolio, namely, the choice between prudent and gambling assets. We determined the threshold interest rate as a critical value of choice. In the rest of this section, we aim to determine the interest rate bank i is willing to offer the depositors. We distinguish between the two cases when the bank is investing in the safe or the risky asset and continue to work in the framework of VAT exemption.

If bank i intends to invest in the prudent asset, it should choose an interest rate and equity such that it maximizes its expected value $(r_P, k_P) = \arg\max_{r,k} V_P$. We analyze the pair of variables (r_P, k_P) based on the symmetrical equilibrium assumption (i.e. $r_i = r_{-i}$) employing the elasticity $\epsilon \equiv (\partial D/\partial r_i)(r/D)$ and the first order condition $(\partial V_P/\partial r_i = 0)$, we acquire:

$$\begin{aligned}\hat{r}_P(k) = \frac{\epsilon}{1+\epsilon}&\left[\alpha(1+k) - \rho k - (1+k)\frac{\partial w(A_i)}{\partial A_i}\right] \\ &+ \frac{\epsilon}{1+\epsilon}\left[-(1+k)\left(1+(1-\xi)\tau_{VAT}\right)\frac{\partial K(A_i)}{\partial A_i}\right]\end{aligned} \tag{4}$$

and

$$\frac{\partial V_P}{\partial k} = \frac{D(r_i, r_{-i})}{1-\delta}\left[\alpha - \rho - \frac{\partial w(A_i)}{\partial A_i} - (1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i}\right] < 0. \tag{5}$$

Equation 5 illustrates that the bank's expected profits decrease with the increase of the bank's capital. The bank will choose to minimize the share of its own capital out of the total amount it invests. Accordingly, within the frames of a competitive equilibrium, if bank i were to choose the prudent asset, then the optimal interest rate should be:

$$\hat{r}_P(0) = \frac{\epsilon}{1+\epsilon}\left[\alpha - \frac{\partial w(A_i)}{\partial A_i} - (1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i}\right]. \tag{6}$$

We follow the same procedure when bank i invests in the gambling asset. Correspondingly, the bank chooses $(r_g, k_g) = \arg\max_{r,k} V_G(r_i, r_{-i}, k)$. The first order condition $\partial V_G/\partial r_i = 0$ leads to the critical deposit rate

$$\begin{aligned}\hat{r}_G &= \frac{\epsilon}{1+\epsilon}\left[\gamma(1+k) - \frac{\rho k}{\theta} - \frac{\partial w(A_i)}{\partial A_i}\frac{1+k}{\theta}\right] \\ &+ \frac{\epsilon}{1+\epsilon}\left[-\frac{1+(1-\xi)\tau_{VAT}}{\theta}\frac{\partial K(A_i)}{\partial A_i}(1+k)\right].\end{aligned} \tag{7}$$

Deriving V_G with respect to k results in

$$\frac{\partial V_G}{\partial k} = \frac{D(r_i, r_{-i})}{1-\theta\delta}\left[(\theta\gamma - \rho) - \frac{\partial w(A_i)}{\partial A_i} - (1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i}\right] < 0. \tag{8}$$

Thus, the optimal amount of equity is $\hat{k} = 0$, which leads to the interest rate

$$\hat{r}_G(0) = \frac{\epsilon}{1+\epsilon}\left[\gamma - \frac{\partial w(A_i)}{\partial A_i}\frac{1}{\theta} - (1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i}\frac{1}{\theta}\right]. \tag{9}$$

One can conclude that the rational behavior requires no bank to hold capital willingly. We also see that $\hat{r}_G(0) \geq \hat{r}_P(0)$.

We can now infer the profit of the bank under each scenario. Plugging our first-order conditions 5 and 6 into the profit function when investing in the safe asset 1 gives the following result

$$\pi_P(\hat{r}_P) = \left[\alpha\left(1 - \frac{\epsilon}{1+\epsilon}\right) + \frac{\epsilon}{1+\epsilon}\left[\frac{\partial w(A_i)}{\partial A_i} + (1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i}\right]\right] D(\hat{r}_P)$$
$$- w(A_i) - (1+(1-\xi)\tau_{VAT})K(A_i). \tag{10}$$

Likewise, the profit function for an investment in the gambling asset is

$$\pi_G(\hat{r}_G) = \left[\theta\gamma\left(1 - \frac{\epsilon}{1+\epsilon}\right) + \frac{\epsilon}{1+\epsilon}\left[\frac{\partial w(A_i)}{\partial A_i} + (1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i}\right]\right] D(\hat{r}_G)$$
$$- w(A_i) - (1+(1-\xi)\tau_{VAT})K(A_i). \tag{11}$$

Will the bank invest in the safe or in the gambling asset? Recall that $\alpha > \theta\gamma$ but also that $\hat{r}_G(0) \geq \hat{r}_P(0)$ implies that $D(\hat{r}_G) > D(\hat{r}_P)$. The optimal amount of equity $\hat{k} = 0$ implies that $A_i = D(\hat{r}_i)$, with $i = P, G$. Hence the labour and capital input costs are higher in the case of an investment in the gambling asset. If deposits are inelastically supplied ($\epsilon = 0$)then interest rates and deposits are equal in both scenarios and the bank has a higher return when investing in the safe asset. If on the other hand deposits become increasingly elastic ($\epsilon \to \infty$), the interest rate will pass the no-gambling threshold and banks will invest in the gambling asset. Following Hellmann et al. (2000), this is the case as soon as

$$\epsilon \geq \frac{\hat{r}(0)}{\left(\alpha - \frac{\partial w(A_i)}{\partial A_i} - (1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i}\right) - \hat{r}(0)}$$

with

$$\hat{r}(0) = \delta\alpha + \frac{1-\delta}{1-\theta}(\alpha - \theta\gamma) - \frac{\delta w(A_i)}{D(r_i, r_{-i})} - \frac{\delta K(A_i)}{D(r_i, r_{-i})}\left(1 + (1-\xi)\tau_{VAT}\right).$$

We keep this section's results in mind as a benchmark for the model's extension following in the next section where we introduce VAT and FAT taxation as well as a scenario with sales tax.

5 Effects of alternative taxes

As we discussed above, as a rule, the financial sector is under compulsory VAT exemption. This is one of the key reasons why this sector is subject to various regulatory proposals suggesting the implementation of additional taxes (IMF, 2010). Among the major goals of these propositions are strengthening stability of the sector as a whole and solving an eventual problem of under-taxation. Therefore, the natural question to ask is, which taxes could achieve such improvements and how the introduction of different instruments would affect the overall environment of the financial sector. In this section we incorporate a Value-Added Tax as well as a Financial Activities Tax and compare the key variables under the outlined scenarios: VAT exemption, VAT, FAT, and sales tax.

5.1 Under VAT

First, we focus our attention on the Value-Added Tax. It is a tax on the sales of real goods and services less purchases of non-labor inputs (IMF, 2010). For this purpose, we introduce the VAT tax τ_{VAT} in our model and show how this tax influences the bank's profits, and more importantly, the bank's incentives to gamble or to invest in the prudent asset. We aim to demonstrate that VAT leads to an increase in prudent investments. The conclusion then is that the VAT reduces externalities caused by moral hazard.

In our context, the above definition could be interpreted as bank i charges and pays VAT on spread-based services as well as all fee-based services, while labor costs stay untaxed. Following the structure of section 4, we first introduce the bank i's profits. For the safe asset the profit becomes

$$\begin{aligned}\pi_{P,VAT}(r_i, r_{-i}, k) = {} & (1-\tau_{VAT})\left[\alpha(1+k) - \rho k - r_i\right] D(r_i, r_{-i}) - w(A_i) \\ & - (1+\tau_{VAT})K(A_i) + \tau_{VAT}\left[\alpha(1+k) - \rho k - r_i\right] D(r_i, r_{-i}) \\ & + \tau_{VAT} K(A_i).\end{aligned} \tag{12}$$

Accordingly, the bank i's profit of the gambling asset is

$$\begin{aligned}\pi_{G,VAT}(r_i, r_{-i}, k) = {} & (1-\tau_{VAT})\left[\theta(\gamma(1+k) - r_i) - \rho k\right] D(r_i, r_{-i}) - w(A_i) \\ & - (1+\tau_{VAT})K(A_i) + \tau_{VAT}\left[\theta(\gamma(1+k) - r_i) - \rho k\right] D(r_i, r_{-i}) \\ & + \tau_{VAT} K(A_i)\end{aligned} \tag{13}$$

We follow the logical steps in Section 4. Having the profit equations of bank i with VAT integrated, we need to define the critical interest level. For this aim we use the no-gambling condition $\pi_P - \pi_G \leq (1-\theta)\delta V_P$, which leads to the threshold interest rate of

$$\hat{r}_{VAT}(k) \leq \delta[\alpha(1+k) - \rho k] + \frac{1-\delta}{1-\theta}(\alpha - \theta\gamma)(1+k) \\ - \frac{\delta w(A_i)}{D(r_i, r_{-i})} - \frac{\delta K(A_i)}{D(r_i, r_{-i})} \tag{14}$$

When investing in the prudent asset, the bank chooses the set $(r_P, k_P) = \arg\max_{r,k} V_P$. To detect the bank i's rational choice with respect to the pair (r_P, k_P), we derive the first order condition $\partial V_P/\partial r_i = 0$. Solving for the interest rate r_P and equivalent to the section above using the elasticity $\epsilon \equiv (\partial D/\partial r_P)(r/D)$, we can derive the best choice of interest rate.

$$r_{i,VAT} = \frac{\epsilon}{1+\epsilon}\left[\alpha(1+k) - \rho k - (1+k)\frac{\partial w(A_i)}{\partial A_i} - (1+k)\frac{\partial K(A_i)}{\partial A_i}\right] \tag{15}$$

Next, we investigate the bank's preferred amount of capital. The bank's expected profits decrease with the increase of bank's capital ($\partial V_P/\partial k < 0$). Thus, the bank will choose to minimize the share of its own capital out of the total amount it invests, such that $\hat{k} = 0$. On that account, when bank i invests in the prudent asset, then

$$\hat{r}_{P,VAT} = \frac{\epsilon}{1+\epsilon}\left[\alpha - \frac{\partial w(A_i)}{\partial A_i} - \frac{\partial K(A_i)}{\partial A_i}\right]. \tag{16}$$

Alternatively, if the bank decides to gamble, it will still choose not to hold equity ($\hat{k} = 0$) and to offer an interest rate

$$\hat{r}_{G,VAT} = \frac{\epsilon}{1+\epsilon}\left[\gamma - \frac{1}{\theta}\frac{\partial w(A_i)}{\partial A_i} - \frac{1}{\theta}\frac{\partial K(A_i)}{\partial A_i}\right]. \tag{17}$$

Analyzing the main findings of this section, one can directly see that the threshold value under VAT is higher than under VAT exemption because of $1 + (1 - \xi)\tau_{VAT} \geq 1$. This decreases the bank i's incentives to gamble and thus leads to more stability in the banking sector. Additionally, the interest rates bank i offers its depositors in both scenarios are higher under VAT than under VAT exemption.

This impacts profit when investing in the safe and the gambling assets, which are now respectively

$$\begin{aligned}\pi_{P,VAT}(\hat{r}_{P,VAT}) = &\left[\alpha\left(1 - \frac{\epsilon}{1+\epsilon}\right) + \frac{\epsilon}{1+\epsilon}\left[\frac{\partial w(A_i)}{\partial A_i} + \frac{\partial K(A_i)}{\partial A_i}\right]\right] D(\hat{r}_{P,VAT}) \\ &- w(A_i) - K(A_i).\end{aligned} \tag{18}$$

and

$$\begin{aligned}\pi_{G,VAT}(\hat{r}_{G,VAT}) = &\left[\theta\gamma\left(1 - \frac{\epsilon}{1+\epsilon}\right) + \frac{\epsilon}{1+\epsilon}\left[\frac{\partial w(A_i)}{\partial A_i} + \frac{\partial K(A_i)}{\partial A_i}\right]\right] D(\hat{r}_{G,VAT}) \\ &- w(A_i) - K(A_i).\end{aligned} \tag{19}$$

The new profits are smaller or larger than under exemption depending on several factors. First, the level of deposits $D(\hat{r}_{P,VAT})$and $D(\hat{r}_{G,VAT})$ are larger. $w(A_i)$ and $K(A_i)$ are increasing in A_i. If we assume that$K(A_i)$ is homogenous of degree 1, then the first term is larger under a VAT regime. This is however not necessarily true if these capital input costs are instead of a higher degree. Next, because the level of A_i is larger under the VAT regime, the levels of costs $w(A_i)$ and $K(A_i)$ are also larger, decreasing profit. Finally, the term $1+(1-\xi)\tau_{VAT} \geq 1$ is an additional pressure for lower profit under the exemption regime.

5.2 Under FAT on top of VAT exemption

Among the various proposals of taxation, one with a considerable potential for implementation is the Financial Activities Tax. FAT is a tax on profits and remunerations, which would have a role close to VAT, overcoming the difficulty to apply VAT in individual transactions. To compute the profits of a bank, one needs the official cash-flow report of the institution. (European Commission 2010b, 2010c)

In the framework of our model we add a Financial Activities Tax to the scenario we presented in section 4.2. Bank i pays FAT on the total amount of profit and physical costs in the default scenario, which implies that the labor costs stay untaxed.

Again, we distinguish between the cases when bank i invests in the safe or the risky asset. Therefore, the profit with prudent asset is

$$\begin{aligned}\pi_{P,FAT}(r_i, r_{-i}, k) = (1-\tau_{FAT})\left[(\alpha(1+k) - \rho k - r_i)D(r_i, r_{-i}) - w(A_i)\right] \\ + (1-\tau_{FAT})\left[-(1+(1-\xi)\tau_{VAT})K(A_i)\right] - \tau_{FAT}w(A_i).\end{aligned} \tag{20}$$

For the gambling asset, profit is

$$\begin{aligned}\pi_{G,FAT}(r_i, r_{-i}, k) = (1-\tau_{FAT})\left[(\theta(\gamma(1+k) - r_i) - \rho k)D(r_i, r_{-i})\right] \\ + (1-\tau_{FAT})\left[-w(A_i) - (1+(1-\xi)\tau_{VAT})K(A_i)\right] \\ - \tau_{FAT}w(A_i).\end{aligned} \tag{21}$$

Having defined the per-period profit from the prudent and gambling asset, to continue the investigation of the effects of the tax instruments on the behavior of the bank, we need to derive the threshold interest rate. Under the no-gambling condition $\pi_P - \pi_G \leq (1-\theta)\delta V_P$ the critical value r_{FAT} becomes

$$\begin{aligned}\hat{r}_{FAT}(k) \leq \delta[\alpha(1+k) - \rho k] + \frac{1-\delta}{1-\theta}(\alpha - \theta\gamma)(1+k) \\ - \frac{\delta K(A_i)}{D(r_i, r_{-i})}(1+(1-\xi)\tau_{VAT}) - \frac{\delta w(A_i)}{D(r_i, r_{-i})}\frac{1}{(1-\tau_{FAT})}.\end{aligned} \tag{22}$$

We apply the structure from the previous sections to show that the implementation of FAT does not change the amount of equity bank i deploys ($\hat{k} = 0$). Therefore, the interest rate with investment in the safe asset is

$$r_{P,FAT} = \frac{\epsilon}{1+\epsilon}\left[\alpha - (1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i} - \frac{1}{1-\tau_{FAT}}\frac{\partial w(A_i)}{\partial A_i}\right] \tag{23}$$

and, respectively, in the risky asset:

$$r_{G,FAT} = \frac{\epsilon}{1+\epsilon}\left[\gamma - \frac{1+(1-\xi)\tau_{VAT}}{\theta}\frac{\partial K(A_i)}{\partial A_i} - \frac{1}{\theta}\frac{1}{1-\tau_{FAT}}\frac{\partial w(A_i)}{\partial A_i}\right]. \quad (24)$$

Within the frame of the theoretical implementation of the instruments VAT and FAT we proved that both taxes affect the behavior of the individual bank towards risk. The increased threshold value, due to an introduction of a VAT, opens more space for the bank to willingly invest in the safe asset and thus, reduce the individual bank's contribution to the systematic risk in the sector.

Having both instruments available, Buettner and Erbe (2014a) suggest that there are arguments in favor of FAT compared to VAT as a better instrument to be applied in the financial sector. In its core, FAT taxes the sum of profit and remunerations of a bank. Computing the latter is less difficult than calculating the value-added accurately.

Besides this argument in favor of FAT, we focus on the stability of the banking sector and compare the outcomes of the no-gambling conditions under a Value-Added Tax and a Financial Activities Tax. This results in the following equation:

$$\frac{\tau_{FAT}}{1-\tau_{FAT}} w(A_i) \gtrless (1-\xi)\tau_{VAT} K(A_i). \quad (25)$$

This inequality shows that the tax to be preferred is dependent on the amount of the taxes themselves as well as the hidden costs and the cost structure of the bank.

The profit of the bank under the safe scenario results in

$$\pi_{P,FAT}(r_P) = (1-\tau_{FAT})\left[\left(1-\frac{\epsilon}{1+\epsilon}\right)\alpha + \frac{\epsilon}{1+\epsilon}\frac{1}{1-\tau_{FAT}}\frac{\partial w(A_i)}{\partial A_i}\right] D(\hat{r}_{P,FAT})$$
$$+ (1-\tau_{FAT})\left[\frac{\epsilon}{1+\epsilon}(1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i}\right] D(\hat{r}_{P,FAT})$$
$$- (1+(1-\xi)\tau_{VAT})K(A_i) - w(A_i) \tag{26}$$

and

$$\pi_{G,FAT}(r_P) = (1-\tau_{FAT})\left[\left(1-\frac{\epsilon}{1+\epsilon}\right)\theta\gamma + \frac{\epsilon}{1+\epsilon}\frac{1}{1-\tau_{FAT}}\frac{\partial w(A_i)}{\partial A_i}\right] D(\hat{r}_{G,FAT})$$
$$+ (1-\tau_{FAT})\left[\frac{\epsilon}{1+\epsilon}(1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i}\right] D(\hat{r}_{G,FAT})$$
$$- (1+(1-\xi)\tau_{VAT})K(A_i) - w(A_i) \tag{27}$$

The above reached results show that the profits in the scenario of financial activities taxation (FAT) could also be smaller or larger than those in the case of VAT exemption. The factors and the reasoning defining the specific outcome are the same as the already described in section 5.1. Once again, the main factors are the level of deposit and costs as well as the cost structure.

5.3 Under sales tax

The retail sales tax is a general consumption tax, which is imposed on goods and services at the point of sales. Under this tax every sale's transaction can be taxed at a different rate, dependent on the specifics of the transaction. The tax is payed by every business or end consumer on its inputs. Additionally to the different tax rates, some commodities or services can be under exemption. (Shome, 1995)

The sales tax is mainly employed in US and Canada as an analogue to the wide-spread VAT in the European Union. In the context of the financial sector, banks as all other businesses pay sales tax on their inputs. However, they cannot retrieve it and are unable to apply a sales tax on their services.

Within the framework of our model, we analyze the bank i's behavior if it was a subject of sales tax and the tax is applied to sales but there is no reclaim of input sales tax. Therefore, when investing in the prudent asset, profits become

$$\begin{aligned}\pi_{P,SAL}(r_i, r_{-i}, k) = (1-\tau_{SAL})[\alpha(1+k) - \rho k - r_i]D(r_i, r_{-i})\\ - w(A_i) - K(A_i).\end{aligned} \tag{28}$$

Thus, the bank's profits consist of the return received on each unit of deposit, taxed by the rate of the sales tax τ_{SAL}, net of labor and physical input costs. Accordingly, the bank's profits when investing in the gambling asset can be described as

$$\begin{aligned}\pi_{G,SAL}(r_i, r_{-i}, k) = (1-\tau_{SAL})[\theta(\gamma(1+k) - r_i) - \rho k]D(r_i, r_{-i})\\ - w(A_i) - K(A_i).\end{aligned} \tag{29}$$

Next, we apply the no-gambling condition to investigate the threshold value

$$\begin{aligned}\hat{r}_{SAL} \leq \delta[\alpha(1+k) - \rho k] + \frac{1-\delta}{1-\theta}(\alpha - \theta\gamma)(1+k)\\ - \frac{\delta w(A_i)}{D(r_i, r_{-i}})\frac{1}{1-\tau_{SAL}} - \frac{\delta K(A_i)}{D(r_i, r_{-i}})\frac{1}{1-\tau_{SAL}}.\end{aligned} \tag{30}$$

We derive the bank i's rational choice on the amount of equity as well as of the interest rates offered to the depositors. The results suggest that the introduction of a sales tax does not change the bank's intended equity of $k = 0$ regardless of whether the bank decides to invest in the safe or in the risky asset. Hence, the bank offers an interest rate of

$$r_{P,SAL} = \frac{\epsilon}{1+\epsilon}\left[\alpha - \frac{\partial w(A_i)}{\partial A_i}\frac{1}{1-\tau_{SAL}} - \frac{\partial K(A_i)}{\partial A_i}\frac{1}{1-\tau_{SAL}}\right] \tag{31}$$

if it decides to invest in the safe asset and

$$r_{G,SAL} = \frac{\epsilon}{1+\epsilon}\left[\gamma - \frac{1}{\theta}\frac{\partial w(A_i)}{\partial A_i}\frac{1}{1-\tau_{SAL}} - \frac{1}{\theta}\frac{\partial K(A_i)}{\partial A_i}\frac{1}{1-\tau_{SAL}}\right] \tag{32}$$

else.

Having investigated the bank's choices under a sales tax, we proceed with comparing the above results to the results of the default scenario as well as to the findings of the scenario under VAT. As described in section 4.2, a higher threshold value incentivizes the bank to choose the safe investment alternative. Comparing the critical values of the interest rates under a sales tax to VAT exemption, one can detect the following link:

$$\frac{\tau_{SAL}}{1-\tau_{SAL}}w(A_i) \overset{>}{<} \left[1 + (1-\xi)\tau_{VAT} - \frac{1}{1-\tau_{SAL}}\right] K(A_i). \tag{33}$$

While choosing a tax, additionally to the tax rates one should take into consideration the cost structure of the bank.

After we proved that a VAT taxation leads to a higher threshold value and thus is preferable to the exemption scenario, we compare the VAT and the sales tax in a next step. Our aim is to investigate if VAT is always the tax of choice when keeping the stability of the financial sector in mind.

In principle, the retail sales tax and the VAT are similar. Both taxes shift the tax burden to the end consumer. Contrasting the critical interest rates under both alternatives, we find that the threshold value of sales tax is always smaller than the threshold value of VAT because $1/(1-\tau_{SAL}) > 1$. Thus, our model suggests a VAT taxation to incentivize banks to invest in the safe asset. This result is backed by literature (e.g., Shome, 1995; Keen and Lockwood, 2010) suggesting that VAT surpasses a sales tax because it enables a higher security of revenue remittance as well as efficiency. Under the retail sales tax revenues are collected and transferred to the government only once. The payment takes place on the final sale stage by the end consumer. If this agent decides on tax evasion than the whole amount would be uncollected and lost. Under VAT the revenues would have been collected at the earlier stage of the production-distribution chain. The VAT design is such that every time a business participates in the chain with a purchase or sale, a tax is collected, payed to or revoked from the government. The narrow tax base of the retail sales tax functions as an incentive for tax avoidance and risky behavior in general

The profit of the bank under the safe scenario results in

$$\pi_{P,SAL}(r_P) = (1-\tau_{SAL})\left[\alpha(1-\frac{\epsilon}{1+\epsilon}) + \frac{\epsilon}{1+\epsilon}\frac{1}{1-\tau_{SAL}}\frac{\partial w(A_i)}{\partial A_i}\right]D(r_p)$$
$$+ (1-\tau_{SAL})\left[\frac{\epsilon}{1+\epsilon}\frac{1}{1-\tau_{SAL}}\frac{\partial K(A_i)}{\partial A_i}\right]D(r_p) - w(A_i)) - K(A_i) \quad (34)$$

and under gambling in

$$\pi_{G,SAL}(r_G) = (1-\tau_{SAL})\left[\theta\gamma(1-\frac{\epsilon}{1+\epsilon}) + \frac{\epsilon}{1+\epsilon}\frac{1}{1-\tau_{SAL}}\frac{\partial w(A_i)}{\partial A_i}\right]D(r_p)$$
$$+ (1-\tau_{SAL})\left[\frac{\epsilon}{1+\epsilon}\frac{1}{1-\tau_{SAL}}\frac{\partial K(A_i)}{\partial A_i}\right]D(r_p) - w(A_i)) - K(A_i) \quad (35)$$

Equivalently, we compare the profits with the introduced sales tax as shown in equation 34 and 35 with the profits in the default scenario of VAT exemption. One can draw the conclusion that the level of profits is defined by the already explained main factors such as the level and structure of deposits and costs. Additionally, a factor which has a significant influence on the profit is the tax rates chosen in the different scenarios.

5.4 Effects on the Depositors

In the previous sections we mainly investigated the decision making process of the bank and respectively, the effects of the introduction of each tax on the risk taking behavior. It it noteworthy to analyze how the implementation of the different tax systems will influence the depositors as a source of capital. Therefore, in this section, we compare the depositors' returns within the different setups. We follow the consequence of the sections 4 and 5 and compare the returns received on each unit of deposit under VAT exemption, VAT, FAT and a sales tax.

Equation 36 shows the interest rate the depositors receive under exemption given the optimal decisions of the bank. The return to depositors for a unit of deposits invested depends on the elasticities of supply as well as on the net return on the investment.

$$
\begin{aligned}
r_{P,EX} &= \frac{\epsilon}{1+\epsilon}\left(\alpha - \frac{\partial w(A_i)}{\partial A_i} - (1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i}\right) \\
r_{G,EX} &= \frac{1}{\theta}\frac{\epsilon}{1+\epsilon}\left(\theta\gamma - \frac{\partial w(A_i)}{\partial A_i} - (1+(1-\xi)\tau_{VAT})\frac{\partial K_{A_i}}{\partial A_i}\right)
\end{aligned} \tag{36}
$$

With equation 37 we show how the returns received by the depositors change due to the introduction of VAT on the spread based services of the bank.

$$
\begin{aligned}
r_{P,VAT} &= \frac{\epsilon}{1+\epsilon}\left(\alpha - \frac{\partial w(A_i)}{\partial A_i} - \frac{\partial K(A_i)}{\partial A_i}\right) \\
r_{G,VAT} &= \frac{1}{\theta}\frac{\epsilon}{1+\epsilon}\left(\theta\gamma - \frac{\partial w(A_i)}{\partial A_i} - \frac{\partial K(A_i)}{\partial A_i}\right)
\end{aligned} \tag{37}
$$

Comparing this result to default scenario, one can see that under VAT one unit of deposits yields a higher return.

Applying the same logic, we investigate the introduction of a FAT on top of the VAT exemption. The result is expressed by equation 38 and states that under FAT the returns on deposits are lower than under the pure VAT exemption.

$$
\begin{aligned}
r_{P,FAT} &= \frac{\epsilon}{1+\epsilon}\left(\alpha - \frac{1}{1-\tau_{FAT}}\frac{\partial w(A_i)}{\partial A_i} - (1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i}\right)\\
r_{G,FAT} &= \frac{1}{\theta}\frac{\epsilon}{1+\epsilon}\left(\theta\gamma - \frac{1}{1-\tau_{FAT}}\frac{\partial w(A_i)}{\partial A_i} - (1+(1-\xi)\tau_{VAT})\frac{\partial K(A_i)}{\partial A_i}\right)
\end{aligned} \tag{38}
$$

Finally, we introduce a sales tax in the setup, which enables us to compare it with the outcome of the default scenario.

$$
\begin{aligned}
r_{P,SAL} &= \frac{\epsilon}{1+\epsilon}\left(\alpha - \frac{1}{1-\tau_{SAL}}\frac{\partial w(A_i)}{\partial A_i} - \frac{1}{1-\tau_{SAL}}\frac{\partial K(A_i)}{\partial A_i}\right)\\
r_{G,SAL} &= \frac{1}{\theta}\frac{\epsilon}{1+\epsilon}\left(\theta\gamma - \frac{1}{1-\tau_{SAL}}\frac{\partial w(A_i)}{\partial A_i} - \frac{1}{1-\tau_{SAL}}\frac{\partial K(A_i)}{\partial A_i}\right)
\end{aligned} \tag{39}
$$

A comparison between the sales tax to the VAT exemption expresses that the returns with the existence of a sales tax are higher than those under exemption when the following condition is satisfied:

$$
\frac{\tau_{VAT}(1-\tau_{SAL})(1-\xi)-\tau_{SAL}}{\tau_{SAL}} > \frac{\frac{\partial w(A_i)}{\partial A_i}}{\frac{\partial K(A_i)}{\partial A_i}}. \tag{40}
$$

The inequality states that the depositors have a higher return under the sales tax than under VAT exemption whenever the sales tax is sufficiently lower than the exempted VAT was before.

In this section, we showed that the depositors prefer the VAT to the VAT exemption and a sales tax to the default scenario when the above mentioned condition is satisfied.

However, we believe they would prefer a VAT to a sales tax because they observe a higher return under a VAT (i.e. $r_{VAT} > r_{SAL}$).

6 Conclusion

Due to the wide destabilization effect on the whole society and output losses caused by financial and banking crises, a stable financial sector is one of the main tasks of the academic and policy circles. The financial crisis since 2007 opens a debate of "how the financial sector could make a fair and substantial contribution toward paying for any burden associated with government interventions to repair the banking system" (IMF, 2010) and of a potential role of the banks in the attempts to minimize the systematic risk in the sector. Therefore, a variety of regulatory measures are developed and applied, among others: strengthening of capital requirements and funding of Deposit Guarantee Schemes. IMF and the European Commission discuss a possibility to introduce several tax designs.

In our work we compare the default option of VAT exemption, to VAT, FAT and a sales tax to gain a solid proof of the effects of the instruments on the risky behavior of the banks. We show that the critical threshold values upon which banks decide to invest in the risky asset can be enhanced under VAT and FAT on top of the VAT exemption and a sales tax. An increase in the threshold value opens more space for the bank to willingly invest in the safe asset and thus, reduce the individual bank's contribution to the systematic risk in the sector.

Furthermore, we investigate the effects caused by an introduction of the taxes on the returns received by the depositors. We employ the model to reach the conclusion that while FAT decreases the returns, VAT opens space for higher returns. In the scenario of a sales tax, one can also argue that a unit of deposits will yield a higher return to the depositors but only under certain restrictions.

Further research should be directed to the effects of the introduction of the set of tax instruments on other interest groups, namely, the government and the clients of the bank. These factors are a matter of interest while on the one hand a main function of taxes is to collect tax revenues for the state and on the other hand, one should not neglect how taxes would change the decision making of the users of the financial institutions' products and services. For example, whether the shift from VAT exemption to VAT would put the burden of the tax from the bank to its clients.

References

Auerbach, A.J. and R.H. Gordon (2002), "Taxation of Financial Services under a VAT", *American Economic Review*, 92(2): 411-416.

Boadway, R. and M. Keen (2003), "Theoretical Perspectives on the Taxation of Capital Income and Financial Services", in P. Honohan (ed), *Taxation of Financial Intermediation: theory and practice for emerging economies*, World bank and Oxford University Press, Washington DC.

Buettner, T. and K. Erbe (2014a), "Revenue and welfare effects of financial sector VAT exemption", *International Tax and Public Finance*, 21(6):

1028-1050.

Buettner, T. and K. Erbe (2014b), "FAT or VAT? The Financial Activities Tax as a Substitute to Imposing Value-Added Tax on Financial Services", chapter 8 in de Mooij and Nicodeme (eds), *Taxation and Regulation of the Financial Sector*, MIT Press, pp. 157-176.

Cannas, G., Cariboni, J., Marchesi, M., Nicodeme, G., Petracco, M. and S. Zedda (2014), "Financial Activities Taxes, Bank Levies, and Systemic Risk", chapter 10 in de Mooij and Nicodeme (eds), *Taxation and Regulation of the Financial Sector*, MIT Press, pp. 203-228.

Chisari, O., Estache, A. and G. Nicodeme (2016), "Efficiency and Equity Effects of Taxing the Financial Sector: Lessons from a CGE Model for Belgium", Finanzarchiv, 72(2): 125-157.

De la Feria, R. and B. Lockwood (2010), "Opting for Opting-In? An Evaluation of the European Commission's Proposals for Reforming VAT on Financial Services,"*Fiscal Studies*, 31(2): 171-202.

Devereux, M. (2014), "New Bank Taxes; Why and What will be the Effects?", chapter 3 in de Mooij and Nicodeme (eds), Taxation and Regulation of the Financial Sector, MIT Press, pp. 25-54.

Diamond, P. and J. Mirrlees (1971), "Optimal Taxation and Public Production, Part I: production efficiency", *American Economic Review*, 61(1): 8-27.

European Commission (2010a), *Taxation of the Financial Sector*, COM(2010) 549, Brussels.

European Commission (2010b), *Taxation of the Financial Sector*, SEC(2010) 1166, Brussels.

European Commission (2010c), *Communication on Taxation of the Financial Sector*, COM (2010)549, Brussels.

European Commission (2011), *Impact Assessment Accompanying the Proposal for a Council Directive on a common system of financial transaction tax and amending Directive 2008/7/EC*, SEC(2011)1102, Brussels.

European Commision (2015) `/http://ec.europa.eu/taxation_customs /taxation/gen_info/index_en.htm` (Visited at 17.05.2015)

European Union (2006), Council Directive 2006/112/EC of 28 November 2006 on the common system of value added tax, *Official Journal of the European Union*, L 347, Volume 49.

Genser, B. and P. Winker (1997), "Measuring the Fiscal Revenue Loss of VAT Exemption in Commercial banking", *FinanzArchiv*, 54: 563-585.

Hellman, T.F., Murdock, K.C. and J.E. Stiglitz (2000), "Liberalization, Moral Hazard in Banking, and Prudential Regulation: Are Capital Requirements Enough?", *American Economic Review*, 90(1): 147-165.

H.M. Treasury (2008), Tax ready reckoner and tax reliefs, November 2008.

Huizinga, H. (2002), "A European VAT on Financial Services?", *Economic Policy*, 17(35): 497-534.

International Monetary Fund (2010), *A Fair and Substantial Contribution by the Financial Sector*, Final report to the G-20, June 2010.

Keen, M., & Lockwood, B. (2010). “The value added tax: Its causes and consequences ”, *Journal of Development Economics*, 92(2), 138-151.

KPMG (2013) *Proposals to apply VAT to the financial services sector in China* /https://www.kpmg.com/CN/en/IssuesAndInsights/Articles Publications/Documents/Proposals-to-apply-VAT-to-the-financial-services-sector-in-China-201311.pdf (Visited at 17.05.2015)

Lockwood, B. (2014), “How Should Financial Intermediation be Taxed?”, chapter 7 in de Mooij and Nicodeme (eds), *Taxation and Regulation of the Financial Sector*, MIT Press, pp. 133-156.

PriceWaterhouseCoopers (2006). *Economic effects of the VAT exemption for financial and insurance services*, Report to the European Commission.

PriceWaterhouseCoopers (2012), “Review of Current Practices for Taxation of Financial Instruments, Profits and Remuneration of the Financial Sector”, *Taxation Papers*, 31, European Commission.

Shome, P. (1995). “Tax policy handbook ”, International Monetary Fund.