Moral Hazard, Regulation and Taxation of the Banking Industry

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Abstract

We consider a dynamic model of moral hazard in banking analyzing the implementation of VAT (value-added tax). The bank faces a capital requirement rule. We find that under most stringent regulation, there is less gambling under VAT than exemption but also smaller than efficient. When there is not the most stringent regulation, decreasing tax under exemption in one or both periods decreases banks' incentive to gamble. There is no effect of tax on banks' gambling when the bank faces VAT in both periods. It is possible that the bank increases its incentive to gamble while increasing the requirement rule. Increasing banks' incentive to gamble is more likely the case when there is either exemption in both periods or VAT in both periods. An increase in gambling is less likely when at the same time the implementation of VAT occurs.

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

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

1 Introduction

The phenomenon of financial crisis is not novelty and typically the shock waves affect the entire economy. Crashes, e.g. stock market crash in 1929, 1987 and the global financial crisis 2007-2009, regulation of banking to decrease their risk-behavior is a subject of discussion once again. Protecting the banking system from these problems is one of the main reason for banking regulation and fiscal policy interference. After the financial crisis, policy makers and academics call for higher security and more stability of banking and financial markets. When the failure of US-banks occurred in 2008, the banking panic went over to Europe and the whole world (Haq and Heaney, 2012). To protect economies against large market failures and prevent destabilization, governmental institutions have different fiscal instruments available.

In order to prevent deep crisis in future, the regulatory regime supports for more regulation and less excessive risk-taking (i.e. risk higher than in first best), (Cordella and Yeyati, 2002).

Since Basel Accord defines capital adequacy rules to decrease banks' incentive to gamble, we analyze a tax regulating banks' risk behavior.

In this paper, we study the effects of a banks' gambling behavior, considering fiscal policy over time. We implement a value-added tax (VAT) in a dynamic model and focus on the effect on banks' gambling, responding to Hellwig (1995, 2010). He asserts that there is too little consideration of dynamic models in the literature even today. When analyzing capital regulation, recent literature usually neglects the dynamic effects over time.

Considering the incentive aspects arising due to an adjustment process over time, banks anticipate a change in capital tomorrow and adapt the gambling behavior today. Blum (1999) builds on a dynamic model describing different impacts over periods on banks' risk-taking behavior. He and respectively, Koehn and Santomero (1980) find that strengthening the capital adequacy rule in future increases banks' incentive in gambling today. The bank expects a stronger regulation rule in future and wants to increase its equity capital today in order to get higher profits tomorrow.

Affecting banks' incentive structures other than capital adequacy rules, a value-added tax (VAT) on financial products is widely discussed in recent literature. Under actual European Union Law, article 135 (1) of the EU VAT Directive, financial products are exempted from VAT. Under VAT exemption, the bank cannot reclaim tax payed on inputs needed to produce spread-based financial outputs (Mirrlees et al., 2010). Implementing VAT on financial products affects various aspects in economy: banks' incentive in gambling, as well as inducing structural and administrative challenges. In this study, we expect the implementation of a VAT decreases banks' gambling incentives.

The remainder of this paper is organized as follows. First, in Section 2 we give a short overview over recent literature. Section 3 clarifies the functioning of VAT and defines basic institutional expressions. In Section 4, the model including a capital requirement rule is introduced. We derive effects of decreasing the tax and strenghen the capital requirement rule in Section 5. Finally, Section 6 discusses policy implications and offers concluding remarks.

2 Literature Review

In recent literature, there are contrasting views whether a VAT on financial products should be integrated or not. Jack (2000) argues not to tax spread-based products. Financial services charged with fixed fees should be taxable, but better apply a zero-rate tax on implicit fees, i.e. spread-based products. Taxing spread-based products causes distortions and increases the relative prices. Even Grubert and Mackie (2000) and Chia and Whalley (1999) argue against taxation of financial products. When taxing credit money, this affects consumption choices yet it should be the same for consumers buying products by cash or credit. Taxing financial products yields distortions and there should be VAT exemption for spread-based services.

Chaudhry et al. (2015) question this argument that VAT on financial services yields distortions. They consider price changes being a correction to the actual distortion the VAT exemption triggers. They argue in favor of VAT, supposing VAT exemption distorts allocation of financial service consumption. Due to the exemption of VAT, prices for fee-based goods and services are too high compared to a scenario without VAT exemption (Huizinga et al. (2002)). There exists an amount of tax the bank cannot recover, namely the 'irrecoverable tax'. Additional to the price distortion, VAT exemption causes misallocation in consumption of financial products between households and businesses. The service to business is over-taxed whereby the service to households taxed too less (Chaudhry et al., 2015; Avi-Yonah, 2010). For firms, VAT included in financial business services is impossible for recovering.

According to Mirrlees et al. (2010), there are several distortions caused by exemptions. As VAT exemption increases the price of banking inputs, it rises the banks' incentive to produce inputs needed by themselves. Internalizing through vertical integration generates high market power and causes the 'too-big-to-fail 'problem. As Hughes and Mester (1993) stated, depositors take into account large banks to be more likely bailed-out rather than small ones. Therefore, high market power has an impact on banks' capital structure and the risk.

VAT exemption biases competition directly through higher input costs and indirectly through market power. At international level, input prices for financial institutions differ across countries due to different VAT reclaim treatments (Chaudhry et al., 2015; Mirrlees et al. 2010). Under VAT exemption, banks possibly face competitive disadvantages regarding international countries when tax rate is high. Then the amount of tax impossible to recover will be high.

Not only concerning international competition, Auerbach and Gordon (2002) examine VAT treatment in different sectors. They want to apply VAT on financial products in order to generate equal taxation with products compounded to other sectors. Similar, Rousslang (2002) concludes, that financial service taxation should be at least as high as other sector taxation to prevent imbalances.

In this paper, after analyzing VAT implementation in the financial sector, we study the effects of a VAT when a bank faces a capital adequacy rule. Taking capital requirement rules into account, Miles et al. (2013); Admati et al. (2013) and Repullo (2004) suppose high capital requirements reduce banks' risk. According to them, capital requirements cause large benefits but minimal social costs. Also Miles et al. (2013) determine the amount of equity capital the bank should hold and come to the result that the ratio defined in Basel III is too low.

In a dynamic setting, De Nicoló et al. (2012) come to the opponent solution. An increase in taxation and capital requirements lead to excessive costs and therefore offset the benefits a decrease in risk yields. Even in a multiperiod setting, Calem and Rob (1999) suggests that banks near bankruptcy take high risk. When the bank increases its capital, risk decreases. Thereafter, increasing capital over a certain point, the bank increases its risk. The reason for diverse impacts of regulation rules could be defined through the banks' ownership structure as Laeven and Levine (2009) explain. Keen (2011) points out the ambiguous effects of taxation and regulation on the financial sector. He describes different instruments of public policy and the effect and impacts on banks' risk behavior strongly depends on the nature of the problem.

3 Institutional Surroundings and Definitions

3.1 VAT Exemption

In general, there is taxation on value-added for firms and institutions. Usually, firms and institutions reclaim VAT paid on inputs when the tax chain is unbroken. Thus, as Mirrlees et al. (2010) stated, final consumption is the tax base.

VAT exemption is not a country specific phenomenon; there exists regulation from the European Union Banking and Tax law. EU VAT Directive Article 135 (1) claimed exemption of VAT applied on most of banking and finance products. VAT exemption holds for financial transactions and banking activities, e.g. credits and insurances (Huizinga et al., 2002). The treatment of financial services has historical and administrative reasons. Historically, many EU member states established VAT exemptions on financial services a long time ago. Abolishing existing exemptions was unenforceable. The easier way was to build up on exemptions. Thus, exemption still holds for spread-based financial products.

Financial institutions have to pay VAT on inputs but cannot reclaim VAT while producing outputs exempted from VAT. De La Feria and Lockwood (2010) calculate a loss in governments revenue, when VAT exemption applies on financial products. On the other hand, they point out administrative problems that will arise when implementing a VAT and eliminating VAT exemption on financial products. Applying a tax on financial products, knowing the value-added is essential as this is the tax base at each stage of production.

In the actual situation of EU VAT exemption, we have to distinguish between business users of financial services and private users. Under VAT exemption, private users pay a lower price of financial services compared to a system under VAT. For business users the reversed effect remains when comparing financial sector with production sector. Under VAT, they can reclaim VAT payed on financial inputs whereas under exemption they cannot. An over-pricing of business use and an under-taxation of private use of financial services occurs (Huizinga et al. (2002)). The VAT is designed to tax consume and not businesses, but due to exemption on financial products, taxation of businesses occurs.

As described in literature review, there are discussions about the exemption of VAT. When VAT applies on capital, there exists double taxation of consume. First, through credit taxation and second during VAT while buying products using credit money. According to Mirrlees et al. (2010), exempting financial services violates the tax neutrality principle and breaks the tax chain. On the other hand, according to Auerbach and Gordon (2002), taxing capital products with VAT ensures equality in taxation to any other product in an economy (especially in production sector).

Additionally, a financial institute provides other businesses than those spread-based ones. To be precise, these are services like administration of bonds and securities, management-services, (i.e. market-analysis or generating reports), preparation of certificates, and rentals of the safe deposit box. These are examples for the so-called fee-based service of a bank. Without exemption from VAT the bank can reclaim input tax of these services.

Buying inputs to generate a product exempted from VAT, nevertheless the bank has to pay tax on inputs, e.g. a new computer or software. The bank cannot charge value-added taxes while selling VAT exempted services. For the bank, there still exist possibilities passing an amount of tax on top of fee-based services. Next, we describe the case when implementation of VAT for spread-based services applies.

3.2 VAT and zero-rating

For products being subject to VAT, the tax base is the value-added generated. According to Huizinga et al. (2002), defining the value-added for financial products is ambiguous and depends on various terms. Inputs for financial products can be described as loans with the price for loans being the deposit rate. This deposit rate usually includes a term against risk, making the deposit rate ambiguous for determining the tax base (Huizinga et al. (2002)). Determining the tax base is one example of administrative problems when implementing VAT on financial services.

As soon as the administrative problems are solved, taxation of financial products under VAT works like taxing conventional products. The bank gets tax credits for VAT payed on inputs and charges VAT on outputs. The tax chain is unbroken and VAT is collected at each production stage.

According to Chaudhry et al. (2015), eliminating VAT exemption reduces costs of financial institutions and additionally increases governmental revenue. With businesses also have the possibility to reclaim tax payed on financial products, the efficiency of the economy may rise, as businesses are no longer over-taxed.

A special form of VAT on financial inputs is the so-called zero-rating. Under VAT and zero rating, banks do not charge VAT on the output of financial products but reclaim VAT payed on inputs (Gottfried and Wiegard, 1991). In contrast to zero-rating, under exemption the bank does not charge VAT on financial products output but also cannot reclaim VAT payed on inputs. A tax reform concerning financial products seems to be easier leaving the VAT exemption on outputs untouched but allowing for VAT recovery of input products. Huizinga et al. (2002) claims under the actual system of taxation, banks try to pass as much tax amount as possible up on to fee-based products. Then, the system works as zero-rating is still applied. Elimination of VAT exemption still legalizes the current practice.

4 The model

Consider a bank that operates for two periods ($t = 0, 1$). In each period, the bank mobilizes an volume of deposits D_t and faces capital and market costs $C(D_t)$. These are allocated in assets wherein the bank faces a moral-hazard problem in choosing its loan portfolio. We assume that the bank chooses between a prudent asset and a gambling asset. Denote return of the prudent asset by $r_p \geq 1$ and denote by $r = (r_h, r_l)$ the return of the gambling asset. The return of the prudent asset is realized with certainty $p(r_p) = 1$. The high return from investment into the gambling asset is realized with probability $p(r_h)$ and a low return results with probability $p_l = 1 - p(r_h)$. Let $r_l = 0$ and $r \geq r_p$. Assume that the expected return of the gambling asset is at least as high as the return of the prudent asset, i.e., $E(r) = p(r)r$ is weakly convex above $r \geq r_p$ and attains an unique $R =: \arg\max E(r)$. Let there exist a capital requirement k with $k = 1$ as most stringent regulation.

4.1 Default scenario

The bank invests both the deposits it mobilizes and its own capital W_t so that the total amount of capital under a capital adequacy rule is described as $D_t + W_t = kW_t + D_t^s$. [1] A capital requirement forces a bank to hold more capital than it would otherwise choose to hold. Bank capital is costly? First we consider a benchmark where VAT exemption of spread-based services is applied in both periods. The bank pays value-added tax τ on inputs $K(D_t)$ while some amount of tax can passed on customers of fee-based products like, e.g., management advice. The proportion possible for passing on consumers is measured by $\xi \in [0, 1]$. Let $(1 - \xi + \beta)\tau K(D_t)$ be the effective amount of the tax the bank has to pay under VAT exemption. Note that the minimum expected profit at the end of the second period depends on whether the gamble is successful. If so, then the bank captures a high return on assets and repays its depositors. Expected profits of the bank are

$$\begin{aligned}\pi_{ee} &= p(r)[kW_1R + D_1^sR_f - C(D_1) - (1 - \xi + \beta)\tau K(D_1) - K(D_1)\beta] \\ &\quad + (1 - p(r)) \max\{0, -[C(D_1) + (1 - \xi + \beta)\tau K(D_1) + K(D_1]\},\end{aligned}$$

where $W_1 = rkW_0 + D_0^sR_f - C(D_0) - (1-\xi+\beta)\tau K(D_0) - K(D_0)\beta$ is the value of equity in case of successful gambling. If the gamble fails, then the bank will loose its franchise and cease operation. Assuming the case of successful gambling the problem of the bank is to

$$\begin{aligned}\max_r \quad \tilde{\pi}_{ee} &= p(r)[kW_1R + D_1^sR_f - C(D_1) \\ &\quad - (1 - \xi + \beta)\tau K(D_1) - K(D_1)\beta]. \qquad (1)\end{aligned}$$

Using the first order condition ($\frac{\partial \tilde{\pi}_{ee}}{\partial r} = 0$), we implicitly obtain the in-

[1]superscript s denotes ‘safe’

terest rate under gambling derived in Appendix 7.1.1. With the regulation just binding in period two and actually binding in period one, taking total derivatives in the first order condition derived above with respect to r and k, we obtain

$$\frac{dr}{dk} = -\frac{\kappa_{ee}}{\phi_{ee}} < 0 \tag{2}$$

with $\phi_{ee} < 0$ is the derivative with respect to r and defining

$$\begin{aligned}\kappa_{ee} &= p'(r)RW_0[r - C'(D_0) - (1-\xi+\beta)\tau K'(D_0) - K'(D_0)\beta] \\ &\quad + p(r)W_0[R - H_{ee}]. \end{aligned} \tag{3}$$

Higher capital requirements ($k \downarrow$) inflate the bank's gambling since (2) is negative. A sufficient condition for this to hold is $R < H_{ee}$ [2]. Under $k = 1$, the most stringent regulation we observe

$$\begin{aligned}\frac{(\frac{\partial \tilde{\pi}_{ee}}{\partial r}|_{k=1})}{\partial r} &= p'(r)\left[\frac{R[D_0^s R_f - C(D_0) - (1-\xi+\beta)\tau K(D_0) - K(D_0)\beta]}{W_0 R}\right] \\ &\quad + p'(r)\left[\frac{D_1^s R_f - C(D_1) - (1-\xi+\beta)\tau K(D_1) - K(D_1)\beta}{W_0 R}\right] \\ &\quad + p'(r)r + p(r). \end{aligned} \tag{4}$$

Proposition: Under the most stringent regulation, there is less gambling under exemption than efficient $(p'(r)r + p(r))$, (Appendix 7.2).

[2] $H_{ee} = k(k-1)(C''(D_1) + (1-\xi+\beta)\tau K''(D_1) + K''(D_1)\beta)$
$[W_1 + (k-1)W_0[r - C'(D_0) - (1-\xi+\beta)\tau K'(D_0) - K'(D_0)\beta]]$

4.2 VAT in period two

Under VAT, banks can fully recover the VAT charged on inputs. VAT increases the final consumer price by the amount of tax applied on inputs. We now implement VAT in the second period. The bank pays VAT on all inputs but charges the whole amount of VAT, no effective taxation occurs for banks. The problem of the bank is to

$$\max_{r} \quad \tilde{\pi}_{ev} = p(r)[kW_1 R + D_1^s R_f - C(D_1) - K(D_1)\beta], \tag{5}$$

facing W_1 the same as in default. Under VAT, the tax on physical inputs is recoverable and there is no effective taxation on these inputs anymore, depreciation based on the net product value. We obtain the interest rate under gambling after solving first order condition $\frac{\partial \tilde{\pi}_{ev}}{\partial r} = 0$. Taking total derivatives (Appendix 7.1.2) we obtain

$$\frac{dr}{dk} = -\frac{\kappa_{ev}}{\phi_{ev}} < 0, \tag{6}$$

whenever $\phi_{ev} < 0$ and

$$\begin{aligned} \kappa_{ev} = {} & p'(r)RW_0[r - C'(D_0) - (1 - \xi + \beta)\tau K'(D_0) - K'(D_0)\beta] \\ & + p(r)W_0[R - H_{ev}]. \end{aligned} \tag{7}$$

Given $\phi_{ev} < 0$, a stronger capital requirement rule ($k \downarrow$) leads to more gambling as long as $\kappa_{ev} < 0$. A sufficient condition for this to hold is $R < H_{ev}$ [3].

[3] $H_{ev} = k(k-1)(C''(D_1) + K''(D_1)\beta)$
$[W_1 + (k-1)W_0[r - C'(D_0) - (1 - \xi + \beta)\tau K'(D_0) - K'(D_0)\beta]]$

Comparing (7) and (3), the effect is the same but with $H_{ee} > H_{ev}$. Banks' incentive to gamble possibly increases while facing a more stringent regulation.

Analyzing this first order condition under the most stringent regulation to compare the result with efficient scenario, we get

$$\begin{aligned}\frac{(\frac{\partial\tilde{\pi}_{ev}}{\partial r}|_{k=1})}{\partial r} &= p'(r)\left[\frac{R[D_0^s R_f - C(D_0) - (1-\xi+\beta)\tau K(D_0) - K(D_0)\beta}{W_0 R}\right] \\ &\quad + p'(r)\left[\frac{D_1^s R_f - C(D_1) - K(D_1)\beta}{W_0 R}\right] + p'(r)r + p(r). \qquad (8)\end{aligned}$$

Proposition: Under $k = 1$, there is less gambling than efficient also in case of VAT implementation.

4.3 VAT in both periods

Consider the case, when VAT applies in period one and two and tax credits are possible in both periods, the maximization problem remains unchanged. We have an adjusted value of equity at the end of the starting period, facing VAT already in first period:

$$W_1 = rkW_0 + D_0^s R_f - C(D_0) - K(D_0)\beta. \qquad (9)$$

Solving $\frac{\partial\tilde{\pi}_{vv}}{\partial r} = 0$ analogous to the problem above obtains the interest rate under gambling. Taking total derivatives and analyzing the point where the regulation actually binds in period one and just binds in period two

(Appendix 7.1.3), we immediately obtain

$$\frac{dr}{dk} = -\frac{\kappa_{vv}}{\phi_{vv}} < 0 \tag{10}$$

since $\phi_{vv} < 0$ and the sufficient condition $R < H_{vv}$ holds,

$$\kappa_{vv} = p'(r)RW_0[r - C'(D_0) - K'(D_0)\beta] + p(r)W_0[R - H_{vv}]. \tag{11}$$

Then, H_{vv} [4]$> H_{ev}$. Similar as above, under $k \downarrow$, more gambling occurs since (11) is negative. A sufficient condition for this to hold is $R < H_{vv}$. Under the most stringent scenario, we have

$$\begin{aligned}\frac{\left(\frac{\partial\tilde{\pi}_{ev}}{\partial r}|_{k=1}\right)}{\partial r} &= p'(r)r + p(r) + p'(r)\left[\frac{R[D_0^s R_f - C(D_0) - K(D_0)\beta}{W_0 R}\right] \\ &+ p'(r)\left[\frac{D_1^s R_f - C(D_1) - K(D_1)\beta}{W_0 R}\right].\end{aligned} \tag{12}$$

Proposition: Under $k = 1$, there is less gambling than efficient. Under the most stringent regulation, gambling is the highest under exemption and the less under VAT in both periods.

5 Tax effects and stricter rules

5.1 Decreasing tax

We are now in a position to examine whether a variation in tax rate leads to a stronger effect on banks' gambling in case of VAT exemption or VAT. Ana-

[4] $H_{vv} = k(k-1)(C''(D_1) + K''(D_1)\beta)[W_1 + (k-1)W_0[r - C'(D_0) - K'(D_0)\beta]]$

lyzing possible effects of a variation in tax rates, we calculate total derivatives in the first order conditions derived in Section 4 with respect to r and τ (Appendix 7.2). Under VAT exemption in both periods and under VAT in period two, a decrease in tax decreases gambling $\frac{dr}{d\tau} = -\frac{\gamma_{ee}}{\phi_{ee}} > 0$ and $\frac{dr}{d\tau} = -\frac{\gamma_{ev}}{\phi_{ev}} > 0$.

It is ambiguous which effect will be stronger. Under VAT in both periods, a variation in tax rate will have no effect on banks' gambling $\frac{dr}{d\tau} = -\frac{\gamma_{vv}}{\phi_{vv}} = 0$.

Proposition: Decreasing tax ($\tau \downarrow$) decreases banks incentive to gamble in case of VAT exemption in both periods and facing VAT in period two. There is no effect on gambling, when facing VAT in both periods.

5.2 Stronger capital requirement rule

Consider the effect a strengthening in capital requirement rule has on banks' incentive in gambling behavior. Independent whether there exists exemption or VAT, when the bank faces a stronger capital adequacy rule, banks' incentive to gamble is ambiguous. A sufficient condition for the banks' gambling incentive to increase is $R < H$. H depends on the regulation term k, the derivatives of the cost functions and the value of equity. With a more convex cost function, the higher k and the amount of equity, the sufficient condition is more likely to be satisfied (Blum, 1999). With $\frac{H}{dk} > 0$, H positively depends on the value of k. $k \downarrow$ leads to $H \downarrow$.

We want to analyze the values of H more precisely. The values of expressions H_{ee} and H_{vv} both are higher than H_{ev}. Increasing banks' incentive to gamble when facing stronger requirement rules is more likely the case, when in both periods there is the same tax treatment and no change in treatment occurs.

Proposition: A more stringent regulation increases banks' incentive to gamble with a higher probability when in both periods there is either VAT exemption or VAT. An increase in gambling behavior is less likely when at the same time the implementation of VAT occurs. Implementing VAT potentially reinforces the effect of strengthening the capital requirement rule.

6 Concluding remarks

Implementing VAT affects banks' incentive in gambling but the effects are ambiguous. Taken into account a capital adequacy rule in the first and in the second period, implementing VAT decreases gambling behavior. Under the most stringent regulation, in every tax treatment banks' gambling will be even smaller than efficient.

Decreasing the tax rate facing a capital adequacy rule decreases gambling both under VAT exemption and when implementing VAT in period two. Whether there is a stronger effect in one scenario is ambiguous. Decreasing the tax rate has an impact on banks' gambling behavior is not true for a bank facing VAT in both periods. At this, the bank has to pay tax on physical costs but can reclaim the whole amount. The net effect of tax payments is zero for the bank and therefore a change does not affect its risk-taking.

Theoretically, the implementation of a tax seems to be simple but in reality, Mirrlees et al. (2010) brings up an argument considering the administrative difficulty applying VAT for financial services. Eliminate exemptions for financial services in European Union needs a sufficient majority to change the law.

Nevertheless, the implementation of VAT causes interesting effects regarding banks' risk behavior that should be analyzed further.

7 Appendix

7.1 F.O.C and total derivative under capital requirement

7.1.1 Default scenario

Solving Problem (1), gives us the necessary and sufficient F.O.C of following structure:

$$\frac{\partial \tilde{\pi}_{ee}}{\partial r} = p'(r)[kW_1R + D_1^sR_f - C(D_1) - (1-\xi+\beta)\tau K(D_1) - K(D_1)\beta] \\ + p(r)W_0[k^2R - k(k-1)[C'(D_1) + (1-\xi+\beta)\tau K'(D_1) + K'(D_1)\beta]] \tag{13}$$

Derivate F.O.C. with respect to r:

$$\frac{(\frac{\partial \tilde{\pi}_{ee}}{\partial r})}{\partial r} = p''(r)[kW_1R + D_1^sR_f - C(D_1) - (1-\xi+\beta)\tau K(D_1) - K(D_1)\beta] \\ + 2p'(r)W_0[k^2R - k(k-1)[C'(D_1) + (1-\xi+\beta)\tau K'(D_1) + K'(D_1)\beta]] \\ - p(r)W_0^2[k(k-1)]^2[C''(D_1) + (1-\xi+\beta)\tau K''(D_1) + K''(D_1)\beta] = \phi_{ee}$$

Derivate F.O.C. (7.1.1) with respect to k:

$$\frac{(\frac{\partial \tilde{\pi}_{ee}}{\partial r})}{\partial k} = p'(r)\Big[W_1 R + kW_0 R[r - C'(D_0) - (1-\xi+\beta)\tau K'(D_0) - K'(D_0)\beta]$$

$$- W_1[C'(D_1) + (1-\xi+\beta)\tau K'(D_1) + K'(D_1)\beta]$$

$$- (k-1)W_0[C'(D_1) + (1-\xi+\beta)\tau K'(D_1) + K'(D_1)\beta]$$

$$[r - C'(D_0) - (1-\xi+\beta)\tau K'(D_0) - K'(D_0)\beta]\Big]$$

$$+ p(r)W_0[2kR - (2k-1)(C'(D_1) + (1-\xi+\beta)\tau K'(D_1) + K'(D_1)\beta) - H_{ee}]$$

$$\frac{(\frac{\partial \tilde{\pi}_{ee}}{\partial r})}{\partial k} = p'(r)\Big[\{R - (C'(D_1) + (1-\xi+\beta)\tau K'(D_1) + K'(D_1)\beta\}$$

$$\{W_1 + kW_0[r - C'(D_0) - (1-\xi+\beta)\tau K'(D_0) - K'(D_0)\beta]\}$$

$$+ [C'(D_1) + (1-\xi+\beta)\tau K'(D_1) + K'(D_1)\beta]$$

$$[W_0(r - C'(D_0) - (1-\xi+\beta)\tau K'(D_0) - K'(D_0)\beta)]\Big]$$

$$+ p(r)W_0[2kR - H_{ee}]$$

$$- p(r)(2k-1)(C'(D_1) + (1-\xi+\beta)\tau K'(D_1) + K'(D_1)\beta) \qquad (14)$$

H_{ee} is described as:

$$H_{ee} = k(k-1)(C''(D_1) + (1-\xi+\beta)\tau K''(D_1) + K''(D_1)\beta)$$

$$[W_1 + (k-1)W_0[r - C'(D_0) - (1-\xi+\beta)\tau K'(D_0) - K'(D_0)\beta]],$$

assuming $r > C'(D_0) + (1-\xi+\beta)\tau K'(D_0) + K'(D_0)\beta$. Determining the point the regulation actually binds in period one and just binds in period two, we examine the following maximization problem, assuming the bank expects no regulation rule:

$$\max_{r} \quad \tilde{\pi}_{ee} = p(r)[(W_1 + D_1^o)R - C(D_1^o) - (1-\xi+\beta)\tau K(D_1^o) - K(D_1^o)\beta]$$

and $W_1 = kW_0 r + D_0^s R_f - C(D_0) - (1-\xi+\beta)\tau K(D_0) - K(D_0)\beta$ [5] is value of equity at the end of starting period. We now want to examine the amount of deposits solving this maximization problem when the restriction just binds. We therefore differentiate the maximization problem regarding the deposits $(\frac{\partial \tilde{\pi}_{ee}}{\partial D_1^o})$, yielding in:

$$R - C'(D_1^o) - (1-\xi+\beta)\tau K'(D_1^o) - K'(D_1^o)\beta = 0$$

Assuming there is only the restricted amount of deposits D_1 allowed, we have:

$$R = C'(D_1) + (1-\xi+\beta)\tau K'(D_1) + K'(D_1)\beta \tag{15}$$

At this point, regulation just binds. Plugging (15) into Eq. (14), we get Equation (3)

$$\begin{aligned}\frac{(\frac{\partial \tilde{\pi}_{ee}}{\partial r})}{\partial k} &= p'(r)RW_0[r - C'(D_0) - (1-\xi)\tau K'(D_0) - (1+\tau)K'(D_0)\beta] \\ &+ p(r)W_0[R - H_{ee}] = \gamma_{ee}.\end{aligned}$$

[5]superscript o denotes ‘optimal’

In the case ϕ_{ee} is negative, the sufficient condition for increase in gambling incentives as k decreases is $R < H_{ee}$.

7.1.2 VAT in period two

Solving Problem (5), gives us the necessary and sufficient F.O.C of following structure:

$$\begin{aligned}\frac{\partial \tilde{\pi}_{ev}}{\partial r} &= p'(r)[kW_1R + D_1^sR_f - C(D_1) - K(D_1)\beta] \\ &+ p(r)W_0[k^2R - k(k-1)(C'(D_1) + K'(D_1)]\end{aligned} \tag{16}$$

Derivate F.O.C. with respect to r:

$$\begin{aligned}\frac{(\frac{\partial \tilde{\pi}_{ev}}{\partial r})}{\partial r} &= p''(r)[kW_1R + D_1^sR_f - C(D_1) - K(D_1)\beta] \\ &+ 2p'(r)W_0[k^2R - k(k-1)[C'(D_1) + K'(D_1)\beta]] \\ &- p(r)W_0^2[k(k-1)]^2[C''(D_1) + K''(D_1)\beta] = \phi_{ev}\end{aligned}$$

Derivate F.O.C. with respect to k:

$$\begin{aligned}\frac{(\frac{\partial \tilde{\pi}_{ev}}{\partial r})}{\partial k} &= \gamma_{ev} = p'(r)\Big[\{R - (C'(D_1) + K'(D_1)\beta\} \\ &\{W_1 + kW_0[r - C'(D_0) - (1 - \xi + \beta)\tau K'(D_0) - K'(D_0)\beta]\} \\ &+ p'(r)[C'(D_1) + K'(D_1)\beta] \\ &[W_0(r - C'(D_0) - (1 - \xi + \beta)\tau K'(D_0) - K'(D_0)\beta)]\Big] \\ &+ p(r)W_0[2kR - (2k-1)(C'(D_1) + K'(D_1)\beta) - H_{ev}]\end{aligned} \tag{17}$$

H_{ev} is described as:

$$H_{ev} = k(k-1)(C''(D_1) + K''(D_1)\beta)$$
$$[W_1 + (k-1)W_0[r - C'(D_0) - (1-\xi+\beta)\tau K'(D_0) - K'(D_0)\beta]],$$

assuming $r > C'(D_0)+(1-\xi+\beta)\tau K'(D_0)+K'(D_0)\beta$. Determining the point the regulation actually binds in period one and just binds in period two, we examine the following maximization problem, assuming the bank expects no regulation rule:

$$\max_{r} \quad \tilde{\pi}_{ev} = p(r)[(W_1 + D_1^o)R - C(D_1^o) - K(D_1^o)\beta]$$

and equity capital W_1 as before. We want to examine the amount of deposits solving this maximization problem when the restriction just binds. We therefore differentiate the maximization problem regarding the deposits ($\frac{\partial \tilde{\pi}_{ev}}{\partial D_1^o}$) and denote the deposits as the regulated ones:

$$R = C'(D_1) + K'(D_1)\beta \tag{18}$$

At this point, regulation just binds. Plugging (18) into Eq. (17), we get Equation (7)

$$\frac{(\frac{\partial \tilde{\pi}_{ev}}{\partial r})}{\partial k} = p'(r)RW_0[r - C'(D_0) - (1-\xi+\beta)\tau K'(D_0) - K'(D_0)\beta]$$
$$+ p(r)W_0[R - H_{ev}] = \gamma_{ev}.$$

In the case ϕ_{ev} is negative, the sufficient condition for gambling to increase as k decreases is $R < H_{ev}$.

7.1.3 VAT both periods

Solving the problem (5) with adjusted value of W_1 (eq. 9), gives us the necessary and sufficient F.O.C of following structure:

$$\begin{aligned}\frac{\partial\tilde{\pi}_{vv}}{\partial r} &= p'(r)[kW_1R + D_1^sR_f - C(D_1) - K(D_1)\beta] \\ &+ p(r)W_0[k^2R - k(k-1)(C'(D_1) + K'(D_1)\beta]\end{aligned} \tag{19}$$

Derivate F.O.C. with respect to r:

$$\begin{aligned}\frac{(\frac{\partial\tilde{\pi}_{vv}}{\partial r})}{\partial r} &= p''(r)[kW_1R + D_1^sR_f - C(D_1) - K(D_1)\beta] \\ &+ 2p'(r)W_0[k^2R - k(k-1)[C'(D_1) + K'(D_1)\beta]] \\ &- p(r)W_0^2[k(k-1)]^2[C''(D_1) + K''(D_1)\beta] = \phi_{vv}\end{aligned}$$

Derivate F.O.C. with respect to k:

$$\begin{aligned}\frac{(\frac{\partial\tilde{\pi}_{vv}}{\partial r})}{\partial k} &= p'(r)\Big[\{R - (C'(D_1)\}\{W_1 + kW_0[r - C'(D_0) - K'(D_0)\beta]\} \\ &+ p'(r)[C'(D_1) + K'(D_1)\beta][W_0(r - C'(D_0) - K'(D_0)\beta)]\Big] \\ &+ p(r)W_0[2kR - (2k-1)(C'(D_1) + K'(D_1)\beta) - H_{vv}] = \gamma_{vv}\end{aligned} \tag{20}$$

H_{vv} is described as:

$$H_{vv} = k(k-1)(C''(D_1) + K''(D_1)\beta)$$
$$[W_1 + (k-1)W_0[r - C'(D_0) - K'(D_0)\beta]].$$

Determining the point the regulation actually binds in period one and just binds in period two, shows the same maximization problem as above.

$$\max_r \quad \tilde{\pi}_{vv} = p(r)[(W_1 + D_1^o)R - C(D_1^o) - K(D_1^o)\beta]$$

We differentiate the maximization problem regarding the deposits ($\frac{\partial \tilde{\pi}_{vv}}{\partial D_1^o}$) and denote the deposits as the regulated ones:

$$R = C'(D_1) + K'(D_1)\beta \tag{21}$$

At this point, regulation just binds. Plugging (21) into Eq. (20), we get Equation (11):

$$\frac{(\frac{\partial \tilde{\pi}_{vv}}{\partial r})}{\partial k} = \gamma_{vv} = p'(r)RW_0[r - C'(D_0) - K'(D_0)\beta] + p(r)W_0[R - H_{vv}]$$

In the case ϕ_{vv} is negative, the sufficient condition for increased gambling behavior as k decreases is $R < H_{vv}$.

7.2 Calculation of F.O.C. and total derivative under the most stringent regulation

7.2.1 Default scenario

Calculating the Equation (13) for the most stringent regulation $k = 1$ and regarding the value of $W_1 = rkW_0 + D_0^s R_f - C(D_0) - (1 - \xi + \beta)\tau K(D_0) - K(D_0)\beta$, this yields an adjusted equation to compare gambling with the first best solution (eq: 4):

$$\frac{(\frac{\partial \tilde{\pi}_{ee}}{\partial r}|_{k=1})}{\partial r} = p'(r)\Bigg[\frac{R[D_0^s R_f - C(D_0) - (1 - \xi + \beta)\tau K(D_0) - K(D_0)\beta]}{W_0 R} + \frac{D_1^s R_f - C(D_1^o) - (1 - \xi + \beta)\tau K(D_1^o) - K(D_1^o)\beta}{W_0 R}\Bigg] + p'(r)r + p(r)$$

When $p(r)$ is concave, this equation compared with first best ($p'(r)r + p(r) = 0$) shows the risk under first best to be higher. Back to the original first order condition, we want to totally differentiate this first order condition with respect to r and τ, to determine the effect of a change in tax:

$$\begin{aligned}\frac{(\frac{\partial \tilde{\pi}_{ee}}{\partial r})}{\partial \tau} &= \omega_{ee} = p'(r)kR[-(1 - \xi + \beta)K(D_0)] \\ &+ p'(r)[(k-1)(1 - \xi + \beta)K(D_0)][C'(D_1) + (1 - \xi + \beta)\tau K'(D_1) + K'(D_1)\beta] \\ &- p'(r)(1 - \xi + \beta)K(D_1) \\ &+ p(r)W_0 k(k-1)^2(1 - \xi + \beta)K(D_0)[C''(D_1) + (1 - \xi + \beta)\tau K''(D_1) + K''(D_1)\beta] \\ &- p(r)W_0 k(k-1)(1 - \xi + \beta)K'(D_1)\end{aligned}$$

$$\frac{(\frac{\partial \tilde{\pi}_{ee}}{\partial r})}{\partial \tau} = \omega_{ee} = p'(r)(1-\xi+\beta)K(D_0)$$

$$[(k-1)(C'(D_1)+(1-\xi+\beta)\tau K'(D_1)+K'(D_1)\beta)-kR]$$

$$-p'(r)(1-\xi+\beta)K(D_1)-p(r)W_0k(k-1)(1-\xi+\beta)K'(D_1)$$

$$+p(r)W_0k(k-1)^2(1-\xi+\beta)K(D_0)$$

$$[C''(D_1)+(1-\xi+\beta)\tau K''(D_1)+K''(D_1)\beta]$$

$$\frac{(\frac{\partial \tilde{\pi}_{ee}}{\partial r})}{\partial \tau} = \omega_{ee} = -p'(r)(1-\xi+\beta)$$

$$\underbrace{[kRK(D_0)-(k-1)K(D_0)(C'(D_1)+(1-\xi+\beta)\tau K'(D_1)+K'(D_1)\beta)+K(D_1)]}_{>0,\text{ bei } R=C'(D_1)+(1-\xi+\beta)\tau K'(D_1)+K'(D_1)\beta}$$

$$-p(r)W_0k(k-1)(1-\xi+\beta)$$

$$[K'(D_1)-(k-1)K(D_0)[C''(D_1)+(1-\xi+\beta)\tau K''(D_1)+K''(D_1)\beta]$$

With a convex cost function and $p(r)$ being concave, this expression will be positive, since $[K'(D_1)-(k-1)K(D_0)[C''(D_1)+(1-\xi+\beta)\tau K''(D_1)+K''(D_1)\beta] < 0$. Therefore we have $\omega_{ee} > 0$ and banks' incentive to gamble decreases when decreasing the tax rate.

7.2.2 VAT in period two

Under VAT in period two and calculating the most stringent regulation, we examine Equation (16) with the same W_1 as in the default and $k = 1$:

$$\frac{(\frac{\partial \tilde{\pi}_{ev}}{\partial r}|_{k=1})}{\partial r} = p'(r)r + p'(r)\bigg[\frac{R[D_0^s R_f - C(D_0) - (1-\xi+\beta)\tau K(D_0) - K(D_0)\beta]}{W_0 R} + \frac{D_1^s R_f - C(D_1^o) - K(D_1^o)\beta}{W_0 R}\bigg] + p(r) = 0$$

Compared with first best, gambling under VAT in the second period is smaller than in first best.

Back to the original first order condition (16), we want to totally differentiate this first order condition with respect to r and τ, to determine the effect of a change in tax:

$$\frac{(\frac{\partial \tilde{\pi}_{ev}}{\partial r})}{\partial \tau} = \omega_{ev} = -p'(r)kR[(1-\xi+\beta)K(D_0)]$$
$$+p'(r)[(k-1)(1-\xi+\beta)K(D_0)][C'(D_1) + K'(D_1)\beta]$$
$$+p(r)W_0 k(k-1)^2(1-\xi+\beta)K(D_0)[C''(D_1) + K''(D_1)\beta]$$

$$\frac{(\frac{\partial \tilde{\pi}_{ev}}{\partial r})}{\partial \tau} = \omega_{ev} = -p'(r)K(D_0)(1-\xi+\beta)\underbrace{[kR - (k-1)(C'(D_1) + K'(D_1)\beta)]}_{>0,\text{ bei } R = C'(D_1)+K'(D_1)\beta} + \underbrace{p(r)W_0 k(k-1)^2(1-\xi+\beta)K(D_0)[C''(D_1) + K''(D_1)\beta]}_{>0}$$

We have $\omega_{ev} > 0$ and incentives in gambling decreases when decreasing the tax rate.

7.2.3 VAT in both periods

Analogous for Equation (19), we calculate gambling under VAT in both periods, with adjusted W_1, $k = 1$ and end up with incentives to gamble smaller than efficient.

$$\frac{\left(\frac{\partial \tilde{\pi}_{vv}}{\partial r}|_{k=1}\right)}{\partial r} = p'(r)r + p(r) + p'(r)\Bigg[\frac{R[D_0^s R_f - C(D_0) - K(D_0)\beta]}{W_0 R} + \frac{D_1^s R_f - C(D_1^o) - K(D_1^o)\beta}{W_0 R}\Bigg] = 0$$

Now we want to totally differentiate this first order condition with respect to r and τ, to determine the effect of a change in tax:

$$\frac{\left(\frac{\partial \tilde{\pi}_{vv}}{\partial r}\right)}{\partial \tau} = \omega_{vv} = 0$$

There is no effect of a change in tax.

References

Admati, A. R.; DeMarzo, P. M.; Hellwig, M. F.; Pfleiderer, P. C. (2013): "Fallacies, Irrelevant Facts, and Myths in the Discussion of Capital Regulation: Why Bank Equity is Not Socially Expensive", Stanford University Working Paper No.161.

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

Avi-Yonah, R. S. (2010): "Designing a Federal VAT: Summary and Recommendations", *Tax Law Review*, 63: 285-300.

Blum, J. (1999): "Do capital adequacy requirements reduce risks in banking?", *Journal of Banking & Finance*, 23(5): 755-771.

Calem, P.; Rob, R. (1999): "The Impact of Capital-Based Regulation on Bank Risk-Taking", *Journal of Financial Intermediation*, 8(4): 317-352.

Chaudhry, S. M.; Mullineux, A.; Agarwal, N. (2015): "Balancing the regulation and taxation of banking", *International Review of Financial Analysis*, 42: 38-52.

Chia, N.; Whalley, J. (1999): "The Tax Treatment of Financial Intermediation", *Journal of Money, Credit and Banking*, 31(4): 704-719.

Cordella, T.; Yeyati, E. L. (2002): "Financial opening, deposit insurance, and risk in a model of banking competition", *European Economic Review*, 46(3): 471-485.

De La Feria, R.; Lockwood, B. (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.

De Nicoló, G.; Gamba, A.; Lucchetta, M. (2012): "Capital Regulation, Liquidity Requirements and Taxation in a Dynamic Model of Banking", IMF Working Paper 12/72.

Gottfried, P.; Wiegard, W. (1991): "Exemption versus zero rating: A hidden problem of VAT", *Journal of Public Economics*, 46(3): 307-328.

Grubert, H.; Mackie, J. (2000): "Must Financial Services be Taxed Under a Consumption Tax?", *National Tax Journal*, 53(1): 23-40.

Haq, M.; Heaney, R. (2012): "Factors determining European bank risk", *Journal of International Financial Markets, Institutions and Money*, 22(4): 696-718.

Hellwig, M. F. (1995): "Systemic Aspects of risk management", *Swiss Journal of Economics and Statistics*, 131(4/2): 723-737.

Hellwig, M. F. (2010): "Capital Regulation after the Crisis: Business as Usual?", Working Paper No. 2010/31. Max Planck Institute for Reasearch on Collective Goods.

Hughes, J. P.; Mester, L. J. (1993): "A quality and risk-adjusted cost function for banks: Evidence on the "too-big-to-fail"doctrine", *Journal of Productivity Analysis*, 4(3): 293-315.

Huizinga, H.; Claessens, S.; Morton, F. S. (2002): "A European VAT on Financial Services?", *Economic Policy*, 17(35): 499-534.

Jack, W. (2000): "The Treatment of Financial Services under a Broad-Based Consumption Tax", *National Tax Journal*, 53(4): 841-852.

Keen, M. (2011): "Rethinking the Taxation of the Financial Sector", *CESifo Economic Studies*, 57(1): 1-24.

Koehn, M.; Santomero, A. M. (1980): "Regulation of Bank Capital and Portfolio Risk", *The Journal of Finance*, 35(5): 1235-1244.

Laeven, L.; Levine, R. (2009): "Bank governance, regulation and risk taking", *Journal of Financial Economics*, 93(2): 259-275.

Miles, D.; Yang, J.; Marcheggiano, G. (2013): "Optimal Bank Capital", *The Economic Journal*, 123(567): 1-37.

Mirrlees, J. A.; Adam, S.; Besley, T.; Blundell, R.; Bond, S.; Chote, R.; Gammie, M.; Johnson, P.; Myles, G.; Poterba, J. (Eds.) (2010): "Dimensions of tax design. The Mirrlees Review", Oxford University Press.

Repullo, R. (2004): "Capital requirements, market power, and risk-taking in banking", *Journal of Financial Intermediation*, 13(2): 156-182.

Rousslang, D. J. (2002): "Should Financial Services be Taxed Under a Consumption Tax? Probably", *National Tax Journal*, 55(2): 281-291.