National Accounting Review

http://www.aimspress.com/journal/NAR

Research article

VAT experience as an influence on banking crises

Guillermo Peña*

Department of Public Economics, Universidad de Zaragoza, 250005, Zaragoza, Spain

* Correspondence: Email: gpenablasco@gmail.com; Tel: +679550633.

Abstract: GST/VAT influences the economy by several channels. VAT does not fully apply to financial services, or these services are usually exempt on the tax, which leads to inefficiencies and could encourage banking crises. This paper employs a dataset of 36 EU and OECD countries for the period 1970–2011 and estimates panel probability models to empirically test the importance of VAT experience in banking crises. An increase of the risk of banking crises is correlated with VAT experience, as empirically checked. Therefore, GST/VAT reforms could pass by fully taxing the value added of financial services. This paper is useful for academicians, policy makers and practitioners.

Keywords: banking crisis; VAT; financial services; trade

JEL Codes: G01, H25, G21, F19, F38

1. Introduction

All countries with Value-Added Tax (VAT), exempting financial services or not, permit a different treatment of financial sector under existing VATs, which sometimes, if not always, exacerbates the risk of the sector becoming excessively large (IMF, 2011). This has recently led to banking crises as the Global Financial Crisis (GFC), and after that economic recessions, as the Great Recession (GR). Due to this, international institutions as the IMF (2011) have advocated for applying more efficient taxes that improve the current treatment of financial services under VAT. Nonetheless and motivated by technical difficulties, there is still no country in which financial services were correctly dealt on VAT as the rest of goods and services. For instance, at New Zealand input VAT credits are allowed, but there is no positive tax rate on these services (Lopez-Laborda and Peña, 2017b). Nonetheless, there are some practical alternatives that allow the full taxation of financial services under

VAT (Lopez-Laborda and Peña, 2018), which are recently taken into account in some technical reports from this country[1].

This paper aims to shed further light on the influence of current VATs and Goods and Services Taxes (GSTs) on the unchaining of banking crises, analysing the transmission channels and providing policy measures. A positive influence of the VAT experience on crises is observed, via inflation and via exemption of financial services on VAT. A dataset of 36 European Union (EU) and Organisation for Economic Co-operation and Development (OECD) countries for the period 1970–2011 to study the importance of VAT experience on banking crises, a relationship not empirically studied before as far as we know. Panel logit probability models with population-averaged and random effects are developed, capturing the most relevant crisis determinants in the literature.

The rest of the paper is divided into five sections. The second section contains the theoretical expectations of the influence of VAT experience on banking crises and develops the literature review of the determinants of these crises. The third section explains data and methodology, using multivariate panel data models. The empirical results are provided in the fourth section. The main result is the corroboration of the significant and robust positive impact of VAT experience on the likelihood of a banking crisis. The fifth section discusses the results and provides conclusions and final remarks.

2.   Expected influence of VAT experience on banking crises

There are two main effects of current VAT systems on banking crises. First, the widening of trade commerce by the establishment of VATs as substitutes of other taxes more distortionary and harmful for trading. Second, the recent GFC has taught economists the importance of systemic risk in these crises. An asymmetric treatment of the several productive sectors of goods and services, as occurs with the financial sector on VAT, encourages banking crises. The exemption of financial services on VAT leads to the unrecoverability of the input VAT on banking purchases, increasing the prices of the real products due to a cascading effect. This last effect, join together with an increase of the price of goods and services due to VAT implementation, could unchain a rise in inflation, which may influence in reducing consumption, credit demand, bank profits and finally, triggering a banking crisis.

The first reason is that VAT experience could increase trade commerce, and this rise leads to a higher exposure to banking crises (Rose and Spiegel, 2010, 2011). Trade commerce could be positively influenced by VAT experience because distortionary taxes that discourages trading are substituted by pro-exporting VAT. If a country turns to be trading-dependent because of the trading increase, an international financial crisis as the GFC would affect in a major sense than countries without external contact (and therefore, less abroad dependents and more self-sufficient). Many authors consider trade openness as determinant for currency crises, although some others find the opposite effect (Cavallo and Frankel, 2008). In fact, according to Haddad et al. (2013), there are other factors as export diversification conditions that could mitigate the effect of trade openness on economic growth volatility. So, the sign of this first effect is not fully clear.

---

[1] A document entitled "Taxing financial services" has been prepared by the Tax Working Group Secretariat (2018) of New Zealand as request for advice on options for applying Good and Services Tax (GST, national Value Added Tax, VAT, on that country) to financial services. It studies methods of taxation, considering Lopez-Laborda and Peña (2018) proposal as a simpler way to avoid technical difficulties in the full taxation of financial services on VAT.

The second reason is the distortion that produces the absence of a full taxation of financial services on VAT with compatibility with the credit-invoice method of standard VAT, mainly due to the complexity and difficulty in implementing a feasible taxation in a transaction-by-transaction basis (Lopez-Laborda & Peña, 2018). As mentioned before, the unrecoverability of the VAT levied to the inputs for banks could lead to banking crises. The next theoretical explanation is based on the assumption that the probability of a banking crisis (Φ) negatively depends on banking profits (Π_b).

According to Lopez-Laborda and Peña (2018), financial value added could be obtained by the addition (sum of profits and wages) and subtraction (difference between sells and purchases). The exemption of financial services on VAT leads to an additional "purchase": the unrecoverable input VAT, so separately considering value added of the main banking services, i.e. loans (l) and deposits (d):

$$\Pi_l + w_l = IR - \varepsilon - (1+\tau)IC_l$$
$$\Pi_d + w_d = \varepsilon - IP - (1+\tau)IC_d \tag{1}$$

where w are the wages, IR and IP are the interest receipts and payments, respectively, ε are the public bonds hold by Banks, which reflect the "pure" interest, IC are the input costs and τ is the rate of general VAT, which is related with VAT experience. The total amounts are reflected by the "b" subscript in the next equation that reflects total banking profits:

$$\Pi_b = IR - IP - (1+\tau)IC_b - w_b \tag{2}$$

For analysing the effect of VAT experience on banking crises, the derivative of bank profits respect to the VAT rate is calculated, obtaining:

$$\frac{\partial \Pi_b}{\partial \tau} = -IC_b < 0 \Rightarrow \frac{\partial \Phi}{\partial \tau} > 0 \tag{3}$$

Which theoretically confirms the expectations that VAT experience positively influences on banking crises through the channel of VAT exemption of financial services. This paper aims to fulfil a hole in the banking crises literature regarding the influence of tax factors as VAT on banking crises.

Recently, several studies in the literature have aimed to explain banking crises (Peña, 2016), while the financial, domestic and credit determinants of banking crises have been well established, the literature has typically avoided the study of tax factors related with the financial institutions as influences on these crises.[2] Gavin & Haussmann (1996) provide theoretically a seminal study of the main factors that trigger a banking crisis, related to liberalization, banking competition, regulation of deposit interest rates, information, macroeconomic volatility, capital assets ratio, bank liquidity, monetary policy and lending booms, but there is no focus on determinants related to the tax system applied to financial entities.

Most of the studies use binary variables reflecting the presence of a banking crises, as Nocetti (2006) shows stating the importance of the use of probit or logit models to identify economic weaknesses and anticipate crises. After the seminal paper, Demirguc-Kunt & Detragiache (1998) captured new determinants as the rate of growth of real Gross Domestic Product (GDP), the external terms of trade and

---

[2] Boudriga & Ghardallou (2012) provide a good review of the literature of banking crisis determinants.

the real short-term interest rate, short-term real interest rates, financial liberalization, included by the ratio of credit to the private sector to GDP (Peña, 2017a), and the rate of depreciation of the exchange rate.

Other studies mainly focus on financial or domestic and commercial variables, such as Hardy and Pazarbasioglu (1999), who include consumption and investment variables as explanatory variables, observing that consumption booms in the years previous to a crisis can be a good predictor of banking crises. These authors state that "banking crises are associated with a sharp decline in the real effective exchange rate, but an appreciation in this rate often precedes a crisis". Rose & Spiegel (2010, 2011) include exports/GDP ratio as a factor of a financial crisis. Finally, Boudriga & Ghardallou (2012) find that deterioration in competitiveness is associated with an increased risk of problems in the banking sector. In contrast to this paper, none of all these authors theoretically analyses the possible interacted effects of domestic and commercial variables with tax factors on the triggering of a crisis.

Regarding financial variables, Beck, Demirgüç-Kunt & Levine (2006), find that bank concentration increases banking crisis probability, and Büyükkarabacak & Valev (2010) differentiate private credit from household and enterprise credit. Financial variables can also have international channels of transmission. For instance, Ye & Han (2010) show that financial contagion decreases with geographical distance from the United States, which was the centre of the 2008 subprime mortgage crisis, and that the closer the distance to that centre, the greater the effect. More recently, Cesa-Bianchi et al. (2019) obtain that, even taking into account domestic loans, credit growth in the other countries has a relevant and positive effect on the likely of banking crises in the specific country. Pedro et al. (2018) specify the financial contagion among countries of the same region and from G7 countries to others. Nevertheless, none of these specifications combines the presence of the largest economic powers with G7 countries in a diversified manner.

Finally, Demirguc-Kunt & Detragiache (1998) include government surplus as a percentage of GDP, used to capture the financial needs of the public administration, but without entering into the impact of the source of revenues for the public administration. They provide two reasons: first, a high surplus involves postponing measures to strengthen bank balance sheets, and second, a failure to control the budget deficit is an impediment to successful financial liberalization, which creates problems for banks. The last relevant variable is the ratio of bank cash and reserves to bank assets. Nonetheless, these authors do not go further in the analysis of the public sector regarding the connections with other variables, as Peña (2017b) does by studying the negative interacted effect of income inequality and public surplus on banking crises. Another recent study carried out by Sosa-Padilla (2018), finds three connections between banking crises and sovereign defaults, observing they usually happen at the same time, the high amount of public debt the banks holds, and the effect of these defaults on higher bank credit and GDP crushes.

The importance of income inequality on banking crises has already been theoretically explained before Peña (2017b) by Claessens & Perotti (2007), Rajan (2010) and Kumhof & Rancière (2011) who propose that an increment in inequality led to a credit boom and finally to a financial crisis in the USA at the beginning of the 21st century, as it did in the 1920s. Krugman (2007) focuses on the extension of bad loans by the private sector, whereas Rajan (2010) highlights the role of the government through its agents. For the determinants of the financial crisis of 2008, Wisman (2013) considers that income inequality, jointly with wage stagnation, generated three dynamics that made the economy vulnerable to crisis.

Icaviello (2008) finds that the long run rise in household debt is explained by higher income inequality, while Roy and Kemme (2012) use the difference of the average productivity and the real wage rate as a measure of income inequality. They also find that the rise of income inequality also contributes to global financial crises.

Finally, as far as we know, the topic of the impact of the VAT experience in a country, measured as the number of years in which a country has settled VAT, on the likelihood of a crisis, is a no dealt issue.

3. Data sample and methodology

In order to check the above-mentioned relationship, binary econometrical models are estimated, including the most relevant determinants from the seen at the previous section.

Our dependent variable of all the econometric models, *crisis*, is available in the World Bank according to Laeven & Valencia (2013), and represents a dummy variable that is one if the country is experiencing a systemic banking crisis and zero if not.[3] Equations are estimated using a population-averaged and random effects panel logit probability model, as Büyükkarabacak & Valev did (2010)[4].

$$\text{logit } \Pr\left(Y_{it} = 1 \mid X_{it}\right) = \alpha^* + \beta^* X_{it} \tag{4}$$

where Y_{it} represents the dependent variable *crisis*,[5] X_{it} the explanatory variables, β^* the shift in the logit of the proportion with $Y = 1$ for a raise in X of a unit and α^* is the constant.

The employed model is the logit probability model. Other ones as probit probability models have been tried to use, but some conditions for those models as normality were not fulfilled.

Panel data is used, specifically, an unbalanced panel[6] from the year 1970 to 2011 for 36 countries, all the EU (27) and OECD countries (including New Zealand) with the exceptions of Switzerland, Cyprus, Romania and Malta. Table 1 gives some basic information about data.

---

[3] According to the World Bank, "a banking crisis is defined as systemic if two conditions are met: a. Significant signs of financial distress in the banking system (as indicated bysignificant bank runs, losses in the banking system, and/or bank liquidations), b. Significant banking policy intervention measures in response to significant losses in the banking system"

[4] As these authors state, for a detailed description of the population-averaged model, see Zeger et al. (1988), Neuhuas et al. (1991), and Wooldridge (2002).

[5] The crisis variable is limited to the Laeven & Valencia (2013) sample, so its threshold is data until 2011. Studying alternative explained variables regarding the presence of economic crises, which could be binary variables based on the growth of the GDP may improve the number of observations, but this try is not close to the targets of the paper.

[6] Unbalanced data usually lead to less consistent estimations, nonetheless, robustness checks applied to the results could partially solve this problem.

Table 1. Countries and years in the sample.

Years: 52	Countries: 36
1970–2011	Australia, Austria, Belgium, Bulgaria, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Iceland, Israel, Italy, Japan, Korea, Luxembourg, Latvia, Mexico, Lithuania, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Turkey, United Kingdom, United States.

Note: Source: By the authors.

The explanatory variables used in this paper are the main determinants of banking crises that do not present multicollinearity problems, in addition to our target variables. Some variables are lagged in order to avoid simultaneously problems (Büyükkarabacak & Valev, 2010). The main characteristics of the variables are summed up in Table 2.

The main determinants of financial crises used in this paper are: *gdppc*, which is the annual percentage variation rate of Gross Domestic Product (GDP) per capita using constant local currency and aggregated by constant 2010 US dollars. The population is calculated at midyear. The *exch* variable is the official exchange rate (national currency unity per US$, average for a period). A real exchange rate appreciation affects the competitiveness of the economy and leads to a deterioration in the profitability of the corporate sector leading to financial crisis.

Table 2. Summary statistics.

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
crisis	1512	0.101	0.301	0.000	1.000
gdppc	1331	2.434	3.653	−31.178	17.557
exch	1205	94.827	253.747	0.00001	1909.439
lerner	535	0.185	0.118	−1.609	0.503
infl	1272	12.538	42.818	−4.480	1058.374
dist	1512	9.844	0.250	9.653	10.670
surplus	541	-1.469	4.356	−29.420	20.010
exp	1512	10.368	11.57	0.000	43
exe	1512	0.865	0.341	0.000	1.000

The *lerner* variable is the Lerner index, a measurement of banking competition that compares output pricing and marginal costs (that is, the mark-up) in the banking market: an increase in the Lerner index indicates a deterioration in the competitive conduct of financial intermediaries. A low banking competition provokes banking concentration and this generates systemic risk, which is involved in crises. The variable *infl*, which is inflation, is measured by the consumer price index and reflects the annual variation of the cost of a shopping basket for a customer. A lower inflation usually indicates a more stable economy, and then, less exposed to banking shocks. The logarithm of the sum

of the bilateral distance of a country to the USA, Japan and France[7] is measured by *dist*, in order to capture the contagion effect (Pedro et al., 2018), i.e. geographical contagion of a crisis. A nearer distance with these three economic potencies could mean a higher level of contagion of financial crises. The budget surplus is measured by *surplus*, public cash surplus or deficit is revenue (including grants) minus expense, minus net acquisition of nonfinancial assets. In general terms, a higher surplus involves postponing measures to strengthen bank balance sheets and is an impediment to successful financial liberalization, which creates problems for banks. Both effects provoke banking crises. Table 3 shows the years when *crisis* takes the value one.

Table 3. Years of banking crisis according to the variable *crisis*.

Country	Years within a banking crisis	Country	Years within a banking crisis	Country	Years within a banking crisis
Australia	0	Greece	2008–2011	Netherlands	2008–2011
Austria	2008–2011	Hungary	1991–1995, 2008–2011	New Zealand	0
Belgium	2008–2011	Ireland	2008–2011	Norway	1991–1993
Bulgaria	1996–1997	Island	2008–2011	Poland	1992–1994
Canada	0	Israel	1977	Portugal	2008–2011
Chile	1976, 1981–1985	Italy	2008–2011	Slovak republic	1998–2002
Czech republic	1996–2000	Japan	1997–2002	Slovenia	1992, 2008–2011
Denmark	2008–2011	Korea	1997–1998	Spain	1977–1981, 2008–2011
Estonia	1992–1994	Luxembourg	2008–2011	Sweden	1991–1995, 2008–2011
Finland	1991–1995	Latvia	1995–1996, 2008–2011	Turkey	1982–1984, 2000–2001
France	2008–2011	Mexico	1981–1985, 1994–1996	UK	2007–2011
Germany	2008–2011	Lithuania	1995–1996	USA	1988, 2007–2012

Finally, the novelty is our target variable, *exp*, which reflects the VAT experience of a country lagged two years, which is the accumulation of years since a country adopted VAT. A positive impact on the likelihood of a banking crisis is expected, according to the second section. In addition,

---

[7] According to IMF (2019), USA was the first economic power in Gross Domestic Product (GDP) at current prices, China, from Asia, was the second largest power of the world, and from the same continent Japan was the second largest Asian economy. The next economic potency of another continent was Germany, and France was the third biggest economy of the European continent. The criteria followed in this paper has been to choose the first, the second and the third potency from the three continents of the sample: America, Europe and Asia-Oceania. The continents are ordered by the same order the first representative for each continent appears in the classification: first in the classification to appear is America, so the first potency of this continent, secondly is Asia, so the second potency of this continent, Japan, is employed, and finally France is the third potency of the third continent to appear in the ranking. By doing so, the selected economic potencies of contagion are combines of G7 countries (Pedro et al., 2018) diversified among the biggest economies (Ye & Han, 2010) for each continent.

the interaction between the target variable and *exe*, and the former with *infl*, on the one side, and the interaction among these three variables is studied, reflecting the influence of the experience of VAT via exemption of the financial services on VAT (*exe*), via inflation (*infl*), and via both of them, expecting a positive impact on banking crises as explained at Section 2. The exemption variable is binary, taking the value one whether there is exemption of financial services on VAT and zero otherwise, calculated as one minus the presence of financial VAT in a country.

VAT experience is lagged for two periods, to minimize simultaneity problems (Büyükkarabacak & Valev, 2010). Data were obtained from the World Bank Database, except *exe*, which the author obtained from the Lopez-Laborda and Peña (2017a, 2017b) tables and database, *exp*, obtained from different sources, and *dist*, obtained from the GeoDist Database (Mayer & Zignago, 2011). In Table 4 we can see the name of the variable with the respective source, and expected sign of the coefficients of our variables with its references, based on the arguments in Section 2. Table 5 shows the correlation matrix.

Table 4. Expected signs of the variable coefficients.

Variable	Sign	Variable	Sign	Variable	Sign
gdppc	-	*infl*	+	*exp*	+
exch	+	*dist*	-	*exp*exe*	+
lerner	+	*surplus*	-	*exp*infl*	+
				exp*exe*infl	+

Table 5. Correlation matrix of independent variables.

	crisis	*gdppc*	*exch*	*lerner*	*infl*	*dist*	*surplus*	*exp*	*exe*
crisis	1								
gdppc	−0.330	1							
exch	−0.009	0.030	1						
lerner	−0.052	0.072	0.162	1					
infl	0.141	0.095	0.050	−0.047	1				
dist	−0.137	−0.080	0.088	−0.072	−0.056	1			
surplus	−0.225	0.158	0.023	0.168	−0.089	0.042	1		
exp	0.090	−0.246	0.115	0.192	−0.321	−0.145	0.261	1	
exe	0.152	0.051	0.147	0.160	0.065	−0.427[ii]	−0.032	0.058	1

Note: i: Other variables have been tested, but they have been eliminated due to multicollinearity.

ii: The correlation is more than 0.3, suggesting that a multicollinearity test (e.g. VIF) should be conducted to check the presence of multicollinearity among these variables. The VIF is 1, and the 1/VIF, 0.999811, being far from multicollineality.

4. Empirical results

The main findings of the paper are summarized in Tables 6 and 7, which show the effects of the variables on the likelihood of a banking crisis. The models are estimated following the population-averaged (Table 6) and the random-effects (Table 7) panel logit probability model.

Models *a* and *b* from Tables 6 and 7 include population-averaged and random effects logit panel data estimations, respectively, where Models (I) include all the main explanatory variables previously known in the literature, without including the variable VAT experience. Models (II-V)

include consecutively the *exp* variable and the interacted variables *exp*exe*, *exp*infl* and *exp*exe*infl*, reflecting the target variable and the respective channels of transmission of VAT experience to banking crisis. This means that the longer the country levies under VAT, the higher the likelihood of a banking crisis, as expected via increases of prices, or exemption of financials services on VAT, or both of them, could leading to lower credit demand and lower banking profits.

The following impacts are statistically significant on encouraging a banking crisis: *infl*, so a high economic volatility is detrimental for banking stability, and the target variable with the three channels of transmission. The reason is the statistically significance of the positive coefficients of their respective variables. On the other hand, the following variables discourages the unchain of banking crises *gdppc*, which means that an economy with stronger economic growth is less exposed to a banking crisis, *lerner*, therefore a higher competitive banking sector leads to crises, which was not expected by the previous section (Table 4), but could be explained by considering a higher concentrated financial sector is more efficient and stronger and more robust for affording a banking crisis. A higher distance to USA, France and Japan reduces the probability of a banking crisis and the *surplus* variable is also beneficial for avoiding banking crises, as the statistical and economic significance of the negative coefficients of the variable show. The rest of the variables obtain a statistical significance lower than 10%.

Table 6. Estimated population averaged logit models.

Dependent variable: *crisis*	Model Ia		Model IIa		Model IIIa		Model IVa		Model Va	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
gdppc	−0.221***	0.000	−0.187***	0.000	−0.207***	0.000	−0.202***	0.000	−0.208***	0.000
exch	−0.00001	0.890	−0.0003	0.740	−0.001	0.587	−0.0003	0.755	−0.0004	0.628
lerner	−0.809	0.734	−2.628	0.291	−3.804	0.128	−1.496	0.545	−1.862	0.462
infl	0.104**	0.034	0.154***	0.005	0.162***	0.004	0.024	0.744	−0.008	0.916
dist	−0.229***	0.000	−0.382***	0.000	−0.390***	0.000	−0.239***	0.000	−0.242***	0.000
surplus	−0.132**	0.040	−0.144**	0.026	−0.153**	0.019	−0.120*	0.057	−0.117*	0.062
exp			0.081***	0.008						
exp*exe					0.102***	0.000				
exp*infl							0.010*	0.086		
exp*exe*infl									0.015***	0.008
No observations	305		305		305		305		305	
Wald	62.92		47.95		45.77		57.71		56.27	
Wald p-value	0		0		0		0		0	

Note: * Significance level of 10%, ** significance level of 5%, *** significance level of 1%.

Table 7. Robustness check: estimated random effects logit models.

Dependent variable: crisis	Model Ib		Model IIb		Model IIIb		Model IVb		Model Vb	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
gdppc	−0.372 ***	0.000	−0.347 ***	0.001	−0.362 ***	0.000	−0.379 ***	0.000	−0.368 ***	0.000
exch	0.0004	0.829	−0.0003	0.907	−0.001	0.730	−0.0001	0.954	−0.0003	0.871
lerner	−3.954	0.220	−10.946 **	0.024	−10.970 **	0.019	−5.714	0.118	−5.783	0.115
infl	0.132*	0.067	0.264***	0.004	0.263***	0.004	0.019	0.835	0.006	0.948
dist	−0.403 ***	0.001	−0.904 ***	0.000	−0.787 ***	0.001	−0.472 ***	0.001	−0.436 ***	0.001
surplus	−0.173 *	0.061	−0.212**	0.041	−0.218**	0.035	−0.157	0.106	−0.160*	0.096
exp			0.227***	0.005						
exp*exe					0.233***	0.003				
exp*infl							0.021**	0.022		
exp*exe*infl									0.024***	0.008
No observations	305		305		305		305		305	
Wald	26.77		31.12		26.31		25.83		25.72	
Wald p-value	0		0		0		0		0	

Note: * Significance level of 10%, ** significance level of 5%, *** significance level of 1%.

Models from Table 7 aim to check the robustness of the estimations by applying random effects logit models, instead of population averaged, keeping other factors constant. Results from Table 7 are similar to those from Table 6, with the exception of the *lerner* variable, with a statistical significance on some models of Table 7 but none from Table 6. It is relevant to highlight that possible endogenous issues on the estimation of the models can be diluted by having in mind that usually VATs are implemented for tax collection, trading and efficient purposes, but nor for avoiding banking crises, so the endogenous issue in this case would be mitigated taking into account the exogenous features of VAT related to banking crises.

5. Discussion, policy measures and concluding remarks

A significant and robust positive influence of VAT experience on the banking crisis risk can be observed. This result confirms our theoretical expectations that time experience with current VATs and GSTs could trigger banking crises. This positive impact of VAT experience on crises is theoretically obtained by studying how bank profits decrease with the VAT exemption on financial services through higher input costs. This unrecoverable VAT on inputs is passed through to the consumers via prices, increasing inflation as well as by the implementation of VAT, and leading to a higher probability of banking crises. This two transmission channels, via exemption and inflation, and the joint interaction of both channels, are also empirically corroborated on the positive coefficient of all these variables. Another theoretical expectation, with a lack of empirical

corroboration in this paper, is the link between inflation and banking crises via lower credit demand, and so, lower bank profits.

The implications for researchers and practitioners are, on the one side, showing some weaknesses of the current VAT regimes, which could trigger banking crises, and on the other side, suggesting the need of avoiding the current VAT exemptions of financial services, because it could partially solve the shown negative effects on crises derived from the inefficiencies of not allowing banks to recover their input VATs. Having in mind the difficulty of taxing financial services on indirect taxes in a transaction-by-transaction basis, the solution could be to apply approximately accurate, but feasible, ways of taxation of this kind of services on VAT/GST. An example is the mobile ratio method proposed by Lopez-Laborda and Peña (2018), where the same proportion of financial margin, calculated by an addition basis, is applied for each transaction of the same entity at the same quarter, directly taxing this amount and the explicit fees and commissions. Another possible solution would be applying Financial Activity Taxes (FATs) or direct taxes on value added as applied at Norway.

Further research could include to analyse not only banking crises but also economic crises, for instance considering as explained a binary variable taking one if GDP is falling two consecutive years, contributing a new and more updated database for economic instead of banking crises. As explanatory variables for the contagion effect could also be used the first potencies of the three continents of the sample. Furthermore, it would be worth to research the empirical check of the impact on banking or economic crises for the proposed alternatives to the current status of VAT, i.e. fully taxing financial services, for example, by applying the mobile ratio method on VAT, increasing the participation of direct taxes on tax collection or applying initiatives as the Norwegian experience, where financial services have been fully, or at least higher, taxed by increasing the income and business taxes.

This paper provides further evidence on banking crises determinants: the positive and significant relationship between VATs/GSTs and the likelihood of a banking crisis. The impact of current VAT systems on banking crunches has been analysed and policy measures have been provided in order to decrease the risk of a banking crisis. Using a sample of 36 countries from the EU and OECD during 42 years for 1970-2011 and binary panel logit econometrical models, a robust significance of the positive influence of VAT experience on banking crises is found, corroborating our theoretical expectations, based on the influence of the trade exposure of countries with VAT and the inefficiencies of not fully taxing financial services on VAT. A reform of the current VAT and GST systems reducing the impact of VAT regimes on the likelihood on banking crises, for instance fully taxing the value added of financial services on these taxes as IMF (2011) suggests, would be beneficial for economic efficiency and for the avoidance of crises.

Acknowledgments

Conflict of interest

The author declares no conflicts of interest in this paper.

References

Beck T, Demirgüç-Kunt A, Levine R (2006) Bank concentration, competition, and crises: First results. *J Bank Financ* 30: 1581–1603.

Boudriga A, Ghardallou W (2012) The Determinants of Banking Crises: The Case of the 2008 Worldwide Financial Crisis. In *29th International Conference of the French Finance Association* (AFFI).

Büyükkarabacak B, Valev NT (2010) The role of household and business credit in banking crises. *J Bank Financ* 34: 1247–1256.

Cavallo EA, Frankel JA (2008) Does openness to trade make countries more vulnerable to sudden stops, or less? Using gravity to establish causality. *J Int Money Financ* 27: 1430–1452.

Cesa-Bianchi A, Martin FE, Thwaites G (2019) Foreign booms, domestic busts: The global dimension of banking crises. *J Financ Intermed* 37: 58–74.

Claessens S, Perotti E (2007) Finance and inequality: Channels and evidence. *J Comp Econ* 35: 748–773.

Demirguc-Kunt A, Detragiache E (1998) The determinants of banking crises in developing and developed countries. *IMF Econ Rev* 45: 81.

Gavin M, Hausmann R (1996) The Roots of Banking Crises: The Macroeconomic Context. Working Paper, Inter-American Development Bank, Office of the Chief Economist, No. 318.

Haddad M, Lim JJ, Pancaro C, et al. (2013) Trade openness reduces growth volatility when countries are well diversified. *Can J Econ/Revue canadienne d'économique* 46: 765–790.

Hardy D, Pazarbaşioğlu C (1999) Determinants and Leading Indicators of Banking Crises: Further Evidence. *IMF Econ Rev* 46: 247.

Icaviello M (2008) Household debt and income inequality: 1963–2003. *J Money Credit Bank* 40: 929–965.

IMF (2010) *A Fair and Substantial Contribution by the Financial Sector: Final Report for the G20.*

IMF (2019) World Economic Outlook Database.

Krugman P (2007) *The conscience of a liberal*, New York: W. W. Norton & Company (Chapter 12).

Kumhof M, Rancière R, Winant P (2015) Inequality, leverage, and crises. *Am Econ Rev* 105: 1217–1245.

Laeven L, Valencia F (2013) Systemic banking crises database: an update. Macroeconomic Context. Working Paper, Inter-American Development Bank, 318

López-Laborda J, Peña G (2017a) Does financial VAT affect the size of the financial sector. *Econ: Open-Access, Open-Assessment E-J* 11: 1–28.

López-Laborda J, Peña G (2017b) International Practices of Financial VAT. *Int VAT Monitor* 28: 457–465.

López-Laborda J, Peña G (2018) A New Method for Applying VAT to Financial Services. *Nat Tax J* 71: 155–182.

Mayer T, Zignago S (2011) Notes on CEPII's distances measures: the GeoDist Database. CEPII Working Paper 2011–25.

Neuhuas JM, Kalbfleisch JD, Hauck WW (1991) A comparison of cluster-specific and population averaged approaches for analyzing correlated binary data. *Int Stat Rev* 59: 25–35.

Nocetti D (2006) Central bank's value at risk and financial crises: an application to the 2001 Argentine crisis. *J Appl Econ* 9: 381–402.

Pedro CP, Ramalho JJ, da Silva JV (2018) The main determinants of banking crises in OECD countries. *Rev World Econ* 154: 203–227.

Peña G (2016) The determinants of banking crises: Further evidence. MPRA Working Paper n °70093.

Peña G (2017a) Money, Lending and Banking Crises. *Econ Pap J Appl Econ Policy* 36: 444–458.

Peña G (2017b) Income inequality, fiscal consolidation and banking crises.

Rajan R (2010) *Fault Lines*, Princeton University Press, Princeton, NJ.

Rose AK, Spiegel MM (2010) Cross-Country Causes and Consequences of the 2008 Crisis: International Linkages and American Exposure. *Pacific Econ Rev* 15: 340–363.

Rose AK, Spiegel MM (2011) Cross-country causes and consequences of the crisis: An update. *Eur Econ Rev* 55: 309–324.

Roy S, Kemme DM (2012) Causes of banking crises: Deregulation, credit booms and asset bubbles, then and now. *Int Rev Econ Financ* 24: 270–294.

Sosa-Padilla C (2018) Sovereign defaults and banking crises. *J Monetary Econ* 99: 88–105.

Stockhammer E (2013) Rising inequality as a cause of the present crisis. *Cambridge J Econ* 39: 935–958.

Wooldridge J (2002) *Econometric Analysis of Cross Section and Panel Data*, Cambridge: The MIT Press.

Ye Q, Han L (2010) The international propagation of shocks in international equity markets during the subprime mortgage crisis. In *Future Information Technology and Management Engineering* (FITME), 2010 International Conference on 2: 468–471, IEEE.

Wisman JD (2013) Wage stagnation, rising inequality and the financial crisis of 2008. *Cambridge J Econ* 37: 921–945.

Zeger S, Liang K, Albert P (1988) Models for longitudinal data: a generalized estimating equation approach. *Biometrics* 44: 1049–1060.