Visible Reserves in Banks – Determinants of Initial Creation, Usage, and Contribution to Bank Stability*

Sven Bornemann†
University of Münster

Susanne Homölle‡
University of Rostock

Carsten Hubensack†
University of Münster

Thomas Kick‡‡
Deutsche Bundesbank

Andreas Pfingsten††
University of Münster

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† Finance Center Münster, University of Münster, Universitätsstraße 14-16, 48143 Münster, Germany.

‡ Chair of Banking and Finance, University of Rostock, Ulmenstraße 69, 18057 Rostock, Germany.

‡‡ Deutsche Bundesbank, Wilhelm-Epstein-Straße 14, 60431 Frankfurt am Main, Germany.

†† Finance Center Münster, University of Münster, Universitätsstraße 14-16, 48143 Münster, Germany, phone +49 251 8322881, fax +49 251 8322882, andreas.pfingsten@wiwi.uni-muenster.de.

Abstract

The opportunity of building up visible "Reserves for General Banking Risks" represents a peculiarity in the German financial accounting frameworks for banks. We investigate German banks' motives for creating and using these reserves and assess their role in German banks' financial stability. In contrast to the lawmaker's original intentions, we find that risk provisioning is a minor motive. Instead, banks of all sectors primarily create and use GBR reserves to build up Tier 1 capital for regulatory capital management. We furthermore reveal that banks using these reserves are less likely to experience a future distress or a bank default event. We conclude that the existence of GBR reserves within the financial accounting framework represents both a convenient regulatory capital management tool for German bank managers and a beneficial regulatory instrument to enhance bank stability.

Key Words: Bank Regulation, Visible Bank Reserves, Risk Provisioning, Capital Management, Earnings Management, Internal Funding, Bank Stability.

JEL Classification: G21, G32, M41.

1 Introduction

The opportunity of building up visible "Reserves for *G*eneral *B*anking *R*isks" ("GBR reserves") represents one of several peculiarities in the German financial accounting framework for banks. As a means of covering rather general banking risks, GBR reserves are designed to foster banks' financial stability. The lawmakers' aim in adding such visible reserves to their hidden counterpart was furthermore to increase transparency in banks' financial reporting. However, the creation and use of GBR reserves involves a considerable amount of discretion, because decisions on building or releasing them are taken solely by a bank's management, and information requirements (e.g., in the notes) are lacking. Therefore, external observers are unaware of the determinants that truly drive the use of these reserves. True to lawmakers' original intentions, GBR reserves may indeed represent a reaction to existing risk exposures of banks. By contrast, they may instead serve for other managerial or accounting purposes, e.g. earnings or capital management. Over the past 15 years, the importance of GBR reserves in banks' financial accounting has significantly increased, as evidenced by the share of banks using GBR reserves surging from below 1% to over 50%. This recent development and the opaque creation and usage motives highlight the importance of an analysis concerning the determinants of GBR reserves.

We address three research questions in our study. First, we examine the factors driving the initial *creation* of GBR reserves. Second, we identify key drivers behind the *usage* of GBR reserves, given that these banks hold GBR reserves in the first place. Third, we check the relationship between the use of GBR reserves and future bank distress and bank default events, i.e., *bank stability*.

Our results are based on a large unbalanced panel of 4,473 German banks for the years 1995 through 2010 provided by the Deutsche Bundesbank that was already used in Bornemann *et al.* (2012) when examining reserves not visible from the balance sheet. In contrast to the lawmakers' original intentions, we find that risk provisioning is a minor motive. Instead, banks of all sectors primarily create and use GBR reserves to build up Tier 1 capital for regulatory capital management. For cooperative banks and savings banks, the subsequent usage is additionally driven by earnings management motives. Savings banks furthermore use GBR reserves for risk provisioning and internal funding purposes. Finally, we reveal that banks holding these reserves are less likely to experience a future distress or a bank default event.

The aim of enhancing transparency in banks' financial reporting is clearly at odds with the public's inability to determine the true motives behind the creation and use of GBR reserves. We shed light on this issue by providing empirical evidence on the relevant motives within different banking groups. The insight that GBR reserves are being created for building up Tier 1 capital and used for earnings management rather than for risk provisioning constitutes useful information for investors. Bank regulators should question the extensive use of GBR reserves for regulatory capital management. These reserves are meant to provide a cushion for risks exceeding those inherent to specific assets, while regulatory capital is, by definition, linked to specific risks. Therefore, using GBR reserves for regulatory capital management clearly runs counter to the whole purpose of their implementation. Our study also extends the ongoing discussion about the usefulness of the almost uniquely German option of building visible GBR reserves, because it helps to evaluate their role in assuring bank stability. As they enhance bank stability, we detect a trade-off between the increase in bank stability and banks' creation and usage motives running counter to the original lawmakers' original intentions. We conclude that the existence of GBR reserves within the financial accounting framework represents both a convenient regulatory capital management tool for German banks and a beneficial regulatory instrument to enhance bank stability.

To the best of our knowledge, we are the first to empirically examine the motives behind the creation and use of GBR reserves. In doing so, we contribute to the literature in at least two ways. Taking advantage of the rare opportunity to investigate decision-making in accounting with respect to a completely discretionary item enables us to circumvent the still-unresolved issue of isolating any discretionary parts of bank accruals (Wahlen (1994), McNichols (2000)) and to disentangle true risk provisioning and discretionary accounting leeway. Our insight that GBR reserves enhance the corresponding banks' resilience to future distress events is also new to the literature.

To arrive at our main results, we borrow ideas from several different strands of the literature. Firstly, we draw upon the few existing studies related to GBR reserves. Waschbusch (1994) predicts that in particular internationally operating banks will increasingly make use of GBR reserves for satisfying transparency needs and improving their international standing. Emmerich and Reus (1995) derive accounting implications of using GBR reserves for a bank's management from a mainly informational perspective. Wagener *et al.* (1995) examine the use of GBR reserves but restrict their analysis to the year 1993 and merely report the number of banks making use of these reserves.

Furthermore, studies examining the use of loan loss provisions (LLP) in banks are closely related to our work, even though GBR reserves, unlike loan loss accruals, need not exclusively be associated with credit risk. Moreover, in contrast to GBR reserves, LLP are not a completely discretionary item of bank accruals. Mostly, one or more of four different motives behind the use of LLP – earnings management, capital management, signaling private information and tax management – are investigated in the literature. As GBR reserves have to be eliminated when filing the tax declaration, the tax management motive is completely disregarded in the following. Furthermore, we do not investigate the motive of signaling private information, mainly owing to data limitations, i.e. the absence of a persuasive proxy for informational asymmetries. Thus, besides analyzing the risk provisioning function, we focus on the first two motives, namely earnings management and capital management. We furthermore also investigate internal funding motives.

With respect to *earnings management*, Greenawalt and Sinkey (1988) and Ma (1988) are among the first to reveal that US banks understate LLP in times of poor economic performance and overstate them during periods of outstanding economic well-being. Similar results are presented by Hasan and Hunter (1999), Lobo and Yang (2001) and Kanagaretnam *et al.* (2003), to name just a few examples. In cross-country examinations Shen and Chih (2005) and Fonseca and González (2008) document the extent to which earnings management is restricted by investor protection and disclosure regulation. Lately, Gebhardt and Novotny-Farkas (2011) find the use of an incurred loss model in IAS 39 to significantly reduce earnings management via LLP.

Capital management refers to banks steering their regulatory capital, for which Kim and Kross (1998) and Ahmed *et al.* (1999) find strong evidence following regulatory changes in the US in 1989. Similarly, Shrieves and Dahl (2003) find that Japanese banks use LLP for earnings and capital management during a period of financial duress. Evidence consistent with capital management via LLP is also presented by Alali and Jaggi (2011).

To evaluate the association between the use of GBR reserves with bank stability, we borrow from the literature that develops bank rating models covering bank defaults. A host of financial sector stability studies for the US banking market define default either as capital ratios falling below two percent (and closure by supervisors) or a restructuring merger assisted by the FDIC (see, for example, Cole and Gunther (1995)). In banking markets like Germany, the number of outright bank defaults is too little and therefore not adequate for estimating real bank default models. Therefore, bank stability and financial stability studies for these markets need to be based either on weaker forms of bank distress, quasi bank defaults or rather simple distance-to-default measures. For the German banking market some bank stability studies have been based on a unique dataset of bank distress and bank default events collected by the Deutsche Bundesbank. Using this data base, Porath (2006) estimated hazard models applying different link functions such as logit, probit, and the complementary log-logistic (cloglog) to explain bank distress based on a CAMEL covariate vector and macroeconomic variables, while Kick and Koetter (2007) examine different shades (i.e., severity) of bank distress. This data base has also been used to examine bank bailouts (e.g., Dam and Koetter (2012), Behn *et al.* (2013)) and bank competition (Kick and Prieto (2013)).

The remainder of this paper is organized as follows. In Section 2, we present the institutional background to our study. In Section 3, we develop our hypotheses to be tested and introduce the data set. Addressing the first two research questions of our paper, we examine the determinants driving the creation and usage of GBR reserves in Section 4. Section 5 refers to the third research questions, namely the effects of GBR reserves on bank stability. Section 6 concludes.

2 Institutional background

2.1 Characteristics of GBR reserves

GBR reserves were introduced into German law via section 340g HGB in 1993 implementing Art. 38 of the European Council Bank Accounts Directive of 1986 (European Council (1986)). The aim of adding such visible reserves to their hidden counterpart was to increase transparency in banks' financial reporting (Bauer (1987), p. 864, Krumnow *et al.* (2004), pp. 604-605).[1] Only very few other countries, such as France (Comité de la réglementation bancaire (1990) and Hossfeld (1996), pp. 179-183), allow banks to build similar reserves.

GBR reserves need to be disclosed as a separate item on the liability side of the banks' balance sheets. Expenses (income) from building (releasing) these reserves are clearly visible from banks' income statements. Being managed entirely at the accounting management's discretion, GBR reserves are built up from net income before the owners get the chance to decide about the appropriation of the yearly annual surplus. There are no information requirements (e.g., in the notes) linked to building GBR reserves and they need not be dedicated to cover the risks inherent to specific assets. Rather, they are intended to provision for unforeseeable risks the banks are exposed to in a broader sense.[2] According to section 340g (1) HGB, the level of existing GBR reserves is not restricted to any quantitative limit as long as it is "reasonable". However, building them up must not lead to negative net income as the bottom line of the income statement. Changes in GBR reserves have to be eliminated when filing the tax statement, which renders their use for tax management irrelevant. Economically speaking, GBR reserves display key features of equity because they help to absorb losses without threatening the bank's existence. Therefore, GBR reserves are acknowledged as Tier 1 capital in banking regulations.

[1] This directive stipulates that members of the European Community that continued to allow their banks to build hidden reserves, such as Germany through section 340f HGB, have to enable the disclosure of visible GBR reserves as well.

[2] German banks, for example, need not set aside capital for the interest rate risk inherent in their banking book.

Accounting decision-making with respect to GBR reserves is closely related to alternative instruments available for exercising discretion. In addition to GBR reserves, German banks are also allowed to create hidden reserves as stated in section 340f HGB (hereinafter “340f reserves”). These are likewise meant to cover general banking risks, and decisions to build or release them are solely taken by the bank’s management, too. These hidden reserves are formed by deliberately undervaluing loans and securities of a certain type by up to 4% of their book value. German financial accounting allows banks to secretly offset expenses (income) from building (releasing) LLP and loan charge-offs against security gains and losses. Thus, banks are allowed to present a single (income or expense) number within their income statement that potentially stems from two very different lines of business of major importance to them. This prevents outsiders from assigning sources of success or failure to the underlying business. Since 340f reserves are built by undervaluing either of the mentioned items, they are not visible in the financial statements of banks and are therefore referred to as hidden. Information on levels of and changes in 340f reserves has to be provided confidentially to the auditors and supervisors of a bank, who monitor compliance with the 4% limit. In contrast to their visible counterpart, 340f reserves are acknowledged as Tier 2 capital only, while they do not influence tax payments either.[3]

2.2 Structure of the German banking market

As accounting decision-making with respect to GBR reserves may be heavily influenced by the governance characteristics of the different types of banks existing in Germany, one needs to be aware of the quite particular structure of the German three-pillar banking market. While most German banks are universal banks, three different categories of institutions with respect to legal form and ownership can be identified.

In terms of the sheer number of institutions, the first and largest pillar consists of credit cooperatives and their central institutions (hereinafter “*Cooperative bank*

[3] For a detailed analysis of the use of “340f reserves” see Bornemann *et al.* (2012).

sector"). While there are two central institutions of the cooperative sector, which held cumulative total assets of 262.5 billion euro at year-end 2010, most cooperative banks operate on a local level and are assisted in their business with large or foreign companies and abroad by the central institutions. These are public companies in terms of their legal form, but their shares are exclusively held by local credit cooperatives. Being quite similar to credit unions in the USA, at year-end 2010 the 1,138 existing local credit cooperatives held cumulative total assets of about 705 billion euro (Deutsche Bundesbank (2010), p. 96). The sole source of core equity of these rather small banks, which mostly conduct business in their home region, are the cooperative shares held by their members. Consequently, the diverse ownership in the *Cooperative bank sector* lacks any institutional investors.

The second-largest pillar of the German banking market are local savings banks and their central institutions (hereinafter "*Savings bank sector*"). The 429 local savings banks held cumulative total assets of about 1,082.9 billion euro at year-end 2010, whereas the ten existing central institutions, the so-called "Landesbanks"(federal and state banks) held cumulative total assets of about 1,463.5 billion euro at year-end 2010. The main task of the federal and state banks is to support local savings banks in their business with large or foreign corporate clients and abroad; they are closely connected to this sector of the German banking market. Individual local savings banks are on average five times larger than credit cooperatives, while both categories are similar to one another with respect to their business models and their local market coverage. Most local savings banks also report according to HGB only, and their debt capital is largely provided by their depositors as well. Moreover, federal and state banks are partly owned by the federal state(s) they are located in and partly by local savings banks in their region. Local savings banks are usually owned by one or a small number of municipalities or counties in their region which are their exclusive equity providers. Thus, ownership is rather concentrated and hardly subject to change.

The third and most heterogenous pillar of the German banking market consists of regional banks, privately held banks and four large money-center banks (hereinafter "*Private bank sector*"). The regionally operating banks are rather small in size, partly manager-owned and operate solely within to their home region. 168 of these banks held cumulative total assets of 735.1 billion euro at year-end 2010. These banks are rather heterogeneous with respect to their business models as well as their ownership structure. Also included in this category are the four money-center banks, which held 2,082.9 billion euro in cumulative total assets at year-end 2010. Their listing yields a widely diversified ownership and they are also much more active on debt capital markets compared to the local banks in this and other categories.

3 Hypotheses and Data

3.1 Hypotheses

In our empirical analysis, we start by examining whether GBR reserves are used as intended by regulators, namely for risk provisioning. If GBR reserves are mainly used for risk provisioning, banks exposed to high risks should hold high stocks of GBR reserves, whereas low-risk banks would not need large risk provisions. Since GBR reserves are meant to cover risks not adequately covered by any other means, this should hold true even when accounting for several specific forms of risk. Thus, we assume a positive association between the risk level of a bank and its use of GBR reserves and hypothesize:

Hypothesis 1 (*H1*). *A bank's risk level is positively related to the creation and use of GBR reserves.*

However, high-risk banks may be in such financial distress that they are simply unable to maintain appropriate amounts of GBR reserves. It might be the case that only healthy banks are able to create GBR reserves, which would contradict our first hypothesis. Moreover, the more practical issue of using GBR reserves for regulatory capital management must not be disregarded. Basel II and the German Solvency Regulation require banks to hold a certain amount of capital in relation to their risk-weighted assets. In order to be able to grow and to increase risk, banks have to comply with minimum regulatory capital requirements. As GBR reserves are explicitly recognized as Tier 1 capital, they might be a convenient tool for bank managers to increase regulatory capital which, in turn, allows them to grow. We therefore hypothesize:

Hypothesis 2 (*H2*). *A bank's level of regulatory capital, net of GBR reserves, is negatively related to the creation and use of GBR reserves.*

For this hypothesis, we additionally control for the growth of a bank's total assets, net of GBR reserves. A positive relationship to the creation and use of GBR reserves would provide further evidence for *H2*.

Given that GBR reserves already exist within a bank, they may also be used for earnings management, i.e., income smoothing. Burgstahler and Dichev (1997) state that managers have to achieve income targets and shift earnings across periods accordingly. Furthermore, banks that do not have unlimited access to capital markets can accumulate GBR reserves in order to deal with losses in bad times. GBR reserves could be used to transfer earnings across periods in order to present a stable income, even if high losses are incurred in certain periods. Taking into account that LLP as well as 340f reserves provide managers with opportunities to manage a bank's net income inconspicuously, the clear visibility of GBR reserves may counteract their suitability for large-scale income smoothing. However, as Bornemann *et al.* (2012) find that 340f reserves, which can only be built up to a certain extent, are indeed used for earnings management, it is interesting to look for evidence whether GBR reserves are likewise used for this purpose. Altogether, this reasoning suggests that banks with a high return on assets, net of GBR reserves, increase their GBR reserves in order to smooth their return on assets and their income and vice versa. Thus, we posit:

Hypothesis 3 (*H3*). *A bank's return on assets, net of GBR reserves, is positively related to the creation and use of GBR reserves.*

Furthermore, given that GBR reserves were already built up, they may also be used to keep funds at the management's disposal (i.e. internal financing of future investments) that may otherwise leave the bank through distribution to its owners. In particular managers of financially sound institutions may deliberately use GBR reserves to build up internal funds and set aside capital to ensure future solvency and liquidity. This might be especially important in situations when funds are scarce, i.e., relatively few deposits are collected. If banks make use of GBR reserves as a tool for internal financing, we therefore suppose a positive association to prevail between the change in the loans-to-deposits (LTD) ratio and the use of GBR reserves:

Hypothesis 4 (*H4*). *A change in a bank's loans-to-deposits ratio is positively related with the creation and use of GBR reserves.*

Having developed our hypotheses for the motives behind the use of GBR reserves, we also investigate the relationship between GBR reserves and future bank stability, measured as the probability of experiencing any distress and bank default event in the subsequent year. This strongly relates to the aforementioned hypotheses, as risk provisioning, higher Tier 1 capital, earnings management and internal funding positively influence bank stability. Therefore, evidence concerning these hypotheses sheds light on the mechanisms through which GBR reserves increase financial stability, as stated in the following hypothesis:

Hypothesis 5 (*H5*). *A bank's use of GBR reserves is negatively related to the probability of experiencing future bank distress and default events.*

The latter hypothesis may look like a straightforward consequence of accounting matters since GBR reserves increase the capital available for distress protection. But it is not, because our analysis controls for total capital including GBR reserves. Moreover, the bank stability hypothesis would not necessarily hold if GBR reserves were true risk provisions, as this implies that banks with a higher risk create and use higher GBR reserves, such that the potentially beneficial effect of GBR reserves on bank stability would be counteracted by the higher risk. However, if banks created and used GBR reserves for other purposes or beyond risk provisioning for existing risks, GBR reserves would enhance bank stability.

We analyze the motives of GBR creation and usage in Section 4. In Section 4.1, we examine the role played by risk provisioning (*H1*) and capital management (*H2*) in the creation of GBR reserves. Building on this, we investigate the motives driving the usage of GBR reserves in Section 4.2, that is earnings management (*H3*) and internal funding (*H4*) as a set of potential drivers of GBR reserves usage. *H5* is covered in Section 5, where we build a bank rating model to determine the effects of GBR reserves on bank stability.

3.2 Data

Our first data source is the Deutsche Bundesbank's prudential database BAKIS. This is the information system on bank-specific data, which is jointly operated by the Deutsche Bundesbank and the German Federal Financial Supervisory Authority BaFin ("Bundesanstalt für Finanzdienstleistungsaufsicht"). This unique database contains information on the financial statements and supervisory reports of individual German banks.[4] The second data source used is the Deutsche Bundesbank's bank distress database. It contains information on various types of distress events which occurred at German financial institutions from the early 1990s on.

The initial sample period stretches from 1994 through 2011. As we use changes in some of our variables and scale others by beginning-of-year total assets, we lose all data from the year 1994. Moreover, by employing some one-year-ahead variables, our final sample period ends in 2010. Therefore, our sample consists of 31,862 observations from 4,473 banks[5] for the period 1995 through 2010. We merely analyze unconsolidated accounts prepared according to HGB. This is appropriate because the vast majority of banks in our sample (primarily referring to the *Savings bank sector* and the *Cooperative bank sector*) do not prepare consolidated accounts at all.[6]

We divide the German banking market along the three pillars: the *Private bank sector*, the *Savings bank sector*, and the *Cooperative bank sector*. We exclude other types of financial institutions such as home loan banks, mortgage banks, or securities trading banks. These either do not fulfill the definition of a bank according to section 1 of the German Banking Act, do not conduct core banking business such as lending and borrowing, or are rather heterogeneous in their business models relative to the rest of the sample. This classification allows for the best balance between strong heterogeneity across the categories and considerable homogeneity within.

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[4] For a detailed description of the BAKIS data base see, for example, Memmel, C. and I. Stein (2008), "The Deutsche Bundesbank's Prudential Database (BAKIS)", in: Schmollers Jahrbuch 128, Duncker & Humblot, Berlin, pages 321-328.

[5] This figure is higher than the actual number of existing banks because, in the case of (frequently occurring) mergers, we, technically speaking, created a new bank independent of the merging ones. This "new" bank starts operating in the year of the merger.

[6] Larger and more internationally oriented banks presumably report, if anything, by means of their consolidated accounts, but leaving out such institutions does not alter the results much.

Table 1 gives detailed information on the number of banks observed in our final panel and the split between the bank categories. The share of each category is somewhat stable over time. The decreasing absolute number of banks reflects mergers that have occurred in the German banking market throughout the last two decades. By numbers, the *Cooperative bank sector* dominates our sample with a share of 69.55%, followed by the *Savings bank sector* (24.40%) and finally the *Private bank sector* (6.05%).

3.3 Descriptive Statistics

In the past 15 years, the importance of GBR reserves in banks' financial accounting has significantly increased. Figure 1 shows the share of banks holding a positive level of these reserves broken down by bank category and year.[7] The development regarding the use of GBR reserves differs to a considerable extent between bank categories. For banks of the *Savings bank sector* (*Cooperative bank sector*), the share of institutions with such a positive level increases over time, climbing to a little below (above) 50% in 2010. For the *Cooperative bank sector*, we note that this share roughly tripled from 2005 to 2010. Regarding the *Private bank sector*, only a minority of just above 20% uses GBR reserves at year-end 2010.

The initially low, but steadily growing share of banks with GBR reserves among the *Savings bank sector* and *Cooperative bank sector* might reflect a change in the risk environment of the banking landscape. Especially Landesbanks and savings banks face a higher risk of default owing to the elimination of state guarantees ("Gewährträgerhaftung" and "Anstaltslast") for state-owned banks – announced in 2001 and effective in 2005 – which significantly changed financial reporting decisions at these banks. In a recent paper, Fischer *et al.* (2012) find that after the announcement to remove the state guarantees, large federal and state banks (i.e., Landesbanks) significantly increased risk relative to the period before, and relative to other banks. Also, Landesbanks issued substantial amounts of bonds in the transition period from 2001 and 2005 in order to lock in the cost advantage offered by the state guarantee. In a similar vein, state-owned banks might have increased the

[7] All figures and tables are collected in the Appendix.

level of GBR reserves to substitute for the protection against insolvency previously provided by the state guarantees.

Figure 2 shows how the ratio of GBR reserves to total assets evolves over time by bank category. This figure exclusively contains observations with a positive level of GBR reserves.[8] We note two findings to be derived from this figure. First, the *Cooperative bank sector* not only exhibits the largest share of institutions holding GBR reserves (as shown in Figure 1); the relative level of these holdings also lies above the levels of the *Savings bank sector* and the *Private bank sector*. Second, in the *Savings bank sector* there is a steady increase in GBR reserves from 2005 on, while the *Cooperative bank sector* reveals sharp increases in 2006 and 2007, whereas this ratio remains rather stable for the *Private bank sector*, except for the sharp increase in 2010. In the *Cooperative bank sector*, this finding is particularly remarkable because the usage of GBR reserves almost doubled from 2005 to 2007, and stayed rather constant until 2010.

For *Private banks* in 2007 and 2008 we observe an explicit decline in both the usage (see Figure 1) and the level (see Figure 2) of GBR reserves, while for the other banking groups at least the usage of those reserves shows a steady and permanent increase until 2010. The heterogeneous developments hint at differences within the relevance of the creation and usage motives across banking groups. The determinants of the GBR creation and usage will be analyzed in the following section.

4 Determinants of GBR reserves

4.1 Initial creation of GBR reserves

Our first research question aims to examine factors driving the initial creation of GBR reserves. To examine a bank's choice whether to create GBR reserves, we employ a Cox proportional hazard model (see Cox (1972)). Belonging to the class of survival models, it allows an estimation to be made of the effect of explanatory

[8] Excluding observations without GBR reserves is helpful to provide a valid picture of the relevance of these reserves in banks using them. However, in our analysis in Section 4.2, we include observations with a zero level of GBR reserves by employing the tobit regression approach.

variables on the time passing before some event occurs (originally called "survival time" until "death"). The event of interest in our model is the amount of years T until the first creation of GBR reserves. We regard T as a random variable with cumulative distribution function $P(t) = Pr(T \leq t)$. The dependent variable in the model is the hazard function shown in Equation 1, which depicts the instantaneous risk of having to create GBR reserves at time t, conditional on not having created GBR reserves before that time.

$$h(t) = \lim_{\triangle t \to 0} \frac{Pr[(t \leq T < t + \triangle t)|T \geq t]}{\triangle t} \tag{1}$$

Owing to the structural form of the Cox model, only explanatory variables in the event year and the years leading up to the event enter. The formal design is given in Equation (2):

$$\begin{aligned} h_i(t) \; &= h_0(t) \cdot exp(\beta_1 \cdot LOANS_{i,t}^{TA} + \beta_2 \cdot AAR_{i,t}^{TA} + \beta_3 \cdot NPL_{i,t}^{TA} \\ &+\beta_4 \cdot LCO_{i,t}^{TA} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t} \\ &+\beta_7 \cdot TIER1_{i,t}^{RWA} + \beta_8 \cdot TAGR_{i,t} \\ &+\beta_9 \cdot 340f_{i,t}^{TA} + \beta_{10} \cdot LNTA_{i,t} + \beta_{11} \cdot GDPGR_{i,t} \\ &+\beta_{12} \cdot D\_SAVINGS + \beta_{13} \cdot D\_COOPS \\ &+ \textstyle\sum_{j=0}^{14} [\beta_{(14+j)} \cdot D\_(1996 + j)_t]) \end{aligned} \tag{2}$$

Regarding *H1*, we follow Lobo and Yang (2001) and others in using a broad set of explanatory variables to measure the bank's risk exposure. $LOANS_{i,t}^{TA}$ is the volume of the overall loan portfolio of bank i at the end of year t.[9] This ratio quite universally proxies the existing credit risk in banks. To prevent endogeneity, we subtract existing GBR reserves from the bank's total assets for $LOANS_{i,t}^{TA}$ and all other variables containing total assets. $AAR_{i,t}^{TA}$ represents risk-weighted assets as a share of total assets and thus reflects the average asset risk. $NPL_{i,t}^{TA}$ is the level of non-performing

[9] Consistent with the literature, we scale all stock variables carrying the superscript "TA" by end-of-year total assets, whereas all flow variables are divided by the beginning-of-year value of total assets, and all mid variables are averaged by the means of the beginning-of-year value and end-of-year value to total assets.

loans (NPL) of bank i in year t. This variable controls for the fact that GBR reserves may also be used to provision against risk in the credit portfolio.[10] $LCO_{i,t}^{TA}$ are the loan charge-offs built by bank i throughout year t. As the final credit risk measure, we calculate a weighted insolvency ratio for bank i at the end of year t (e.g., Ahmed *et al.* (1999)), which we name $INR_{i,t}$. As banks have credit exposures to more or less risky sectors, we weight the sectoral insolvency ratios taken from the German Federal Statistical Office by banks' exposures to 14 German industries.[11]

The risk measures used so far are exclusively related to credit risk, which is not the only type of risk banks are exposed to. Moreover, most of the measures (such as NPL or LCO) are rather backward-looking, because most banks do not provision for loan losses in a timely manner (e.g., Laeven and Majnoni (2003), Beatty and Liao (2011)). To overcome these two drawbacks, we follow Laeven and Levine (2009) and Houston *et al.* (2010) in using a z-score (named $ZSCORE_{i,t}$) as a somewhat more forward-looking risk indicator. It is calculated as the natural logarithm of the ratio of Tier 1 capital and profits of bank i at the end of year t to the standard deviation of profits of bank i over time, each position measured relative to the mid of total assets of bank i.[12] As a standard measure of future default risk, a higher z-score implies that the bank is further away from bankruptcy, i.e., that it is more stable.[13]

[10] A loan is classified as non-performing when payments of interest and principal are 90 days or more past due. It is frequently proven that higher NPL ratios are accompanied by larger loan loss provisions (e.g., Kanagaretnam *et al.* (2004), Adams *et al.* (2009)) which, in turn, reduce net income available for building GBR reserves. Building (releasing) LLPs is a discretionary accounting decision; therefore, LLPs are not convenient as an inherent credit risk measure for a bank's loan portfolio. Using NPL as a non-discretionary credit risk measure allows us to isolate the non-discretionary part of LLP.

[11] The industries are defined as follows: (1) agriculture, forestry, and fishing, (2) mining, energy, and water supply, (3) processing (metal), (4) processing (chemicals, machines, and vehicles), (5) other processing, (6) building and construction, (7) trade, maintenance, and repair of vehicles and durables, (8) hotel and restaurant industry, (9) transportation and communications, (10) insurance, (11) real estate, (12) renting and leasing, (13) health, veterinarian, and social sector, (14) other public and personal services.

[12] The quality of this variable largely depends on the availability of a long time dimension in the panel data set from which the standard deviation of the return on assets (as the measure for profits) is derived. Owing to our unbalanced panel, we limit the calculation of the standard deviation of the return on assets in the denominator of the z-score to the 1 and 99 percentiles for all banks. The calculation of the bounds, for which only banks with a time series of at least six years are used, is done by bank sector (i.e., private banks, savings banks and cooperative banks).

[13] Banks that generally accept more interest rate risk in their banking book (without setting aside more capital) should on average exhibit lower z-scores.

In line with the previous literature, we are confident that we can overcome mechanical relationships by using the broad set of variables introduced above to account for the credit risk exposure of banks. If GBR reserves are indeed created for risk provisioning, one or several of these variables should be positively correlated with $h_i(t)$, i.e., a higher risk level would correspond to higher hazard rates of creating GBR reserves. Contrarily, negative relationships can be interpreted such that "healthier" banks with lower risks create GBR reserves for other motives. The only exception is $ZSCORE_{i,t}$. If GBR reserves are primarily a means of risk provisioning, high-risk banks, i.e., those with a low z-score, should be more likely to create GBR reserves and, therefore, a negative relationship with $h_i(t)$ should prevail. If, by contrast, GBR reserves are predominantly created for other purposes, banks with a high z-score should create GBR reserves to a larger extent, and we should observe a positive association.

Regarding *H2*, we use the variable $TIER1_{i,t}^{RWA}$, which is the level of Tier 1 capital (net of GBR reserves to prevent endogeneity) of bank i at the end of year t as a percentage of its risk-weighted assets at the end of year t. If regulatory capital management drives the creation of GBR reserves, we should observe a negative association between this Tier 1 capital ratio and $h_i(t)$. We furthermore use $TAGR_{i,t}$, which captures the growth of total assets, net of GBR reserves of bank i at the end of year t. A positive relationship to $h_i(t)$ would provide additional evidence that GBR reserves are used to comply with minimum regulatory capital requirements while pursuing growth strategies.

We include the following control variables: $340f_{i,t}^{TA}$ is the level of 340f reserves of bank i in year t as a percentage of its end-of-year total assets. It might be the case that banks using hidden reserves are more likely to create GBR reserves as well. Moreover, $LNTA_{i,t}$ is the natural logarithm of total assets of bank i at the end of year t, as a proxy for the size of the bank. Finally, $GDPGR_{i,t}$ is included in our regressions as the annual growth rate of real per capita GDP on a state level. This macroeconomic variable is not necessarily equal across observations in a given year, but it may differ between banks located in different German federal states. It is meant to assure that the time dummy variables (included to capture an increasing use of GBR reserves over time) do not include catch-up effects that are attributable to the regional macroeconomic development.

Table 2 summarizes our variable descriptions.[14] Furthermore, Table 3 reveals the number of banks as well as the means and the standard deviations of all important variables by bank category. The rather high levels of Tier 1 capital for banks of the *Private bank sector* are not uncommon, because particularly manager-owned institutions are frequently equipped with equity capital far above any regulatory threshold. All other means and standard deviations are conclusive across all categories.

As an alternative specification, we model the decision to create GBR reserves by using a logit model. In this model, the dependent variable is the binary variable $D\_GBR_{i,t+1}$, which takes the value 1 if bank i shows a positive level of GBR reserves at the end of year $t+1$ (thus, $GBR^{TA}_{i,t+1} > 0$), and is 0 otherwise. The set of regressors and the expected coefficients are identical to the Cox model. We apply a time-fixed effects estimation where we cluster standard errors at the bank level.[15] The logit model is formally represented by Equation (3):

$$\begin{aligned} P(D\_GBR_{i,t+1} = 1) \quad &= \beta_0 + \beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} \\ &+\beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t} \\ &+\beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} \\ &+\beta_9 \cdot 340f^{TA}_{i,t} + \beta_{10} \cdot LNTA_{i,t} + \beta_{11} \cdot GDPGR_{i,t} \\ &+\beta_{12} \cdot D\_SAVINGS + \beta_{13} \cdot D\_COOPS \\ &+ \sum_{j=0}^{14} [\beta_{(14+j)} \cdot D\_(1996 + j)_t] + \epsilon_{i,t}. \end{aligned} \tag{3}$$

In a first step, we use the full sample and control for banking pillar fixed effects. The results for the full sample are presented and discussed in Section 4.1.1. However, the very distinct characteristics of the German banking market and the high degree of heterogeneity across the different categories of banks make investigating each category separately a worthwhile proposition. We do so in a second step by estimating the Cox and the logit model for each bank category separately, with the results shown and discussed in Section 4.1.2.

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[14] Note that a relatively moderate outlier treatment is applied to the data set. We winsorize all continuous variables at the 1.0% and 99.0% percentiles.

[15] We do not include bank fixed effects as this would exclude all banks which never created GBR reserves from the sample.

4.1.1 Results for the full sample

Table 4 shows the estimated coefficients as well as the corresponding standard errors (clustered at the bank level) in brackets under the coefficients for both the Cox and the logit estimations of the full sample. To facilitate comparability between the two models, the results for the Cox model are displayed as hazard rates instead of hazard ratios.[16] A positive (negative) sign indicates that a higher value of the respective variable results in higher (lower) "hazard" of creating GBR reserves, and therefore a shorter (longer) expected time until the first creation. Thus, we expect the coefficients of both the Cox model and the logit model to display similar signs of the coefficients and significance. The estimates as given in Panel A.1 of Table 4 are, broadly speaking, almost identical and allow us to comment on the results from both models at the same time.

We first describe the results related to risk provisioning (*H1*). The coefficient on $LOANS^{TA}_{i,t}$ is negative for the Cox and the logit model, but only significant in the Cox model; this means that a higher ratio of loans to total assets seems to decrease the likelihood of GBR reserves being created, indicating that GBR reserves are not used to cover additional risks from the loan portfolio.[17] For $AAR^{TA}_{i,t}$, the coefficient is insignificant in the Cox regression, and negative and significant in the logit regression. This suggests that banks with a higher average asset risk are less likely to create GBR reserves. The coefficients on $NPL^{TA}_{i,t}$ and $LCO^{TA}_{i,t}$ are insignificant (except for one coefficient showing significance at the 10% level) in both models, meaning that neither more loans being provisioned nor being charged off leads to additional risk provisioning via the creation of GBR reserves. Finally, the coefficients on $INR_{i,t}$ are insignificant, revealing that banks that are invested in more risky industries (i.e., those with higher insolvency ratios) do not create GBR reserves as further risk protection. Moreover, the positive and significant coefficients on $ZSCORE_{i,t}$ in both

[16] Usually, survival time models report hazard ratios. A hazard ratio is obtained by comparing the linear predictors η_i and $\eta_{i'}$ of two observations i and i': $\frac{h_i(t)}{h_{i'}(t)} = \frac{h_0(t)e^{\eta_i}}{h_0(t)e^{\eta_{i'}}} = \frac{e^{\eta_i}}{e^{\eta_{i'}}}$. They can be transformed to hazard rates by log(hazard ratio) = hazard rate = $\frac{\eta_i}{\eta_{i'}}$.

[17] The hazard rate of $LOANS^{TA}_{i,t}$ is -0.0145, which is equivalent to a hazard ratio of exp(-0.0145) = 0.9856. Holding other variables constant, an increase of the overall loan portfolio of bank i as a percentage of its end-of-year total assets (net of GBR reserves) by 1% reduces the hazard of creating GBR reserves by a factor of 0.9856 (or 1.44%). Other hazard rates can be interpreted similarily.

models indicate that banks with a larger distance to default hold higher levels of GBR reserves, i.e., healthier banks are more likely to create GBR reserves. Since basically all the signs of the coefficients and their significance contradict the motives of creating GBR reserves for risk provisioning, *H1* can be rejected for the full sample, i.e., banks do not create GBR for risk provisioning. Whether a link still exists between financial stability and GBR reserves will be examined in Section 5.

In line with *H2*, the negative and significant coefficients on $TIER1_{i,t}^{RWA}$ in both models indicate that regulatory capital management is a significant driver of GBR reserves. Banks with lower Tier 1 capital ratios (net of GBR reserves) are more likely to create these reserves. The coefficient on $TAGR_{i,t}$ is positive and significant in both models. This suggests that banks build up GBR reserves to comply with minimum regulatory capital requirements while pursuing a growth strategy. We conclude that instead of being created for risk provisioning, GBR reserves are rather a convenient tool for building up regulatory capital, especially given the fact that GBR reserves may be created without first consulting investors and owners.

We only briefly comment on our remaining control variables. The coefficients on $340f_{i,t}^{TA}$ are positively and highly significant, which indicates that managers using hidden reserves are more likely to create GBR reserves as well, but this observation does not allow any discrimination between different purposes. The association of $LNTA_{i,t}$ with the creation of GBR reserves is positive and significant. Apparently, larger banks create GBR reserves more intensively. The coefficients on $GDPGR_{i,t}$ are insignificant, indicating that economic conditions (which may require additional risk provisioning) have no effect on the creation of GBR reserves.

Beyond using McFadden's adjusted R^2 as a measure of the goodness of fit of the logit model, we follow Hosmer and Lemeshow (2000), who advise caution in using measures based on any type of pseudo R^2 to assess the quality of logit models. Therefore, we also calculate the value of the area under the receiver operating characteristics curve (AUC value). The AUC value reads as the probability that the predicted probability of creating GBR reserves ex ante assigned to a randomly chosen bank, but one that nonetheless creates GBR reserves, is higher than that assigned to a randomly chosen bank that does not create GBR reserves (Hanley and McNeill (1982), Fawcett (2006)). As a general rule of thumb, an AUC value exceeding 0.8 is considered as being excellent (Hosmer and Lemeshow (2000), p. 261). The goodness of fit of the logit model in Panel A.1 with an AUC value of 0.885 is excellent.

As a robustness check, we also estimate both the Cox and the logit model for a sample excluding the years 2007 and 2008, i.e., the time of the recent financial crisis. The results are presented in Panel A.2. They are nearly identical to the results obtained in Panel A.1, with the sole exception of $TAGR_{i,t}$ being insignificant in the Cox model excluding the financial crisis. This is intuitive regarding the fact that banks were unable to pursue growth strategies during the crisis years.

4.1.2 Results for subsamples

To take into account the quite different characteristics of banks within the German three-pillar banking market, which is represented in Table 4 by the bank group dummies, we proceed by investigating determinants for creating GBR reserves for each bank category separately. The results of the Cox and the logit model for banking groups are given in Table 5.

For private banks, we find no evidence for the risk provisioning (*H1*) motive, since all respective coefficients in Panel A.3 are insignificant at the 5% level. Contrarily, the significant coefficient on $TIER1_{i,t}^{RWA}$ in the logit model and $TAGR_{i,t}$ in both models suggests that private banks create GBR reserves primarily for capital management.

In the subsample of savings banks (Panel A.4), the coefficients on variables linked to *H1* either exhibit negative signs or are insignificant at the 5% level. Therefore, we find no support for risk provisioning in the subsample of savings banks. For their part, savings banks seem to build up GBR reserves for regulatory capital management. The respective coefficients on $TIER1_{i,t}^{RWA}$ are negative and highly significant.

In the subgroup of cooperative banks (Panel A.5), the Cox model provides some evidence that cooperative banks indeed create GBR reserves for risk provisioning (*H1*). The positive coefficients on $AAR_{i,t}^{TA}$ and $LCO_{i,t}^{TA}$ suggest that cooperative banks create GBR reserves as additional risk provisioning for credit risk, as measured by average asset risk and loan charge-offs. However, those coefficients are insignificant in the logit model. The logit model rather supports *H2*, as the coefficients on $TIER1_{i,t}^{RWA}$ and $TAGR_{i,t}$ are highly significant. For now, we conclude that there is some evidence that cooperative banks create GBR reserves in respect of both risk provisioning and capital management considerations.

The results of the robustness check excluding the financial crisis years are presented in Panel A.6 to Panel A.8 of Table 6. The results are in line with those obtained by using the full sample. Having investigated both the overall sample as well as banking group and time period subsamples, we conclude that banks of all banking groups create GBR reserves primarily for regulatory capital management, i.e., to build up Tier 1 capital. The original function of GBR reserves as a means of risk provisioning, as intended by lawmakers, is only supported for the subsample of cooperative banks.

4.2 Usage of GBR reserves

Our second research question aims at investigating factors that are responsible for the usage of GBR reserves in banks, assuming that GBR reserves are created in the first place. Besides analyzing the motives of risk provisioning (*H1*) and capital management (*H2*), we thus additionally examine the role of earnings management (*H3*) and internal funding (*H4*). For this purpose, we analyze the factors driving both levels and changes of GBR reserves.

Concerning the level of GBR reserves, Figures 1 and 2 already reveal that a high probability of using GBR reserves is not necessarily accompanied by large amounts of such reserves. In our analysis, we apply $GBR^{TA}_{i,t+1}$ as the explanatory variable, being the level of GBR reserves of bank i accumulated at the end of year $t+1$ as a percentage of its end-of-year $t+1$ total assets. We have to adequately take into account the large number of observations not using GBR reserves, i.e., having $GBR^{TA}_{i,t+1} = 0$, in analyzing this research question. As the level of GBR reserves is naturally truncated at zero and negative values cannot occur, we employ a tobit model (Tobin (1958)) with $GBR^{TA}_{i,t+1}$ as the dependent variable.

We use the same set of independent variables as in Section 4.1 and add two variables linked to earnings management and internal funding. For earnings management (*H3*), it is insightful to investigate the association of GBR reserves with the contemporaneous return on assets, net of GBR reserves (i.e., before building or releasing). Due to the fact that the dependent variable is the level of GBR reserves in $t+1$, we use the return on assets in $t+1$, named $ROA^{TA}_{i,t+1}$. If managers use these reserves for income smoothing, the coefficient on $ROA^{TA}_{i,t+1}$ should be positive. Managers will increase (decrease) the level of GBR reserves if the return on assets of the contemporaneous period is high (low) in order to smooth the return and income stream. To test internal funding motives (*H4*), we use the change in the loans-to-deposits (LTD) ratio $CHLTD_{i,t+1}$ of bank i from year t to year $t+1$. If banks make use of GBR reserves as a tool for internal financing, we suppose a positive association with the use of GBR reserves to prevail. This is particularly likely for banks from both the *Cooperative bank sector* and *Savings bank sector*, which are much less active on capital markets for funding purposes than banks from the *Private bank sector*.

The formal design of the regression is given in Equation (4):

$$GBR^{TA}_{i,t+1} = \begin{cases} Y_{i,t+1} & \text{if } Y_{i,t+1} > 0 \\ 0 & \text{if } Y_{i,t+1} \leq 0 \end{cases} \tag{4}$$

$$\begin{aligned} Y_{i,t+1} &= \beta_0 + \beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} \\ &+\beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t} \\ &+\beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} \\ &+\beta_9 \cdot ROA^{TA}_{i,t+1} + \beta_{10} \cdot CHLTD_{i,t+1} \\ &+\beta_{11} \cdot 340f^{TA}_{i,t} + \beta_{12} \cdot LNTA_{i,t} + \beta_{13} \cdot GDPGR_{i,t} \\ &+\beta_{14} \cdot D\_SAVINGS + \beta_{15} \cdot D\_COOPS \\ &+ \textstyle\sum_{j=0}^{14} [\beta_{(15+j)} \cdot D\_(1996+j)_t] + \epsilon_{i,t}. \end{aligned}$$

We again cluster standard errors at the bank level. We account for banking pillar fixed effects by using banking group dummies, which is appropriate owing to the rather high degree of heterogeneity between and the clear homogeneity within banking groups in Germany. Using a large set of regressors, we also control for a variety of bank specific characteristics to ensure that there is no omitted variable bias.[18]

Regarding changes of GBR reserves, Tables 7 and 8 show changes in the use of GBR reserves from the current to the subsequent year. Whereas Table 7 depicts the number of changes from not holding to holding GBR reserves (and vice versa),

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[18] See also Wooldridge (2010).

Table 8 also includes changes in the still positive level of GBR reserves. Both tables indicate that GBR reserves are rather persistent over time. As a consequence, a lot of observations regarding changes of GBR reserves will be equal to zero. We therefore once again run a tobit regression using $CHGBR^{TA}_{i,t+1}$, which is the change in GBR reserves as a percentage of end-of-year total assets (net of GBR reserves) in bank i from period t to period $t+1$, as the dependent variable. As the regressors are identical to the previous tobit model, the regression can be represented by Equation (5):

$$CHGBR^{TA}_{i,t+1} = \begin{cases} Y_{i,t+1} & \text{if } Y_{i,t+1} > 0 \\ 0 & \text{if } Y_{i,t+1} \leq 0 \end{cases} \tag{5}$$

$$\begin{aligned} Y_{i,t+1} \quad &= \beta_0 + \beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} \\ &+\beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t} \\ &+\beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} \\ &+\beta_9 \cdot ROA^{TA}_{i,t+1} + \beta_{10} \cdot CHLTD_{i,t+1} \\ &+\beta_{11} \cdot 340f^{TA}_{i,t} + \beta_{12} \cdot LNTA_{i,t} + \beta_{13} \cdot GDPGR_{i,t} \\ &+\beta_{14} \cdot D\_SAVINGS + \beta_{15} \cdot D\_COOPS \\ &+ \textstyle\sum_{j=0}^{14} [\beta_{(15+j)} \cdot D\_(1996 + j)_t] + \epsilon_{i,t}. \end{aligned}$$

Following the same procedure as in Section 4.1, we first estimate both tobit models using the full sample. These results are presented in 4.2.1. The results for banking categories are discussed in Section 4.2.2.

4.2.1 Results for the full sample

Table 9 shows the results of the tobit models estimations on the full sample using $GBR^{TA}_{i,t+1}$ and $CHGBR^{TA}_{i,t+1}$ as dependent variables in Panel B.1. The coefficients are in line with the results obtained in Section 4.1. This indicates that the choice of our models is adequate for analyzing our research questions.[19] We therefore only briefly comment simultaneously on the results of both tobit models.

[19] If different variables influenced the likelihood of the use of GBR reserves, as analyzed in Section 4.1, on the one hand and the level and changes of GBR reserves on the other, a two-stage approach following Heckman (1979) would be appropriate for adequately modeling our research questions.

The coefficients of the portfolio risk variables $LOANS_{i,t}^{TA}$, $AAR_{i,t}^{TA}$, $NPL_{i,t}^{TA}$, $LCO_{i,t}^{TA}$, and $INR_{i,t}$ are either insignificant, or they reveal a negative relationship between banks' portfolio risk and the use of GBR reserves. The coefficients on $ZSCORE_{i,t}$ are positive and highly significant. The results are in line with the findings from Section 4.1.1; *H1* is again not supported. This confirms that GBR reserves are not primarily used for risk provisioning.

Turning to *H2*, we find that all coefficients are highly significant and exhibit signs supporting the hypothesis, with $TIER1_{i,t}^{RWA}$ showing a negative and $TAGR_{i,t}$ showing a positive coefficient. In line with Section 4.1.1, a case can be made that banks use GBR reserves primarily because of regulatory capital management motives. GBR reserves are used to build up (minimum) regulatory capital in order to be able to grow.

The relevance of earnings management (*H3*) for the use of GBR reserves is confirmed, as we find that the coefficients on $ROA_{i,t+1}^{TA}$ are positive and significant in both regressions. This suggests that income smoothing motives play a role in using GBR reserves and should not be seen as contradicting Tables 7 and 8. As previously discussed, one can see that GBR reserves are rather persistent and decreases of GBR reserves, in particular, hardly ever occur. If GBR were used for income smoothing, one would at first glance expect to see a more even distribution of increases and decreases in the reserves. However, we argue that these findings rather advocate the notion that banks use GBR reserves for earnings management predominantly in good times. If high returns on assets (before building GBR reserves) are achieved, a bank has an incentive to build up additional GBR reserves to smooth income. However, if banks experience periods of low returns on assets, they only release GBR reserves under very severe circumstances to avoid posting extremely low returns or even losses, as evidenced in the recent financial crisis. As additional income from building these reserves is clearly visible from banks' income statements, investors are able to identify parts of returns on assets that result from income smoothing, which will potentially not lead to a considerably better assessment of the banks' real performance. This results in lower incentives to smooth low returns by releasing GBR reserves compared to the adverse situation, in particular because 340f reserves are available for secret income smoothing.

Our models furthermore support the hypothesis concerning internal funding motives (*H4*), as the coefficients on $CHLTD_{i,t+1}$ in both models are positive and highly significant. In combination with the results obtained for the variables linked to risk provisioning, we thus conclude that financially sound institutions deliberately use GBR reserves as an internal financing tool to set aside capital for future usage.

As expected, the control variables $340f_{i,t}^{TA}$ and $LNTA_{i,t}$ show positive coefficients and high significance. The coefficient on $GDPGR_{i,t}$ is significant and negative in the regression using $CHGBR_{i,t+1}^{TA}$ as the dependent variable, suggesting that higher GDP growth results in a future reduction of GBR reserves. With respect to the high correlation between $ZSCORE_{i,t}$ and $ROA_{i,t+1}^{TA}$, we also present different specifications as robustness checks. Panel B.2 shows the results of running both tobit models excluding $ZSCORE_{i,t}$, while Panel B.3 depicts the coefficients obtained by excluding $ROA_{i,t+1}^{TA}$. The results of these regressions are almost identical to Panel B.1 with respect to coefficient signs and significance.

4.2.2 Results for subsamples

In Table 11, Table 12 and Table 13, we present the results from the tobit models on banking group samples with $GBR_{i,t+1}^{TA}$ and $CHGBR_{i,t+1}^{TA}$ as dependent variables.

Regarding private banks (Table 11), *H1* is not supported by the insignificant coefficients on the respective variables. However, the coefficients on $TIER1_{i,t}^{RWA}$ support *H2*, indicating that private banks use GBR reserves primarily for capital management. For *H3*, we find no evidence that private banks also use GBR reserves for earnings management. However, there is some indication that private banks use GBR reserves as an internal financing tool (*H4*). In line with the results obtained in Section 4.1.2, we conclude that private banks primarily create and use GBR reserves for capital management.

In the subsample of savings banks (Table 12), the results are different to private banks. Positive and significant coefficients on $LOANS_{i,t}^{TA}$ indicate that GBR reserves are used as additional risk provisioning (*H1*) for credit risks. *H2*, *H3* and *H4* are also strongly supported. Taking the results from Section 4.1.2 into consideration, this suggests that savings banks initially create GBR reserves for regulatory capital management, while subsequent usage is also driven by credit risk provisioning considerations, earnings management and internal funding motives.

For cooperative banks (Table 13), we find no further evidence of risk provisioning (*H1*), as contrasted with the results of the Cox model (see Section 4.1.2). Similarly to savings banks, *H2* and *H3* are strongly supported. However, we find no evidence for *H4*. We therefore conjecture that risk provisioning motives at least partially influence the initial creation of GBR reserves in cooperative banks, while the ongoing usage seems to be driven more by capital management (*H2*) and earnings management motives (*H3*).

The relationship and significance of our remaining control variables almost coincide with the estimations of our full sample. The only difference is $GDPGR_{i,t}$ being significantly positive in explaining the level of GBR reserves for savings banks. This is in line with the positive and significant coefficients on $TAGR_{i,t}$ for savings banks. Favorable macroeconomic conditions increase the amount of capital needed by savings banks to meet the demand for more loans within their regional area. Given local political pressure to increase loan volume and thus accept additional risks that are not adequately covered by regulatory requirement, this is in line with the finding that savings banks use GBR reserves for credit risk provisioning.

Combining the results from Section 4.1 and Section 4.2, the bottom line of our analysis is that banks of all sectors primarily create GBR reserves for regulatory capital management purposes. The creation of GBR reserves in cooperative banks is also a result of risk provisioning motives. Concerning the usage of GBR reserves, the motive of capital management remains valid for all banks. For cooperative banks and savings banks, the subsequent usage is additionally driven by earnings management motives. Savings banks furthermore use GBR reserves for risk provisioning and internal funding purposes.

5 Effects of GBR reserves on bank stability

5.1 The bank rating model

By examining the determinants of the creation and the usage of GBR reserves, we have mainly answered our first two research questions so far. Our third research questions refers to the effects of the creation and usage of GBR reserves for the respective banks. As enhancing future bank stability is one of the main arguments for allowing banks to build such reserves, it is crucial to investigate this in more detail. Indeed, the results from the previous chapter suggest that GBR reserves enhance financial stability of banks as a measure of capital management, earnings management and internal funding. However, as the hypothesis on GBR reserves being created and/or used for risk provisioning was rejected in the majority of cases, an investigation of the relationship between GBR reserves and bank stability promises further insights.

The bank rating model used in this study is based on the so called CAMEL taxonomy (Capital Adequacy, Asset Quality, Management, Earnings, and Liquidity) introduced in 1987 by the National Credit Union Administration (NCUA (1994)) and revised and updated by the U.S. Federal Deposit Insurance Corporation, FDIC (see, for example, King *et al.* (2006)). While many other studies on bank stability try to proxy bank risks with measures of credit risk, we take a more sophisticated route. Instead of using just a z-score or NPL ratio as an indicator for bank stability, we apply both real bank distress and bank default events. These measures have some important advantages over those used in previous studies. Most importantly, our measures capture events where real bank defaults are happening instead of reflecting a theoretical distance to default risk. Thus, they can be regarded as displaying reality one-to-one.[20]

[20] To illustrate the main idea, we provide a short example. Consider bank A, which hands out a high percentage of non-performing loans every year and has a low z-score. Nevertheless, the bank is able to manage these problems, which means it has not faced insolvency so far. By contrast, there is bank B, which has delivered perfect management ratios for the last 10 years but suddenly encounters one miserable year, which leads to insolvency. Coming back to our empirical analysis, taking the z-score in this case would be misleading and create serious problems. While the distinct characteristics of bank A would indicate bank instability, those of bank B would not.

For these reasons, we additionally provide two measures, which reflect both a broader and a narrower definition of real bank distress events. The broader definition *Bank Distress* covers not only bank default but also reflects capital support measures by the banking associations (insurance schemes). The narrower definition *Bank Default* takes only distressed mergers and bank moratoria into account.[21] This obviously reduces the number of distress observations, but by using this indicator we are also able to provide a measure for severe banking problems. Nevertheless, we also use the z-score as a robustness check and to allow a better comparison to related papers which have only used the z-score as a measure of a bank's financial stability.

Our logit models are designed to predict the probability of a bank experiencing a distress event within the subsequent year. As outright bank defaults have been extremely rare in Germany over the past few decades, we first follow Porath (2006), Kick and Koetter (2007), Kick and Prieto (2013), in line with the literature, and define distress in a broader sense. We denote all types of interventions by the Bundesbank as well as several other incidents as being bank distress.[22] The dependent variables used in our hazard rate model, $D\_DISTRESS_{i,t+1}$ and $D\_DEFAULT_{i,t+1}$, respectively indicate that bank i will experience a distress or default event in year $t+1$. Formally, Equation (6) is formulated as:

$$P(D\_DISTRESS_{i,t+1} = 1) = Y_{i,t+1} \tag{6}$$

Our second version of the model is based on the narrower definition, which only includes bank moratoria and takeovers classified by the Bundesbank as restructuring mergers and is given in Equation (7):

$$P(D\_DEFAULT_{i,t+1} = 1) = Y_{i,t+1} \tag{7}$$

21 Note that the Bundesbank Distress database is only available until 2006. Therefore, we define a "distressed merger" in the years 2007 until 2010 as takeovers where the bank that was acquired experienced severe distress (i.e., a very low capital ratio, a capital support measure, or a moratorium) within the three years before the merger. (See also Behn *et al.* (2013), and Kick and Prieto (2013)).

22 Kick and Koetter (2007) describe the possible shades of distress in more detail.

As an additional robustness check we also apply the z-score as a distance-to-default measure and, therefore, as a bank stability indicator. The functional relationship is described in Equation (8):

$$Z\_SCORE_{i,t+1} = Y_{i,t+1} \tag{8}$$

The right-hand side is defined as:

$$\begin{aligned} Y_{i,t} = \; & \beta_0 + \beta_1 \cdot D\_GBR_{i,t} \left[+\beta_1 \cdot GBR_{i,t}^{TA}\right] + \beta_2 \cdot LOANS_{i,t}^{TA} + \beta_3 \cdot AAR_{i,t} \\ & +\beta_4 \cdot NPL_{i,t} + \beta_5 \cdot D\_LIAB_{i,t} + \beta_6 \cdot D\_REDUCTION_{i,t} \\ & +\beta_7 \cdot INR_{i,t} + \beta_8 \cdot HHI\_SEC_{i,t} \\ & +\beta_9 \cdot TIER1_{i,t}^{RWA} + \beta_{10} \cdot ROA_{i,t+1} + \beta_{11} \cdot TAGR_{i,t} \\ & +\beta_{12} \cdot 340f_{i,t}^{TA} + \beta_{13} \cdot LNTA_{i,t} + \beta_{14} \cdot GDPGR_{i,t} \\ & +\beta_{15} \cdot D\_SAVINGS + \beta_{16} \cdot D\_COOPS \\ & + \textstyle\sum_{j=0}^{14} [\beta_{(17+j)} \cdot D\_(1996+j)_t] + \epsilon_{i,t}. \end{aligned}$$

The choice of the independent variables used here is based on evidence presented in the literature (i.e., CAMEL taxonomy), the assessment of practitioners at the Deutsche Bundesbank, data availability as well as statistical properties. Some of the variables used in the model are also included in our previous analyses investigating the determinants for the use of GBR reserves. The definitions of the additional variables used in the bank rating model are summarized in Table 14, and the descriptives are reported in Table 15.[23]

5.2 Empirical results

The results of our regressions are presented in Table 16. We estimate logit models with standard errors clustered at the bank level.[24] The variables of main interest

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[23] Descriptions and summary statistics of the remaining variables can be found in Table 2 and Table 3.

[24] Note that the logit specification of the bank rating models again does not allow the inclusion of bank fixed effects, as otherwise all banks which never faced any distress event would be excluded from the regressions.

in this estimation are the dummy variable indicating a bank's use of GBR reserves ($D\_GBR_{i,t}$) and the amount of GBR held by a bank over total assets ($GBR_{i,t}^{TA}$). These variables allow us to evaluate the role these reserves play in bank stability.

For our broader definition of distress (Panel C.1), the management decision whether the bank holds GBR reserves or not has a positive impact on bank stability: banks which hold GBR reserves face a significantly lower probability of experiencing a distress event. Yet the amount of GBR reserves over total assets is insignificant for this regression model. The dummy for GBR reserves also displays a significant result for the regression with the default dummy as the dependent variable (Panel C.2). Moreover, we also find that the amount of GBR reserves has a significantly negative influence on the default probability. Bearing in mind that default events occur much less frequently than wider distress events, significance at the 5% level is a highly satisfactory outcome. To sum up, the decision as to whether a bank holds visible reserves, as well as the amount of GBR reserves over total assets positively affect bank stability. *H5* is strongly confirmed, in particular with respect to actual bank default events. In line with the results obtained while analyzing the first four hypotheses, we thus conclude that banks use GBR reserves to take precautions beyond true risk provisioning to increase their stability.

Regarding the control variables related to a bank's risk level, we find similarities to all the models in Section 4.1 and Section 4.2. As expected, non-performing loans, the dummy variable for hidden liabilities and the dummy for a reduction in reserves increase the probability for all kinds of distress events. Loans over total assets, industry risk exposure and credit portfolio concentration do not have any significant effects. Average asset risk surprisingly decreases the probability of a distress event, while it has no effect on default events.[25]

Interestingly, we face some different results between the two distress measures concerning Tier 1 capital. While the Tier 1 ratio is not significant for the broader definition of distress, it is is strongly significant for the narrower one.[26] This gives

[25] The former may be a statistical artifact (which is much smaller in size than the expected effect of non-performing loans).

[26] We note that unlike the previous analyzes in Sections 4.1 and 4.2, we now use a Tier 1 capital ratio which includes the level of existing GBR reserves. Therefore, the impact of GBR reserves on financial stability does not come from a higher total capital ratio.

us – in addition to our main research questions – the insight that Tier 1 capital is much more important for banks when it comes to severe problems, while when it comes to weaker problems, other factors play a more important role. Furthermore, a higher return on asset reduces the probability of banks experiencing distress and default events, while a positive asset growth only decreases the probability of distress events.

Likewise, the amount of 340f reserves has a positive impact on bank stability. Moreover, larger banks are more likely to face distress events, while smaller banks have a higher probability of experiencing a default event. Our macroeconomic indicator of annual per capita GDP growth at the federal state level does not have any significant association with bank distress.

In addition to our two measurements of distress events and our two measurements of GBR reserves, we present a regression with the forwarded z-score as the dependent variable (Panel C.3 of Table 16). As already explained in the introduction to this chapter, we do not believe that the z-score is an accurate measure for bank stability, because of its inability to predict real events. Nevertheless, as a robustness check, we are able to show that the results for our variables of interest are the same. Bearing in mind that a higher z-score reflects a lower probability of a bank filing for bankruptcy, the dummy variable for GBR reserves as well as the GBR reserves over total assets confirm our results from the previous test. They are both positive and highly significant. We refrain from a detailed look at other variables in this robustness check.

An additional robustness check excluding the crisis years 2007 and 2008 is presented in Panels C.4 to C.6 of Table 17, yielding identical outcomes.

6 Conclusions

The fact that banks are allowed to build “Reserves for General Banking Risks” represents a specific quality within the German financial accounting framework. This provides a rare opportunity to assess banks’ motives for building completely discretionary visible reserves. Legally speaking, these reserves are intended to provision for general risks inherent in banking business. However, the fact that decisions on these reserves are at the sole discretion of the management and they do not need to be commented on in the notes allow managers to use them for quite different purposes. Thus, even though the level of these reserves is clearly visible from the balance sheets, the true reasons for their existence remain opaque to anyone outside the bank.

Our study examines factors potentially influencing the use of these reserves. In doing so, we explicitly take into account different accounting and managerial motives. Thus, the first objective of our study is to shed light on the motives behind creating and using GBR reserves. As the second objective, our study contributes to the discussion on whether GBR reserves enhance banks' financial stability, which was stated as being one of the main reasons for their implementation in 1993.

In contrast to the original lawmakers' intentions, we find that risk provisioning is a minor motives. Instead, banks across all sectors primarily create and use GBR reserves to build up Tier 1 capital for regulatory capital management. For cooperative banks and savings banks, the subsequent usage is additionally driven by earnings management motives. Savings banks furthermore use GBR reserves for risk provisioning and internal funding purposes. We reveal that banks using these reserves have a lower probability of experiencing a future bank distress or bank default event. We therefore detect a trade-off between the increase in bank stability and banks' creation and usage motives running counter to the lawmakers' original intentions. However, our analysis has shown that GBR reserves can be used as a versatile instrument for various purposes. We therefore conclude that the existence of GBR reserves within the financial accounting framework represents a convenient accounting tool for risk capital management and earnings management purposes. From a banking supervision point of view, GBR reserves represent a beneficial regulatory instrument enhancing bank stability.

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A Appendix

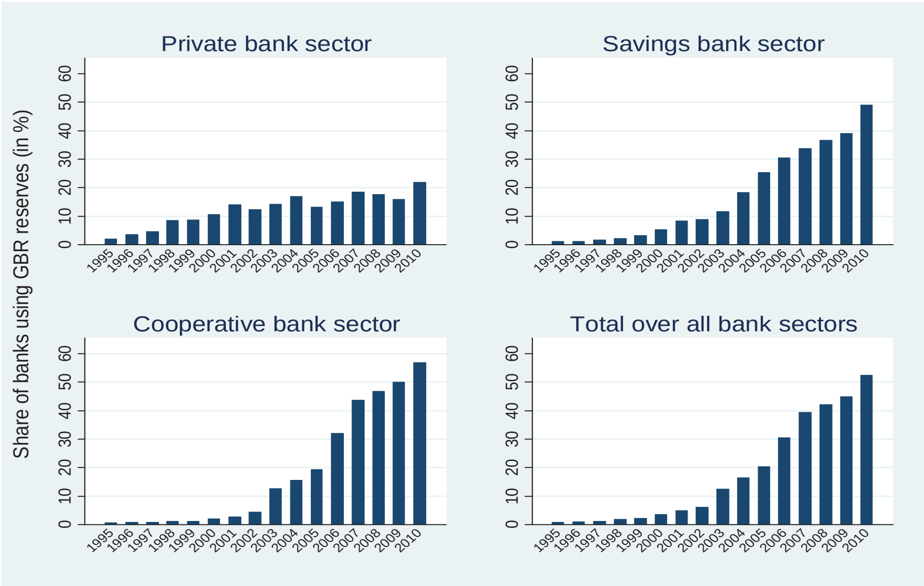

Figure 1: Share of banks using GBR reserves by bank category and year

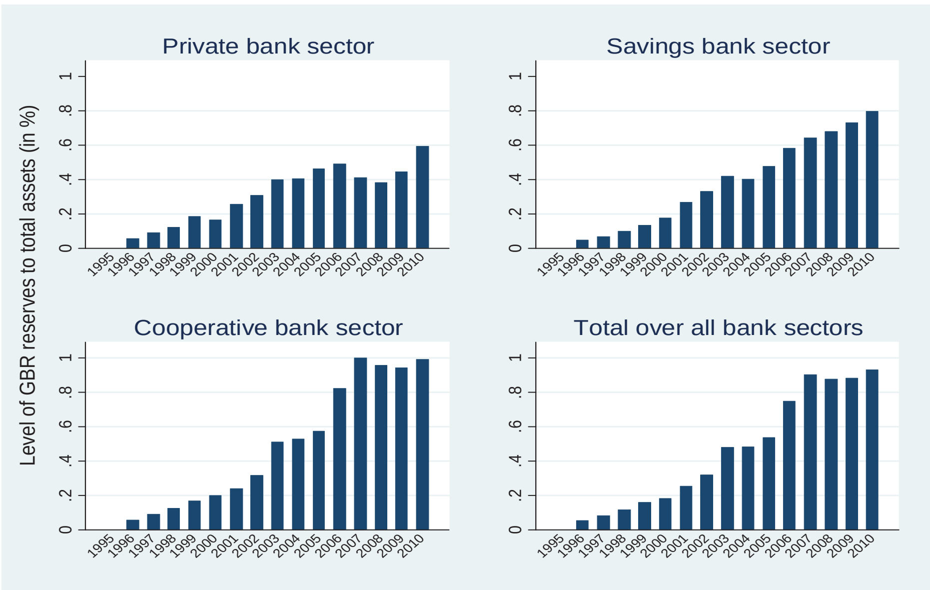

Figure 2: Mean of $GBR_{i,t}^{TA}$ by bank category and year

Year	Private bank sector		Savings bank sector		Cooperative bank sector		Total	
	No.	Row%	No.	Row%	No.	Row%	No.	Col%
1995	139	4.64	575	19.21	2,279	76.14	2,993	9.38
1996	136	4.67	584	20.04	2,194	75.29	2,914	9.13
1997	129	4.82	585	21.86	1,962	73.32	2,676	8.39
1998	139	5.85	565	23.76	1,674	70.40	2,378	7.45
1999	138	6.62	540	25.90	1,407	67.48	2,085	6.54
2000	140	7.31	513	26.80	1,261	65.88	1,914	6.00
2001	128	6.99	491	26.80	1,213	66.21	1,832	5.74
2002	122	6.97	451	25.77	1,177	67.26	1,750	5.49
2003	119	6.82	446	25.54	1,181	67.64	1,746	5.47
2004	118	6.79	446	25.65	1,175	67.57	1,739	5.45
2005	114	6.62	445	25.84	1,163	67.54	1,722	5.40
2006	112	6.58	436	25.60	1,155	67.82	1,703	5.34
2007	108	6.53	424	25.62	1,123	67.85	1,655	5.19
2008	102	6.42	419	26.39	1,067	67.19	1,588	4.98
2009	100	6.35	423	26.87	1,051	66.77	1,574	4.93
2010	109	6.68	431	26.41	1,092	66.91	1,632	5.12
Total	1,953	6.12	7,774	24.37	22,174	69.51	31,901	100.00

Table 1: Number of observations by bank category and year

Note: The *Savings bank sector* (*Cooperative bank sector*) contains local savings banks and their central institutions (cooperative banks and their central institutions). The *Private bank sector* comprises regional banks, privately held banks and four money-center banks. "No." shows the number of banks in each category in our panel by year. "Row%" reveals the share of each bank category with respect to the overall number of banks in our panel by year. "Total No." displays the overall number of observations in our panel by year. "Col.%" gives the share of observations by year on the overall number of observations in our panel.

Variable	Description
$D\_GBR_{i,t+1}$	Binary variable equaling 1 if bank i in year $t+1$ has a positive level of GBR reserves, and 0 otherwise.
$GBR^{TA}_{i,t+1}$	Level of GBR reserves of bank i accumulated at the end of year $t+1$ as a percentage of its end-of-year $t+1$ total assets.
$CHGBR^{TA}_{i,t+1}$	Change of GBR reserves as a percentage of its end-of-year total assets, net of GBR reserves, in bank i from period t to period $t+1$.
T_i	The number of years between the first year of our sample and the year of the first creation of GBR reserves by bank i.
$LOANS^{TA}_{i,t}$	Volume of the overall loan portfolio of bank i at the end of year t as a percentage of its end-of-year t total assets, net of GBR reserves.
$AAR^{TA}_{i,t}$	Average asset risk, risk weighted assets of bank i as a percentage of its end-of-year t total assets, net of GBR reserves.
$NPL^{TA}_{i,t}$	Level of the non-performing loans of bank i at the end of year t as a percentage of its end-of-year t total assets, net of GBR reserves.
$LCO^{TA}_{i,t}$	Loan charge-offs of bank i built throughout year t as a percentage of its beginning-of-year t total assets, net of GBR reserves.
$INR_{i,t}$	Weighted insolvency ratio for bank i at the end of year t, based on weighted sectoral insolvency ratios of 14 German industry sectors (as taken from the German Federal Statistical Office) and banks' exposures into those sectors.
$ZSCORE_{i,t}$	Natural logarithm of the ratio of Tier 1 capital and profits of bank i at the end of year t to the standard deviation of profits of bank i over time, each position measured relative to (an average at the begin and end of year t) total assets of bank i.
$TIER1^{RWA}_{i,t}$	Level of Tier 1 capital, net of GBR reserves, of bank i at the end of year t as a percentage of its end-of-year t risk-weighted assets, net of GBR reserves.
$TAGR_{i,t}$	Growth of total assets, net of GBR reserves, of bank i at the end of year t over end-of-year $t-1$.
$ROA^{TA}_{i,t+1}$	One-year ahead return (operative result) as a percentage of end-of year t total assets, net of GBR reserves.
$CHLTD_{i,t+1}$	Change in the LTD ratio of bank i from year t to year $t+1$.
$340f^{TA}_{i,t}$	Level of 340f reserves ("hidden reserves") of bank i in year t as a percentage of its end-of-year total assets, net of GBR reserves.
$LNTA_{i,t}$	Natural logarithm of total assets, net of GBR reserves, of bank i at the end of year t.
$GDPGR_{i,t}$	Annual growth rate of real per capita GDP at the federal state ("Bundesland") level.
$D\_SAVINGS$	Binary variable equaling 1 if observation refers to a bank from the *Savings bank sector*.
D_COOPS	Binary variable equaling 1 if observation refers to a bank from the *Cooperative bank sector*.
$D\_(1996+j)_t$	Binary variable equaling 1 if observation i stems from year t.

Table 2: Description of variables for Panel A and Panel B in Section 4.

	Private bank sector (N = 1,953)		Savings bank sector (N = 7,774)		Cooperative bank sector (N = 22,174)		Total (N = 31,901)	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
$D\_GBR_{i,t+1}$	0.14	0.35	0.20	0.40	0.18	0.39	0.18	0.39
$GBR^{TA}_{i,t+1}$, for $D\_GBR_{i,t+1} = 1$ (in %)	0.41	0.59	0.62	0.56	0.85	0.61	0.77	0.61
$CHGBR^{TA}_{i,t+1}$, for $D\_GBR_{i,t+1} = 1$ (in %)	0.11	0.21	0.18	0.20	0.20	0.24	0.19	0.23
T_{i+1}, for $D\_GBR_{i,t+1} = 1$	8.13	5.39	11.23	4.17	9.04	4.26	9.58	4.41
$LOANS^{TA}_{i,t}$ (in %)	78.62	16.36	67.66	10.69	71.96	10.40	71.32	11.23
$AAR^{TA}_{i,t}$ (in %)	59.73	20.03	54.77	11.38	60.35	11.38	58.95	12.32
$NPL^{TA}_{i,t}$ (in %)	3.64	4.07	2.72	1.86	3.53	2.67	3.34	2.63
$LCO^{TA}_{i,t}$ (in %)	0.40	0.53	0.26	0.28	0.20	0.32	0.23	0.33
$INR_{i,t}$ (in %)	1.05	0.26	1.07	0.18	1.05	0.19	1.06	0.20
$ZSCORE_{i,t}$	2.31	0.74	2.64	0.48	2.81	0.52	2.74	0.54
$TIER1^{RWA}_{i,t}$ (in %)	13.33	7.12	8.38	2.46	8.95	2.75	9.08	3.33
$TAGR_{i,t}$ (in %)	5.33	11.59	2.25	4.42	2.65	4.55	2.72	5.27
$ROA^{TA}_{i,t+1}$ (in %)	0.65	0.96	0.72	0.48	0.71	0.50	0.71	0.53
$CHLTD_{i,t+1}$ (in %)	4.58	13.31	2.41	5.37	2.45	5.98	2.57	6.56
$340f^{TA}_{i,t}$ (in %)	0.30	0.64	1.74	1.12	1.32	1.00	1.36	1.06
$LNTA_{i,t}$ (in %)	20.26	1.75	20.90	1.02	18.88	1.13	19.46	1.45
$GDPGR_{i,t}$ (in %)	1.22	2.04	1.33	2.11	1.32	2.11	1.32	2.11
$D\_SAVINGS$ (in %)	0.00	0.00	1.00	0.00	0.00	0.00	0.24	0.43
D_COOPS (in %)	0.00	0.00	0.00	0.00	1.00	0.00	0.70	0.46

Table 3: Descriptive statistics by banking groups for variables used in Section 4.

Note: The *Savings bank sector* (*Cooperative bank sector*) contains local savings banks and their central institutions (cooperative banks and their central institutions). The *Private bank sector* comprises regional banks, privately held banks and four money-center banks. “N” reveals the number of banks cumulated over years in our sample by sector. “Mean” (“Std. dev.”) describes the mean (standard deviation) of each variable across all observations in each category.

	Panel A.1		Panel A.2 (excluding crisis years)	
	COX_i	$D\_GBR_{i,t+1}$	COX_i	$D\_GBR_{i,t+1}$
Indep. var.	(1)	(2)	(3)	(4)
$LOANS^{TA}_{i,t}$	-0.0145***	-0.0052	-0.0139***	-0.0049
	[0.004]	[0.004]	[0.005]	[0.004]
$AAR_{i,t}$	0.0047	-0.0107**	0.0039	-0.0108**
	[0.005]	[0.005]	[0.005]	[0.005]
$NPL^{TA}_{i,t}$	0.0068	-0.0254	0.0057	-0.0229
	[0.017]	[0.017]	[0.018]	[0.017]
$LCO^{TA}_{i,t}$	0.0952	-0.1791*	0.0894	-0.1720
	[0.112]	[0.099]	[0.124]	[0.106]
$INR_{i,t}$	0.1818	-0.0739	0.0382	-0.1535
	[0.276]	[0.279]	[0.299]	[0.279]
$ZSCORE_{i,t}$	0.4705***	0.4898***	0.4865***	0.4201***
	[0.101]	[0.096]	[0.114]	[0.099]
$TIER1^{RWA}_{i,t}$	-0.0592***	-0.1020***	-0.0709***	-0.1085***
	[0.018]	[0.018]	[0.021]	[0.018]
$TAGR_{i,t}$	0.0147**	0.0248***	0.0121	0.0251***
	[0.007]	[0.005]	[0.009]	[0.006]
$340f^{TA}_{i,t}$	0.5753***	0.5429***	0.5272***	0.5155***
	[0.041]	[0.047]	[0.044]	[0.048]
$LNTA_{i,t}$	0.5494***	0.3451***	0.5348***	0.3713***
	[0.040]	[0.046]	[0.043]	[0.048]
$GDPGR_{i,t}$	-0.0113	-0.0037	0.0263	0.0053
	[0.038]	[0.021]	[0.041]	[0.023]
$D\_SAVINGS$	-1.3467***	-1.0660***	-1.2236***	-1.0940***
	[0.236]	[0.254]	[0.260]	[0.261]
D_COOPS	0.4198*	-0.2661	0.3180	-0.3439
	[0.223]	[0.242]	[0.244]	[0.251]
Observations	29,528	33,707	27,736	30,357
Number of Banks	4,412	4,612	4,401	4,601
McFadden's Adj. R^2	0.063	0.345	0.055	0.357
AUC value		0.885		0.891
Year Dummies	YES	YES	YES	YES

Table 4: Cox hazard and logit estimations

Note: We apply Cox hazard and logit estimation techniques to examine the factors driving the initial creation of GBR reserves. Panel A.1 shows regression results from the full sample while Panel A.2 excludes the crisis years 2007 and 2008. The functional form of the Cox hazard model is given by $h_i(t) = h_0(t) \cdot exp(\beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} + \beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t} + \beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} + \beta_9 \cdot 340f^{TA}_{i,t} + \beta_{10} \cdot LNTA_{i,t} + \beta_{11} \cdot GDPGR_{i,t} + \beta_{12} \cdot D\_SAVINGS + \beta_{13} \cdot D\_COOPS + \sum_{j=0}^{14}[\beta_{(14+j)} \cdot D\_(1996+j)_t])$. The logit estimations can be represented by $P(D\_GBR_{i,t+1} = 1) = Y_{i,t+1}$ with $Y_{i,t+1} = \beta_0 + \beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} + \beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t} + \beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} + \beta_9 \cdot 340f^{TA}_{i,t} + \beta_{10} \cdot LNTA_{i,t} + \beta_{11} \cdot GDPGR_{i,t} + \beta_{12} \cdot D\_SAVINGS + \beta_{13} \cdot D\_COOPS + \sum_{j=0}^{14}[\beta_{(14+j)} \cdot D\_(1996+j)_t] + \epsilon_{i,t}$. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered at the bank level. For variable descriptions, see Table 2.

Indep. var.	Panel A.3 Private bank sector COX_i (1)	$D\_GBR_{i,t+1}$ (2)	Panel A.4 Savings bank sector COX_i (3)	$D\_GBR_{i,t+1}$ (4)	Panel A.5 Cooperative bank sector COX_i (5)	$D\_GBR_{i,t+1}$ (6)
$LOANS^{TA}_{i,t}$	-0.0044	-0.0041	-0.0006	0.0160*	-0.0213***	-0.0164***
	[0.012]	[0.010]	[0.010]	[0.010]	[0.005]	[0.005]
$AAR_{i,t}$	-0.0134	-0.0019	-0.0328***	-0.0600***	0.0143**	0.0070
	[0.011]	[0.009]	[0.011]	[0.012]	[0.006]	[0.006]
$NPL^{TA}_{i,t}$	0.0215	-0.0725*	-0.0076	-0.0770	0.0055	-0.0144
	[0.046]	[0.039]	[0.055]	[0.058]	[0.021]	[0.020]
$LCO^{TA}_{i,t}$	0.0540	-0.2480	-1.1998***	-1.1268***	0.3077**	0.0902
	[0.330]	[0.317]	[0.374]	[0.298]	[0.121]	[0.101]
$INR_{i,t}$	0.7052	-0.3288	-0.1868	-0.8074	0.2711	0.2711
	[0.712]	[0.620]	[0.691]	[0.694]	[0.344]	[0.389]
$ZSCORE_{i,t}$	0.2122	0.1182	0.1329	0.4066*	0.6210***	0.5750***
	[0.282]	[0.222]	[0.206]	[0.246]	[0.132]	[0.115]
$TIER1^{RWA}_{i,t}$	-0.0829*	-0.0662**	-0.2267***	-0.2527***	-0.0304	-0.0763***
	[0.044]	[0.031]	[0.058]	[0.052]	[0.021]	[0.022]
$TAGR_{i,t}$	0.0297**	0.0173**	0.0085	0.0233**	0.0043	0.0239***
	[0.015]	[0.008]	[0.021]	[0.012]	[0.010]	[0.007]
$340f^{TA}_{i,t}$	0.2241	0.3498	0.5023***	0.5445***	0.5502***	0.5272***
	[0.244]	[0.246]	[0.075]	[0.086]	[0.051]	[0.060]
$LNTA_{i,t}$	0.6337***	0.7231***	0.4632***	0.4483***	0.5484***	0.2220***
	[0.145]	[0.124]	[0.088]	[0.100]	[0.046]	[0.056]
$GDPGR_{i,t}$	0.0707	-0.0354	0.0571	0.0807**	-0.0693	-0.0271
	[0.148]	[0.106]	[0.083]	[0.039]	[0.045]	[0.024]
Observations	1,852	2,110	6,911	7,974	20,765	23,623
Number of Banks	282	295	744	785	3,388	3,534
McFadden's Adj. R^2	0.248	0.298	0.087	0.339	0.072	0.379
AUC value		0.866		0.880		0.898
Year Dummies	YES	YES	YES	YES	YES	YES

Table 5: Cox hazard and logit estimations by banking group

Note: We apply Cox hazard and logit estimation techniques to examine the factors driving the initial creation of GBR reserves. Panel A.3, Panel A.4, and Panel A.5 show regression results from the full sample. The functional form of the Cox hazard model is given by $h_i(t) = h_0(t) \cdot exp(\beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} + \beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t} + \beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} + \beta_9 \cdot 340f^{TA}_{i,t} + \beta_{10} \cdot LNTA_{i,t} + \beta_{11} \cdot GDPGR_{i,t} + \sum_{j=0}^{14}[\beta_{(12+j)} \cdot D\_(1996+j)_t])$. The logit estimations can be represented by $P(D\_GBR_{i,t+1} = 1) = Y_{i,t+1}$ with $Y_{i,t+1} = \beta_0 + \beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} + \beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t} + \beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} + \beta_9 \cdot 340f^{TA}_{i,t} + \beta_{10} \cdot LNTA_{i,t} + \beta_{11} \cdot GDPGR_{i,t} + \sum_{j=0}^{14}[\beta_{(12+j)} \cdot D\_(1996+j)_t] + \epsilon_{i,t}$. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered at the bank level. For variable descriptions, see Table 2.

	Panel A.6 Private bank sector		Panel A.7 Savings bank sector		Panel A.8 Cooperative bank sector	
	COX_i	$D\_GBR_{i,t+1}$	COX_i	$D\_GBR_{i,t+1}$	COX_i	$D\_GBR_{i,t+1}$
Indep. var.	(1)	(2)	(3)	(4)	(5)	(6)
$LOANS^{TA}_{i,t}$	-0.0102	-0.0071	0.0026	0.0176*	-0.0210***	-0.0164***
	[0.011]	[0.010]	[0.010]	[0.010]	[0.006]	[0.005]
$AAR_{i,t}$	-0.0083	0.0021	-0.0316**	-0.0639***	0.0133**	0.0079
	[0.013]	[0.009]	[0.013]	[0.013]	[0.006]	[0.006]
$NPL^{TA}_{i,t}$	0.0162	-0.0718*	-0.0151	-0.0668	0.0051	-0.0142
	[0.050]	[0.039]	[0.057]	[0.058]	[0.022]	[0.020]
$LCO^{TA}_{i,t}$	0.0428	-0.1427	-1.0993***	-1.1372***	0.2829**	0.0742
	[0.384]	[0.335]	[0.391]	[0.314]	[0.133]	[0.106]
$INR_{i,t}$	0.8983	-0.5445	-0.2419	-0.8106	0.0707	0.2028
	[0.800]	[0.614]	[0.732]	[0.697]	[0.372]	[0.384]
$ZSCORE_{i,t}$	0.1327	0.0727	0.1959	0.4167	0.6688***	0.4674***
	[0.315]	[0.226]	[0.221]	[0.260]	[0.155]	[0.118]
$TIER1^{RWA}_{i,t}$	-0.0787	-0.0623**	-0.2221***	-0.2658***	-0.0444*	-0.0835***
	[0.050]	[0.030]	[0.064]	[0.054]	[0.025]	[0.023]
$TAGR_{i,t}$	0.0359**	0.0208**	0.0120	0.0247*	-0.0038	0.0210**
	[0.016]	[0.009]	[0.023]	[0.014]	[0.012]	[0.008]
$340f^{TA}_{i,t}$	0.0829	0.2822	0.5047***	0.5400***	0.4733***	0.4948***
	[0.229]	[0.208]	[0.081]	[0.089]	[0.058]	[0.062]
$LNTA_{i,t}$	0.6945***	0.7495***	0.4097***	0.4670***	0.5220***	0.2356***
	[0.162]	[0.125]	[0.094]	[0.104]	[0.050]	[0.058]
$GDPGR_{i,t}$	0.0761	0.0168	0.1230	0.1015**	-0.0394	-0.0378
	[0.156]	[0.104]	[0.085]	[0.044]	[0.050]	[0.025]
Observations	1,670	1,883	6,335	7,114	19,371	21,360
Number of Banks	279	291	743	785	3,381	3,527
McFadden's Adj. R^2	0.260	0.301	0.077	0.364	0.067	0.390
AUC value		0.869		0.892		0.904
Year Dummies	YES	YES	YES	YES	YES	YES

Table 6: Cox hazard and logit estimations by banking group excluding crisis years

Note: We apply Cox hazard and logit estimation techniques to examine the factors driving the initial creation of GBR reserves. Panel A.6, Panel A.7, and Panel A.8 show regression results excluding the crisis years 2007 and 2008. The functional form of the Cox hazard model is given by $h_i(t) = h_0(t) \cdot exp(\beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} + \beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t} + \beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} + \beta_9 \cdot 340f^{TA}_{i,t} + \beta_{10} \cdot LNTA_{i,t} + \beta_{11} \cdot GDPGR_{i,t} + \sum_{j=0}^{14}[\beta_{(12+j)} \cdot D\_(1996+j)_t])$. The logit estimations can be represented by $P(D\_GBR_{i,t+1} = 1) = Y_{i,t+1}$ with $Y_{i,t+1} = \beta_0 + \beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} + \beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t} + \beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} + \beta_9 \cdot 340f^{TA}_{i,t} + \beta_{10} \cdot LNTA_{i,t} + \beta_{11} \cdot GDPGR_{i,t} + \sum_{j=0}^{14}[\beta_{(12+j)} \cdot D\_(1996+j)_t] + \epsilon_{i,t}$. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered at the bank level. For variable descriptions, see Table 2.

	Private bank sector		Savings bank sector	
	$D\_GBR_{i,t} = 0$	$D\_GBR_{i,t} = 1$	$D\_GBR_{i,t} = 0$	$D\_GBR_{i,t} = 1$
increase *i, t + 1*	55	–	324	–
constant *i, t + 1*	1,665	219	6,234	1,206
decrease *i, t + 1*	–	14	–	10
Total by bank sector	1,953		7,774	
	Cooperative bank sector		Total over all banks	
	$D\_GBR_{i,t} = 0$	$D\_GBR_{i,t} = 1$	$D\_GBR_{i,t} = 0$	$D\_GBR_{i,t} = 1$
increase *i, t + 1*	772	–	1,151	–
constant *i, t + 1*	18,127	3,256	26,026	4,681
decrease *i, t + 1*	–	19	–	43
Total by bank sector	22,174		31,901	

Table 7: Change in use of GBR reserves cumulated by bank sector and year

Note: The *Savings bank sector* (*Cooperative bank sector*) contains local savings banks and their central institutions (cooperative banks and their central institutions). The *Private bank sector* comprises regional banks, privately held banks and four money-center banks. The bank i reveals *increase*, *constant*, or *decrease* in the use of GBR reserves if the difference of the forwarded $(t + 1)$ and the current (t) dummy for the use of GBR reserves takes the value 1, 0, or -1.

	Private bank sector		Savings bank sector	
	$D\_GBR_{i,t} = 0$	$D\_GBR_{i,t} = 1$	$D\_GBR_{i,t} = 0$	$D\_GBR_{i,t} = 1$
increase *i, t + 1*	55	57	324	764
constant *i, t + 1*	1,665	152	6,234	434
decrease *i, t + 1*	–	24	–	18
Total by bank sector	1,953		7,774	
	Cooperative bank sector		Total over all banks	
	$D\_GBR_{i,t} = 0$	$D\_GBR_{i,t} = 1$	$D\_GBR_{i,t} = 0$	$D\_GBR_{i,t} = 1$
increase *i, t + 1*	772	1,789	1,151	2,610
constant *i, t + 1*	18,127	1,457	26,026	2,043
decrease *i, t + 1*	–	29	–	71
Total by bank sector	22,174		31,901	

Table 8: Change in levels of GBR reserves cumulated by bank sector and year

Note: The *Savings bank sector* (*Cooperative bank sector*) contains local savings banks and their central institutions (cooperative banks and their central institutions). The *Private bank sector* comprises regional banks, privately held banks and four money-center banks. The bank i reveals *increase*, *constant*, or *decrease* in the level of GBR reserves if the difference of the forwarded $(t + 1)$ and the current (t) level of GBR reserves takes positive, zero, or negative values.

Indep. var.	Panel B.1 $GBR^{TA}_{i,t+1}$ (1)	$CHGBR^{TA}_{i,t+1}$ (2)	Panel B.2 $GBR^{TA}_{i,t+1}$ (3)	$CHGBR^{TA}_{i,t+1}$ (4)	Panel B.3 $GBR^{TA}_{i,t+1}$ (5)	$CHGBR^{TA}_{i,t+1}$ (6)
$LOANS^{TA}_{i,t}$	-0.0012	-0.0010	0.0016	-0.0002	-0.0018	-0.0015
	[0.003]	[0.001]	[0.003]	[0.001]	[0.003]	[0.001]
$AAR_{i,t}$	-0.0082***	-0.0026**	-0.0053*	-0.0018	-0.0071**	-0.0016
	[0.003]	[0.001]	[0.003]	[0.001]	[0.003]	[0.001]
$NPL^{TA}_{i,t}$	-0.0077	-0.0044	-0.0195**	-0.0076*	-0.0095	-0.0057
	[0.010]	[0.004]	[0.010]	[0.004]	[0.010]	[0.004]
$LCO^{TA}_{i,t}$	-0.0411	-0.0318	-0.1006*	-0.0478*	-0.0434	-0.0357
	[0.059]	[0.029]	[0.059]	[0.029]	[0.059]	[0.029]
$INR_{i,t}$	-0.0889	0.1258*	-0.0804	0.1289*	-0.0948	0.1168
	[0.172]	[0.075]	[0.171]	[0.075]	[0.172]	[0.076]
$ZSCORE_{i,t}$	0.3007***	0.0822***			0.3192***	0.0966***
	[0.055]	[0.024]			[0.055]	[0.024]
$TIER1^{RWA}_{i,t}$	-0.0553***	-0.0167***	-0.0387***	-0.0116***	-0.0527***	-0.0141***
	[0.010]	[0.004]	[0.009]	[0.004]	[0.010]	[0.004]
$TAGR_{i,t}$	0.0115***	0.0066***	0.0106***	0.0063***	0.0123***	0.0075***
	[0.003]	[0.002]	[0.003]	[0.002]	[0.003]	[0.002]
$ROA_{i,t+1}$	0.1727***	0.1523***	0.2072***	0.1593***		
	[0.044]	[0.021]	[0.042]	[0.021]		
$CHLTD_{i,t+1}$	0.0053***	0.0043***	0.0058***	0.0044***	0.0057***	0.0046***
	[0.002]	[0.001]	[0.002]	[0.001]	[0.002]	[0.001]
$340f^{TA}_{i,t}$	0.3322***	0.1760***	0.3376***	0.1768***	0.3523***	0.1930***
	[0.029]	[0.012]	[0.029]	[0.012]	[0.030]	[0.013]
$LNTA_{i,t}$	0.1506***	0.0786***	0.1706***	0.0840***	0.1510***	0.0787***
	[0.025]	[0.011]	[0.025]	[0.011]	[0.025]	[0.011]
$GDPGR_{i,t}$	-0.0003	-0.0178***	0.0026	-0.0169**	-0.0005	-0.0170**
	[0.011]	[0.007]	[0.011]	[0.007]	[0.011]	[0.007]
D_SAVINGS	-0.6167***	-0.1319**	-0.4588***	-0.0791	-0.6563***	-0.1673***
	[0.139]	[0.063]	[0.136]	[0.061]	[0.138]	[0.061]
D_COOPS	-0.1324	0.0665	0.0852	0.1352**	-0.1700	0.0318
	[0.131]	[0.061]	[0.127]	[0.058]	[0.131]	[0.059]
Observations	31,901	31,901	31,973	31,973	31,940	31,940
Number of Banks	4,478	4,478	4,482	4,482	4,482	4,482
McFadden's Adj. R^2	0.277	0.302	0.273	0.301	0.276	0.297
Year Dummies	YES	YES	YES	YES	YES	YES

Table 9: Tobit models for full sample

Note: We apply tobit estimation techniques to examine the factors driving the usage of GBR reserves in banks. Panel B.1, Panel B.2, and Panel B.3 show regression results from the full sample. The dependent variable of the first model is $GBR^{TA}_{i,t+1} = Y_{i,t+1}$ if $Y_{i,t} > 0$ and $GBR^{TA}_{i,t+1} = 0$ if $Y_{i,t+1} \leq 0$. The dependent variable of the second model is $CHGBR^{TA}_{i,t+1} = Y_{i,t+1}$ if $Y_{i,t} > 0$ and $CHGBR^{TA}_{i,t+1} = 0$ if $Y_{i,t+1} \leq 0$. The functional form is given by $Y_{i,t+1} = \beta_0 + \beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} + \beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t}\beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} + \beta_9 \cdot ROA^{TA}_{i,t+1} + \beta_10 \cdot CHLTD_{i,t+1} + \beta_11 \cdot 340f^{TA}_{i,t} + \beta_{12} \cdot LNTA_{i,t} + \beta_{13} \cdot GDPGR_{i,t} + \beta_{14} \cdot D\_SAVINGS + \beta_{15} \cdot D\_COOPS + \sum_{j=0}^{14}[\beta_{(15+j)} \cdot D\_(1996+j)_t] + \epsilon_{i,t}$. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered at the bank level. For variable descriptions, see Table 2.

	Panel B.4	
	$GBR^{TA}_{i,t+1}$	$CHGBR^{TA}_{i,t+1}$
Indep. var.	(1)	(2)
$LOANS^{TA}_{i,t}$	-0.0014	-0.0018
	[0.003]	[0.001]
$AAR_{i,t}$	-0.0082***	-0.0020
	[0.003]	[0.001]
$NPL^{TA}_{i,t}$	-0.0055	-0.0052
	[0.010]	[0.005]
$LCO^{TA}_{i,t}$	-0.0411	-0.0411
	[0.061]	[0.032]
$INR_{i,t}$	-0.1489	0.1040
	[0.164]	[0.077]
$ZSCORE_{i,t}$	0.2421***	0.0756***
	[0.055]	[0.025]
$TIER1^{RWA}_{i,t}$	-0.0566***	-0.0178***
	[0.010]	[0.004]
$TAGR_{i,t}$	0.0119***	0.0076***
	[0.003]	[0.002]
$ROA_{i,t+1}$	0.2070***	0.1642***
	[0.048]	[0.025]
$CHLTD_{i,t+1}$	0.0042*	0.0038***
	[0.002]	[0.001]
$340f^{TA}_{i,t}$	0.2946***	0.1724***
	[0.028]	[0.013]
$LNTA_{i,t}$	0.1548***	0.0861***
	[0.025]	[0.011]
$GDPGR_{i,t}$	-0.0065	-0.0093
	[0.011]	[0.007]
$D\_SAVINGS$	-0.5932***	-0.1278*
	[0.136]	[0.066]
D_COOPS	-0.1623	0.0847
	[0.131]	[0.065]
Observations	28,658	28,658
Number of Banks	4,466	4,466
McFadden's Adj. R^2	0.294	0.321
Year Dummies	YES	YES

Table 10: Tobit model excluding crisis years

Note: We apply tobit estimation techniques to examine the factors driving the usage of GBR reserves in banks. Panel B.4 shows regression results excluding the crisis years 2007 and 2008. The dependent variable of the first model is $GBR^{TA}_{i,t+1} = Y_{i,t+1}$ if $Y_{i,t} > 0$ and $GBR^{TA}_{i,t+1} = 0$ if $Y_{i,t+1} \leq 0$. The dependent variable of the second model is $CHGBR^{TA}_{i,t+1} = Y_{i,t+1}$ if $Y_{i,t} > 0$ and $CHGBR^{TA}_{i,t+1} = 0$ if $Y_{i,t+1} \leq 0$. The functional form is given by $Y_{i,t+1} = \beta_0 + \beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} + \beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t}\beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} + \beta_9 \cdot ROA^{TA}_{i,t+1} + \beta_10 \cdot CHLTD_{i,t+1} + \beta_11 \cdot 340f^{TA}_{i,t} + \beta_{12} \cdot LNTA_{i,t} + \beta_{13} \cdot GDPGR_{i,t} + \beta_{14} \cdot D\_SAVINGS + \beta_{15} \cdot D\_COOPS + \sum_{j=0}^{14}[\beta_{(15+j)} \cdot D\_(1996+j)_t] + \epsilon_{i,t}$. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered at the bank level. For variable descriptions, see Table 2.

Indep. var.	Panel B.5 $GBR^{TA}_{i,t+1}$ (1)	$CHGBR^{TA}_{i,t+1}$ (2)	Panel B.6 $GBR^{TA}_{i,t+1}$ (3)	$CHGBR^{TA}_{i,t+1}$ (4)	Panel B.7 $GBR^{TA}_{i,t+1}$ (5)	$CHGBR^{TA}_{i,t+1}$ (6)
$LOANS^{TA}_{i,t}$	0.0038	-0.0001	0.0041	0.0001	0.0040	0.0002
	[0.006]	[0.004]	[0.006]	[0.004]	[0.006]	[0.004]
$AAR_{i,t}$	-0.0058	-0.0068*	-0.0054	-0.0060	-0.0055	-0.0052
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
$NPL^{TA}_{i,t}$	-0.0294	-0.0052	-0.0292	-0.0061	-0.0310	-0.0085
	[0.021]	[0.017]	[0.021]	[0.017]	[0.021]	[0.017]
$LCO^{TA}_{i,t}$	0.0331	-0.0660	0.0251	-0.0743	0.0376	-0.0709
	[0.152]	[0.138]	[0.149]	[0.136]	[0.152]	[0.138]
$INR_{i,t}$	0.3388	0.3918	0.2968	0.3658	0.3470	0.3874
	[0.405]	[0.344]	[0.393]	[0.339]	[0.403]	[0.344]
$ZSCORE_{i,t}$	0.0775	0.0837			0.0681	0.0663
	[0.109]	[0.078]			[0.107]	[0.076]
$TIER1^{RWA}_{i,t}$	-0.0274**	-0.0240**	-0.0264**	-0.0223**	-0.0275**	-0.0217**
	[0.014]	[0.011]	[0.013]	[0.010]	[0.014]	[0.010]
$TAGR_{i,t}$	0.0081**	0.0042	0.0078**	0.0034	0.0075*	0.0040
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
$ROA_{i,t+1}$	-0.0055	0.0447	0.0119	0.0505		
	[0.078]	[0.073]	[0.076]	[0.071]		
$CHLTD_{i,t+1}$	0.0075*	0.0145***	0.0073*	0.0143***	0.0078**	0.0137***
	[0.004]	[0.005]	[0.004]	[0.005]	[0.004]	[0.005]
$340f^{TA}_{i,t}$	0.3080*	0.2466**	0.2981*	0.2353**	0.3092*	0.2499**
	[0.159]	[0.117]	[0.160]	[0.116]	[0.160]	[0.114]
$LNTA_{i,t}$	0.2736***	0.1252***	0.2822***	0.1311***	0.2750***	0.1286***
	[0.071]	[0.041]	[0.073]	[0.042]	[0.071]	[0.040]
$GDPGR_{i,t}$	-0.0045	-0.0636	0.0013	-0.0609	-0.0061	-0.0621
	[0.042]	[0.043]	[0.042]	[0.043]	[0.039]	[0.043]
Observations	1.953	1,953	1,989	1,989	1,982	1,982
Number of Banks	277	277	279	279	281	281
McFadden's Adj. R^2	0.213	0.204	0.215	0.201	0.216	0.200
Year Dummies	YES	YES	YES	YES	YES	YES

Table 11: Tobit models for private bank sector

Note: We apply tobit estimation techniques to examine the factors driving the usage of GBR reserves in banks. The dependent variable of the first model is $GBR^{TA}_{i,t+1} = Y_{i,t+1}$ if $Y_{i,t} > 0$ and $GBR^{TA}_{i,t+1} = 0$ if $Y_{i,t+1} \leq 0$. The dependent variable of the second model is $CHGBR^{TA}_{i,t+1} = Y_{i,t+1}$ if $Y_{i,t} > 0$ and $CHGBR^{TA}_{i,t+1} = 0$ if $Y_{i,t+1} \leq 0$. The functional form is given by $Y_{i,t+1} = \beta_0 + \beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} + \beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t}\beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} + \beta_9 \cdot ROA^{TA}_{i,t+1} + \beta_10 \cdot CHLTD_{i,t+1} + \beta_11 \cdot 340f^{TA}_{i,t} + \beta_{12} \cdot LNTA_{i,t} + \beta_{13} \cdot GDPGR_{i,t} + \beta_{14} \cdot D\_SAVINGS + \beta_{15} \cdot D\_COOPS + \sum_{j=0}^{14}[\beta_{(15+j)} \cdot D\_(1996+j)_t] + \epsilon_{i,t}$. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered at the bank level. For variable descriptions, see Table 2.

	Panel B.8		Panel B.9		Panel B.10	
	$GBR^{TA}_{i,t+1}$	$CHGBR^{TA}_{i,t+1}$	$GBR^{TA}_{i,t+1}$	$CHGBR^{TA}_{i,t+1}$	$GBR^{TA}_{i,t+1}$	$CHGBR^{TA}_{i,t+1}$
Indep. var.	(1)	(2)	(3)	(4)	(5)	(6)
$LOANS^{TA}_{i,t}$	0.0102**	0.0043**	0.0118***	0.0045**	0.0090**	0.0036**
	[0.004]	[0.002]	[0.004]	[0.002]	[0.004]	[0.002]
$AAR_{i,t}$	-0.0310***	-0.0114***	-0.0294***	-0.0111***	-0.0303***	-0.0109***
	[0.005]	[0.002]	[0.005]	[0.002]	[0.005]	[0.002]
$NPL^{TA}_{i,t}$	0.0000	-0.0059	-0.0053	-0.0067	-0.0042	-0.0080
	[0.029]	[0.009]	[0.029]	[0.009]	[0.029]	[0.010]
$LCO^{TA}_{i,t}$	-0.4909***	-0.2062***	-0.5318***	-0.2131***	-0.5006***	-0.2136***
	[0.136]	[0.057]	[0.139]	[0.057]	[0.141]	[0.057]
$INR_{i,t}$	-0.5239*	-0.1290	-0.4996*	-0.1252	-0.5181*	-0.1275
	[0.295]	[0.118]	[0.292]	[0.117]	[0.298]	[0.121]
$ZSCORE_{i,t}$	0.1763	0.0300			0.2347*	0.0595
	[0.116]	[0.042]			[0.121]	[0.043]
$TIER1^{RWA}_{i,t}$	-0.1096***	-0.0349***	-0.0956***	-0.0325***	-0.1057***	-0.0323***
	[0.025]	[0.008]	[0.023]	[0.008]	[0.025]	[0.008]
$TAGR_{i,t}$	0.0152***	0.0079***	0.0155***	0.0079***	0.0159***	0.0084***
	[0.006]	[0.003]	[0.005]	[0.003]	[0.006]	[0.003]
$ROA_{i,t+1}$	0.3335***	0.1847***	0.3620***	0.1888***		
	[0.088]	[0.033]	[0.092]	[0.033]		
$CHLTD_{i,t+1}$	0.0111***	0.0076***	0.0113***	0.0076***	0.0111***	0.0076***
	[0.003]	[0.002]	[0.003]	[0.002]	[0.003]	[0.002]
$340f^{TA}_{i,t}$	0.2622***	0.1339***	0.2549***	0.1326***	0.3059***	0.1578***
	[0.041]	[0.015]	[0.040]	[0.015]	[0.045]	[0.016]
$LNTA_{i,t}$	0.1404***	0.0620***	0.1537***	0.0641***	0.1310***	0.0582***
	[0.042]	[0.015]	[0.042]	[0.015]	[0.042]	[0.016]
$GDPGR_{i,t}$	0.0347**	0.0079	0.0377**	0.0084	0.0360**	0.0093
	[0.016]	[0.009]	[0.017]	[0.009]	[0.017]	[0.009]
Observations	7,774	7,774	7,777	7,777	7,776	7,776
Number of Banks	769	769	770	770	769	769
McFadden's Adj. R^2	0.289	0.376	0.287	0.376	0.283	0.365
Year Dummies	YES	YES	YES	YES	YES	YES

Table 12: Tobit models for savings bank sector

Note: We apply tobit estimation techniques to examine the factors driving the usage of GBR reserves in banks. The dependent variable of the first model is $GBR^{TA}_{i,t+1} = Y_{i,t+1}$ if $Y_{i,t} > 0$ and $GBR^{TA}_{i,t+1} = 0$ if $Y_{i,t+1} \leq 0$. The dependent variable of the second model is $CHGBR^{TA}_{i,t+1} = Y_{i,t+1}$ if $Y_{i,t} > 0$ and $CHGBR^{TA}_{i,t+1} = 0$ if $Y_{i,t+1} \leq 0$. The functional form is given by $Y_{i,t+1} = \beta_0 + \beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} + \beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t}\beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} + \beta_9 \cdot ROA^{TA}_{i,t+1} + \beta_1 0 \cdot CHLTD_{i,t+1} + \beta_1 1 \cdot 340f^{TA}_{i,t} + \beta_{12} \cdot LNTA_{i,t} + \beta_{13} \cdot GDPGR_{i,t} + \beta_{14} \cdot D\_SAVINGS + \beta_{15} \cdot D\_COOPS + \sum_{j=0}^{14}[\beta_{(15+j)} \cdot D\_(1996+j)_t] + \epsilon_{i,t}$. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered at the bank level. For variable descriptions, see Table 2.

	Panel B.11		Panel B.12		Panel B.13	
	$GBR^{TA}_{i,t+1}$	$CHGBR^{TA}_{i,t+1}$	$GBR^{TA}_{i,t+1}$	$CHGBR^{TA}_{i,t+1}$	$GBR^{TA}_{i,t+1}$	$CHGBR^{TA}_{i,t+1}$
Indep. var.	(1)	(2)	(3)	(4)	(5)	(6)
$LOANS^{TA}_{i,t}$	-0.0077**	-0.0039***	-0.0038	-0.0029**	-0.0087**	-0.0047***
	[0.003]	[0.001]	[0.003]	[0.001]	[0.004]	[0.001]
$AAR_{i,t}$	0.0026	0.0015	0.0065*	0.0025	0.0037	0.0026
	[0.004]	[0.002]	[0.004]	[0.002]	[0.004]	[0.002]
$NPL^{TA}_{i,t}$	-0.0059	-0.0051	-0.0217*	-0.0090*	-0.0076	-0.0062
	[0.012]	[0.005]	[0.012]	[0.005]	[0.012]	[0.005]
$LCO^{TA}_{i,t}$	0.0929	0.0251	0.0213	0.0078	0.0805	0.0155
	[0.065]	[0.033]	[0.065]	[0.032]	[0.065]	[0.033]
$INR_{i,t}$	0.0935	0.1431	0.1202	0.1501	0.0734	0.1260
	[0.252]	[0.097]	[0.249]	[0.096]	[0.252]	[0.100]
$ZSCORE_{i,t}$	0.3745***	0.0932***			0.3976***	0.1111***
	[0.069]	[0.029]			[0.069]	[0.030]
$TIER1^{RWA}_{i,t}$	-0.0458***	-0.0135**	-0.0213*	-0.0072	-0.0427***	-0.0105*
	[0.013]	[0.006]	[0.013]	[0.005]	[0.013]	[0.006]
$TAGR_{i,t}$	0.0074*	0.0066***	0.0072*	0.0066***	0.0088**	0.0080***
	[0.004]	[0.002]	[0.004]	[0.002]	[0.004]	[0.002]
$ROA_{i,t+1}$	0.2231***	0.1935***	0.2634***	0.2009***		
	[0.059]	[0.028]	[0.057]	[0.027]		
$CHLTD_{i,t+1}$	-0.0000	0.0010	0.0011	0.0012	0.0004	0.0014
	[0.003]	[0.002]	[0.003]	[0.002]	[0.003]	[0.002]
$340f^{TA}_{i,t}$	0.3231***	0.1832***	0.3412***	0.1871***	0.3441***	0.2012***
	[0.040]	[0.017]	[0.040]	[0.017]	[0.042]	[0.018]
$LNTA_{i,t}$	0.1019***	0.0708***	0.1285***	0.0776***	0.1029***	0.0715***
	[0.033]	[0.013]	[0.033]	[0.013]	[0.033]	[0.013]
$GDPGR_{i,t}$	-0.0165	-0.0291***	-0.0134	-0.0281***	-0.0171	-0.0286***
	[0.013]	[0.009]	[0.013]	[0.009]	[0.013]	[0.009]
Observations	22,174	22,174	22,207	22,207	22,182	22,182
Number of Banks	3,434	3,434	3,435	3,435	3,434	3,434
McFadden's Adj. R^2	0.300	0.317	0.294	0.316	0.298	0.311
Year Dummies	YES	YES	YES	YES	YES	YES

Table 13: Tobit models for cooperative bank sector

Note: We apply tobit estimation techniques to examine the factors driving the usage of GBR reserves in banks. The dependent variable of the first model is $GBR^{TA}_{i,t+1} = Y_{i,t+1}$ if $Y_{i,t} > 0$ and $GBR^{TA}_{i,t+1} = 0$ if $Y_{i,t+1} \leq 0$. The dependent variable of the second model is $CHGBR^{TA}_{i,t+1} = Y_{i,t+1}$ if $Y_{i,t} > 0$ and $CHGBR^{TA}_{i,t+1} = 0$ if $Y_{i,t+1} \leq 0$. The functional form is given by $Y_{i,t+1} = \beta_0 + \beta_1 \cdot LOANS^{TA}_{i,t} + \beta_2 \cdot AAR^{TA}_{i,t} + \beta_3 \cdot NPL^{TA}_{i,t} + \beta_4 \cdot LCO^{TA}_{i,t} + \beta_5 \cdot INR_{i,t} + \beta_6 \cdot ZSCORE_{i,t}\beta_7 \cdot TIER1^{RWA}_{i,t} + \beta_8 \cdot TAGR_{i,t} + \beta_9 \cdot ROA^{TA}_{i,t+1} + \beta_1 0 \cdot CHLTD_{i,t+1} + \beta_1 1 \cdot 340f^{TA}_{i,t} + \beta_{12} \cdot LNTA_{i,t} + \beta_{13} \cdot GDPGR_{i,t} + \beta_{14} \cdot D\_SAVINGS + \beta_{15} \cdot D\_COOPS + \sum_{j=0}^{14} [\beta_{(15+j)} \cdot D\_(1996 + j)_t] + \epsilon_{i,t}$. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered at the bank level. For variable descriptions, see Table 2.

Variable	Description
$D\_DISTRESS_{i,t+1}$	Binary variable equaling 1 if bank i in year $t+1$ experiences any kind of distress event, and 0 otherwise.
$D\_DEFAULT_{i,t+1}$	Binary variable equaling 1 if bank i in year $t+1$ experiences a bank moratorium or a takeover classified by the Bundesbank as a restructuring merger, and 0 otherwise.
$HHI\_SEC_{i,t}$	Concentration in bank i's domestic credit portfolio measured by a Herfindahl-Hirschman index (i.e., a higher value indicates a more concentrated portfolio).
$D\_LIAB_{i,t}$	Binary variable equaling 1 if bank i in year t has hidden liabilities (i.e., avoided write-offs), and 0 otherwise.
$D\_REDUCTION_{i,t}$	Binary variable equaling 1 if bank i in year t reduced its accumulated holdings of reserves, and 0 otherwise.

Table 14: Additional variable descriptions for the bank stability model.

	Private bank sector (N = 2,032)		Savings bank sector (N = 7,779)		Cooperative bank sector (N = 22,208)		Total (N = 32,019)	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
$D\_DISTRESS_{i,t+1}$	0.05	0.21	0.01	0.11	0.03	0.18	0.03	0.17
$D\_DEFAULT_{i,t+1}$	0.01	0.10	0.00	0.07	0.01	0.12	0.01	0.11
$HHI\_SEC_{i,t}$ (in %)	47.77	22.22	30.57	7.44	27.19	11.24	29.32	12.55
$D\_LIAB_{i,t}$	0.15	0.36	0.09	0.29	0.10	0.30	0.10	0.30
$D\_REDUCTION_{i,t}$	0.06	0.25	0.07	0.26	0.07	0.26	0.07	0.26

Table 15: Descriptive statistics for additional variables for the bank stability model by bank sector

Note: "N" reveals the number of banks cumulated over years in our sample by sector. "Mean" ("Std. dev.") describes the mean (standard deviation) of each variable across all observations in each category.

	Panel C.1 $D\_DISTRESS_{i,t+1}$		Panel C.2 $D\_DEFAULT_{i,t+1}$		Panel C.3 $ZSCORE_{i,t+1}$	
Indep. var.	(6)	(7)	(8)	(9)	(10)	(11)
D_GBR	-0.4671**		-1.2739**		0.1210***	
	[0.238]		[0.532]		[0.018]	
$GBR^{TA}_{i,t}$		0.2682		-3.6634**		0.1039***
		[0.271]		[1.726]		[0.015]
$LOANS^{TA}_{i,t}$	-0.0052	-0.0056	0.0044	0.0042	0.0066***	0.0066***
	[0.006]	[0.006]	[0.007]	[0.007]	[0.001]	[0.001]
$AAR_{i,t}$	-0.0144**	-0.0133**	-0.0039	-0.0036	0.0078***	0.0078***
	[0.007]	[0.007]	[0.008]	[0.008]	[0.001]	[0.001]
$NPL^{TA}_{i,t}$	0.2464***	0.2478***	0.1251***	0.1264***	-0.0515***	-0.0521***
	[0.017]	[0.017]	[0.019]	[0.019]	[0.003]	[0.003]
$D\_LIAB_{i,t}$	0.7636***	0.7533***	0.6343***	0.6354***	-0.0939***	-0.0919***
	[0.129]	[0.130]	[0.152]	[0.152]	[0.016]	[0.016]
$D\_REDUCTION_{i,t}$	0.2885**	0.2729**	0.9595***	0.9600***	-0.1571***	-0.1576***
	[0.117]	[0.117]	[0.145]	[0.145]	[0.015]	[0.015]
$INR_{i,t}$	-0.6606	-0.7366	-0.0839	-0.0892	-0.0838	-0.0798
	[0.482]	[0.473]	[0.502]	[0.499]	[0.054]	[0.054]
$HHI\_SEC_{i,t}$	0.0006	0.0004	0.0096	0.0093	-0.0054***	-0.0054***
	[0.005]	[0.005]	[0.006]	[0.006]	[0.001]	[0.001]
$TIER1^{RWA}_{i,t}$	-0.0341	-0.0302	-0.0731**	-0.0725**	0.0504***	0.0500***
	[0.029]	[0.028]	[0.033]	[0.033]	[0.003]	[0.003]
$ROA_{i,t+1}$	-0.9905***	-0.9983***	-0.6554***	-0.6535***	0.1082***	0.1063***
	[0.094]	[0.094]	[0.135]	[0.135]	[0.014]	[0.014]
$TAGR_{i,t}$	-0.0185**	-0.0192**	-0.0172	-0.0175	-0.0043***	-0.0042***
	[0.008]	[0.008]	[0.012]	[0.012]	[0.001]	[0.001]
$340f^{TA}_{i,t}$	-1.4870***	-1.5092***	-1.7437***	-1.7360***	-0.0007	-0.0022
	[0.192]	[0.191]	[0.211]	[0.211]	[0.008]	[0.008]
$LNTA_{i,t}$	0.3328***	0.3099***	-0.3055***	-0.3109***	0.0543***	0.0571***
	[0.051]	[0.051]	[0.068]	[0.068]	[0.008]	[0.008]
$GDPGR_{i,t}$	0.0200	0.0214	0.0100	0.0101	-0.0079**	-0.0080**
	[0.038]	[0.038]	[0.045]	[0.045]	[0.003]	[0.003]
$D\_SAVINGS$	-0.0920	-0.0784	0.9748**	0.9796**	0.5229***	0.5202***
	[0.323]	[0.321]	[0.387]	[0.387]	[0.060]	[0.060]
D_COOPS	1.0681***	1.0727***	0.8980***	0.8948***	0.7255***	0.7245***
	[0.260]	[0.257]	[0.313]	[0.313]	[0.061]	[0.061]
Observations	32,019	32,019	32,019	32,019	32,019	32,019
Number of Banks	4,487	4,487	4,487	4,487	4,487	4,487
McFadden's Adj. R^2	0.367	0.366	0.277	0.277	0.264	0.264
AUC value	0.911	0.911	0.904	0.904		
Year Dummies	YES	YES	YES	YES	YES	YES

Table 16: Bank stability regressions for full sample

Note: We apply a logit estimation technique to examine the impact of CAMEL variables and the use of GBR reserves on the probability of bank i of experiencing a bank distress ("$D\_DISTRESS_{i,t}$"), or a default event ("$D\_DEFAULT_{i,t}$") between year t and year $t+1$. Panel C.1, Panel C.2, and Panel C.3 show regression results from the full sample. As a robustness check we also use ("$Z\_SCORE_{i,t+1}$") as a dependent variable in OLS regressions. For variable descriptions, see Table 2 and Table 14. The functional form of the models is given by $P(D\_DISTRESS_{i,t+1}=1)=Y_{i,t}$ and $P(D\_DEFAULT_{i,t+1}=1)=Y_{i,t}$ and $Z\_SCORE_{i,t+1}=Y_{i,t}$ with $Y_{i,t}=\beta_0+\beta_1\cdot D\_GBR_{i,t}\left[+\beta_1\cdot GBR^{TA}_{i,t}\right]+\beta_2\cdot LOANS^{TA}_{i,t}+\beta_3\cdot AAR_{i,t}+\beta_4\cdot NPL_{i,t}+\beta_5\cdot D\_LIAB_{i,t}+\beta_6\cdot D\_REDUCTION_{i,t}+\beta_7\cdot INR_{i,t}+\beta_8\cdot HHI\_SEC_{i,t}+\beta_9\cdot TIER1^{RWA}_{i,t}+\beta_{10}\cdot ROA_{i,t+1}+\beta_{11}\cdot TAGR_{i,t}+\beta_{12}\cdot 340f^{TA}_{i,t}+\beta_{13}\cdot LNTA_{i,t}+\beta_{14}\cdot GDPGR_{i,t}+\beta_{15}\cdot D\_SAVINGS+\beta_{16}\cdot D\_COOPS+\sum_{j=0}^{14}[\beta_{(17+j)}\cdot D\_(1996+j)_t]+\epsilon_{i,t}$. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered at the bank level.

	Panel C.4 $D\_DISTRESS_{i,t+1}$		Panel C.5 $D\_DEFAULT_{i,t+1}$		Panel C.6 $ZSCORE_{i,t+1}$	
Indep. Var.	(6)	(7)	(8)	(9)	(10)	(11)
D_GBR	-0.5627**		-1.2061**		0.1108***	
	[0.262]		[0.534]		[0.019]	
$GBR^{TA}_{i,t}$		0.3512		-3.5009**		0.1064***
		[0.246]		[1.706]		[0.017]
$LOANS^{TA}_{i,t}$	-0.0058	-0.0064	0.0050	0.0048	0.0065***	0.0064***
	[0.006]	[0.006]	[0.007]	[0.007]	[0.001]	[0.001]
$AAR_{i,t}$	-0.0133*	-0.0117*	-0.0037	-0.0034	0.0078***	0.0078***
	[0.007]	[0.007]	[0.008]	[0.008]	[0.001]	[0.001]
$NPL^{TA}_{i,t}$	0.2388***	0.2399***	0.1179***	0.1192***	-0.0511***	-0.0517***
	[0.016]	[0.016]	[0.019]	[0.019]	[0.003]	[0.003]
$D\_LIAB_{i,t}$	0.8054***	0.7975***	0.6291***	0.6299***	-0.1043***	-0.1030***
	[0.136]	[0.136]	[0.154]	[0.154]	[0.017]	[0.017]
$D\_REDUCTION_{i,t}$	0.2978**	0.2790**	0.9207***	0.9212***	-0.1732***	-0.1738***
	[0.118]	[0.118]	[0.145]	[0.146]	[0.017]	[0.017]
$INR_{i,t}$	-0.8461*	-0.9112*	-0.2922	-0.2955	-0.0790	-0.0751
	[0.506]	[0.492]	[0.492]	[0.490]	[0.055]	[0.055]
$HHI\_SEC_{i,t}$	0.0003	-0.0000	0.0066	0.0063	-0.0055***	-0.0055***
	[0.006]	[0.006]	[0.007]	[0.007]	[0.001]	[0.001]
$TIER1^{RWA}_{i,t}$	-0.0330	-0.0284	-0.0757**	-0.0751**	0.0519***	0.0516***
	[0.031]	[0.030]	[0.035]	[0.034]	[0.003]	[0.003]
$ROA_{i,t+1}$	-1.0359***	-1.0497***	-0.7260***	-0.7231***	0.0965***	0.0946***
	[0.098]	[0.097]	[0.134]	[0.134]	[0.015]	[0.015]
$TAGR_{i,t}$	-0.0189**	-0.0195**	-0.0155	-0.0158	-0.0039***	-0.0038***
	[0.008]	[0.008]	[0.012]	[0.012]	[0.001]	[0.001]
$340f^{TA}_{i,t}$	-1.4926***	-1.5065***	-1.7206***	-1.7141***	0.0011	-0.0004
	[0.195]	[0.192]	[0.214]	[0.214]	[0.008]	[0.008]
$LNTA_{i,t}$	0.3198***	0.2977***	-0.3098***	-0.3152***	0.0555***	0.0579***
	[0.051]	[0.051]	[0.069]	[0.069]	[0.008]	[0.008]
$GDPGR_{i,t}$	0.0176	0.0196	0.0132	0.0132	-0.0069*	-0.0067*
	[0.038]	[0.038]	[0.044]	[0.045]	[0.004]	[0.004]
$D\_SAVINGS$	-0.1865	-0.1698	1.0487***	1.0526***	0.5084***	0.5060***
	[0.334]	[0.333]	[0.397]	[0.397]	[0.061]	[0.061]
D_COOPS	1.0280***	1.0440***	0.9544***	0.9504***	0.7260***	0.7250***
	[0.269]	[0.267]	[0.324]	[0.324]	[0.061]	[0.061]
Observations	28,765	28,765	28,765	28,765	28,765	28,765
Number of Banks	4,475	4,475	4,475	4,475	4,475	4,475
McFadden's Adj. R^2	0.371	0.371	0.266	0.266	0.259	0.259
AUC value	0.913	0.913	0.896	0.896		
Year Dummies	YES	YES	YES	YES	YES	YES

Table 17: Bank stability regressions excluding crisis years

Note: We apply a logit estimation technique to examine the impact of CAMEL variables and the use of GBR reserves on the probability of bank i of experiencing a bank distress ("$D\_DISTRESS_{i,t}$"), or a default event ("$D\_DEFAULT_{i,t}$") between year t and year $t+1$. Panel C.4, Panel C.5, and Panel C.6 show regression results excluding the crisis years 2007 and 2008. As a robustness check we also use ("$Z\_SCORE_{i,t+1}$") as a dependent variable in OLS regressions. For variable descriptions, see Table 2 and Table 14. The functional form of the models is given by $P(D\_DISTRESS_{i,t+1}=1) = Y_{i,t}$ and $P(D\_DEFAULT_{i,t+1}=1) = Y_{i,t}$ and $Z\_SCORE_{i,t+1} = Y_{i,t}$ with $Y_{i,t} = \beta_0 + \beta_1 \cdot D\_GBR_{i,t} \left[+\beta_1 \cdot GBR^{TA}_{i,t}\right] + \beta_2 \cdot LOANS^{TA}_{i,t} + \beta_3 \cdot AAR_{i,t} + \beta_4 \cdot NPL_{i,t} + \beta_5 \cdot D\_LIAB_{i,t} + \beta_6 \cdot D\_REDUCTION_{i,t} + \beta_7 \cdot INR_{i,t} + \beta_8 \cdot HHI\_SEC_{i,t} + \beta_9 \cdot TIER1^{RWA}_{i,t} + \beta_{10} \cdot ROA_{i,t+1} + \beta_{11} \cdot TAGR_{i,t} + \beta_{12} \cdot 340f^{TA}_{i,t} + \beta_{13} \cdot LNTA_{i,t} + \beta_{14} \cdot GDPGR_{i,t} + \beta_{15} \cdot D\_SAVINGS + \beta_{16} \cdot D\_COOPS + \sum_{j=0}^{14}[\beta_{(17+j)} \cdot D\_(1996+j)_t] + \epsilon_{i,t}$. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered at the bank level.